2010
POWER INTEGRATED RESOURCE PLAN
Final

City of Los Angeles
Department of Water and Power
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Los Angeles Department of Water and Power

2010 Power Integrated Resource Plan

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Power System Planning & Development

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FORWARD

The Los Angeles Department of Water and Power (LADWP) 2010 Power Integrated Resource Plan (IRP) was prepared throughout the calendar year 2010 with assumptions and approved supporting documents available at the time of publication along with the input of many stakeholders. There are literally hundreds of assumptions that are used to prepare an IRP and these assumptions may change over time and in some cases very rapidly such as new regulatory requirements. That is why the IRP process is continual to achieve an annual update.

This 2010 IRP will be used to prepare LADWP's financial plan in early 2011. This financial plan will outline to LADWP's policy makers the fiscal actions, including rate action, that need to take place to implement the objectives and near term actions identified in the IRP. Many of the assumptions in the 2010 IRP will be updated for the financial plan to more accurately present the most current status of assumptions. Some of the assumptions that could change during the development of the financial plan include an updated load forecast, regulatory requirements regarding greenhouse gas reduction, renewable energy regulations, rules on the use of ocean water cooling, and cost data for fuels and plant construction. Any such changes will be clearly communicated in the financial planning documentation.

The financial plan will use the recommendations of the IRP in its analysis only modified by any current changes in assumptions. All changes during the financial planning process will be incorporated into the 2011 update.

I INTRODUCTION AND PURPOSE

The Los Angeles Department of Water and Power (LADWP) is currently facing some of the most serious environmental, regulatory, and economic challenges in its 100-year plus history. LADWP now finds itself at a crossroads in terms of how the utility operates that will require revamping its power generation portfolio to continue providing the same reliable, low-cost electricity to the residents and businesses of Los Angeles for the next 100 years. As the largest municipally owned utility in the nation, LADWP must continue to ensure reliable electricity service as it reduces greenhouse gas (GHG) emissions and transitions from energy sources based on fossil fuels to sustainable forms of renewable energy.

This 2010 Power Integrated Resources Plan (IRP) provides a 20-year framework to ensure LADWP will meet the future energy needs of its ratepayers. Through an IRP, utilities forecast the demand for energy and determine how that demand will be met. This 2010 IRP is guided by the following key objectives:

- Maintain a high level of electric service reliability
- Maintain competitive rates
- Exercise environmental stewardship.

In balancing these key objectives, LADWP's integrated resource planning efforts must be deliberate, comprehensive, and clear to our ratepayers as well as all other City stakeholders. LADWP's goal—and primary challenge—is to develop a long-term resource plan that is informative, sensitive to the local and regional economy, and adaptable to changes in state and federal regulations, fuel prices, and advances in power generation technologies.

This 2010 IRP is a high-level plan that establishes the overall strategic course of the Power System over the next 20 years and provides the necessary flexibility to adjust to changes in the system. This plan sets forth various initiatives requiring steady progress to ensure the availability of the greatest number of options at each step, while avoiding costly delays, setbacks, and rate impacts.

This IRP presents several potential strategies for meeting LADWP's regulatory requirements and policy objectives for increasing renewable energy generation and reducing GHG emissions, maintaining electric power service reliability, and minimizing any financial impact on ratepayers. LADWP rigorously evaluated each potential strategy to identify and recommend the best overall plan to meet its key objectives at the least cost.

Reducing GHG emissions while increasing generation from renewable resources is one of this IRP's key objectives. LADWP will increase procurement of renewable resources significantly over the next several years. Initiatives in energy efficiency (EE) and the implementation of demand-side resources (DSR) will help ensure LADWP meets its environmental policy objectives and regulatory requirements.

To ensure a minimal effect on energy rates, this IRP outlines anticipated capital, operations, and maintenance expenditures for each potential strategy. All strategies are analyzed and compared to ensure LADWP identifies how to achieve key IRP objectives at the least cost.

This plan also strives to maintain a high level of electric service reliability. To ensure reliability, LADWP recommends replacing portions of its aging transmission and distribution infrastructure along with re-powering several units of its natural gas-fired generation fleet. Furthermore, the integration of intermittent renewable resources like wind and solar poses significant challenges. The siting of intermittent renewable resources over a wide geographic region, together with incorporating a variety of generation technologies into LADWP's resource mix, contribute to system reliability and is a strength of this IRP.

II PUBLIC OUTREACH

To ensure that this 2010 IRP accurately reflects the needs of the City of Los Angeles and all of its various stakeholders, a public review process was conducted to encourage public participation and solicit feedback from the community. LADWP's community outreach program, through a series of public workshops held at various venues throughout Los Angeles, allowed community members to provide valuable input and direction during the development of this IRP. Additionally, LADWP conducted a series of stakeholder meetings with participants, including representatives from neighborhood councils, environmental interests, and local businesses.

LADWP's IRP public outreach program was designed to

- Educate and create awareness of the 2010 IRP process and goals.
- Communicate strategies for reducing carbon emissions, integrating renewable energy to meet various policy goals and regulatory requirements, and maintaining reliability and competitive electricity rates.
- Receive public input to help shape the various strategies under consideration.

LADWP also made the Draft 2010 IRP available to the public on a dedicated website, www.lapowerplan.org. This website included interactive features designed to gather additional public comments. All comments received from the public workshops and website were carefully considered during development of this Final 2010 IRP.

Several themes emerged from the comments and ideas LADWP received from its public outreach program (presented below). More details on each theme are provided within this IRP document.

- LADWP should emphasize a variety of energy resources.
  - LADWP is including 160 MW of generic renewable resources that could include biomass, ocean tidal, and other emerging technologies in this IRP.
  - LADWP will also continue to seek a diversified energy mix and diversify its portfolio regionally to enhance system reliability.
- LADWP should maximize energy efficiency and conservation.
  - LADWP is recommending increasing energy efficiency to achieve at least a seven percent reduction of total load by 2020. Prior to 2010, LADWP was achieving a three percent load reduction through energy efficiency initiatives. Next year, LADWP will conclude a study on implementing various energy efficiency technologies and initiatives. The results of this study will be addressed in future IRPs.

- LADWP is recommending 500 MW of Demand Response (DR) programs to control and shift load during peak hours. Tactical plans will be developed that may utilize smart grid technology, incentives, and rate structuring to meet this objective.

- LADWP should eliminate coal from its generation portfolio.

  - LADWP is recommending a policy action to replace the Navajo Generating Station by 2014—four years ahead of the date mandated by Senate Bill (SB)1368. The Intermountain Power Project (IPP) is modeled in this IRP through 2027, but LADWP is open to a mutually agreeable early compliance plan between the project participants that preserves the site and transmission for clean fossil and renewable generation.
  - LADWP is currently 22 percent below 1990 levels of GHG emissions and is planning further emissions reductions.

- LADWP should increase local solar generation.

  - LADWP is recommending a policy action to allow approximately 40-50 percent of its solar resources be sited locally through initiatives including the Solar Incentive Program, feed-in tariffs, and installation of solar on City-owned properties. LADWP recommends this as a balanced approach between the benefits of local solar and the benefits of large, controllable solar projects connected to LADWP's transmission lines. The actual percentage will vary based on the success of the local programs.

- LADWP should avoid adverse impacts to vulnerable communities.

  - LADWP will continue to provide reduced low-income electric rates.
  - LADWP will develop plans that address energy efficiency deployment and other incentive programs that effectively reach out to low-income communities that may help mitigate impacts of future rate increases.
  - Local geographic diversity is critical to maintain high reliability of the electric grid, and LADWP will continue this policy so that no single community will experience an inequitable share of impacts from energy facilities.

- LADWP should clarify costs of IRP implementation and potential impacts to ratepayers

  - LADWP will incorporate a detailed financial analysis into the IRP development process to identify the costs of various planning alternatives and recommendations using computer modeling software.

- LADWP should reduce environmental impacts

    - To minimize environmental impacts, LADWP will maximize the use of existing transmission and facility infrastructure to generate and deliver energy. All projects will have the proper environmental review and impacts on the environment will be mitigated as necessary.

- LADWP should lead by example, proactively engage the public, and increase transparency.

    - LADWP will develop plans to better educate ratepayers on progress related to this IRP (e.g. energy efficiency) and will continue the IRP process of biannual updates to provide transparency on its long-term goals.
    - LADWP will improve its system operations and run its power grid as efficiently as possible. LADWP is completing a study on how it can increase the efficiency of the power delivery grid through advanced reliability improvements.
    - This 2010 IRP sets forth LADWP's long-term plans and objectives, clarifying implementation of various initiatives and their potential impacts on ratepayers. A discussion of rate impact is included in Section 5.4 of this IRP

III ACCOMPLISHMENTS TO DATE

A summary of LADWP's accomplishments in achieving its key objectives of reliability, competitive rates, and environmental stewardship is provided below.

Reliability

- Power Reliability Program (PRP)
  - The PRP is a comprehensive, long-term power reliability program developed by LADWP to replace aging distribution infrastructure. Through this program, LADWP is accelerating the replacement of transformers, poles, underground cables, underground vaults, station transformers, and distribution and receiving stations. LADWP is also installing new control, integrated central monitoring and dispatch systems needed to facilitate reliable and secure system operations.
- Re-powering Haynes Generating Station units 3 and 4 and all units of Valley Generating Station
  - In 2003 and 2005, two combined cycle generating units were installed, one at Valley Generating Station and the other at Haynes Generating Station, to replace older, inefficient, and less reliable gas fired units. The new units are 30 percent to 40 percent more efficient, and produce 30 percent to 40 percent fewer emissions. Additionally, Valley Generating Station now uses reclaimed water for cooling. These combined cycle generating units also have a shorter start-up time and increased ramp rates to respond to load changes for improved reliability over the older units.
- Castaic
  - The seven units of the Castaic Pumped-Storage Hydroelectric Plant are currently being rotated out of service for modernization. This multi-phase process, initiated in 2004, is expected to be completed in 2013. To date, modernization of five units has been completed. The associated increase in efficiency is projected to add 80 MW of renewable qualifying capacity to Castaic. The increased capacity also results in more reserves available to reliably meet peak system demands.
- Sylmar Converter Station
  - LADWP replaced aging transformers, removed hazardous materials, and installed new technology on this high-voltage direct-current facility to provide continuously reliable transmission capacity to access low cost hydro and renewable energy available from the Pacific Northwest.

- Combustion Turbines installed at Harbor and Valley Generating Station
  - Six natural gas combustion turbine “peaker” units totaling 280 MW have been installed in the Los Angeles area. These quick-start peaking units are used to provide reliable sources of electricity during periods of peak demand. Five of the units are located at Harbor Generating Station, and one unit is located at Valley Generating Station.
- NOx reduction of In-basin Units
  - Selective Catalytic Reduction (SCR) equipment to reduce NOx emissions has been installed on all natural gas-fired generating units in the Los Angeles area. The SCR installations resulted in a 90% reduction in NOx emissions since 1989.

Environmental Stewardship

- Renewable Portfolio Standard
  - Through the active procurement of energy from renewable resources, LADWP has increased its energy mix from 3 percent renewables in 2003 to an expected 20 percent in 2010.
- Energy efficiency
  - LADWP continued its commitment to reduce demand through numerous programs encouraging customer energy efficiency and the installation of energy efficiency equipment. Since 2000, LADWP’s energy efficiency programs have reduced average peak demand by 270 MW, providing over 890 GWh of energy savings.
- Emissions reductions
  - LADWP has reduced its CO_2 emissions from power generation, achieving a 22 percent reduction from 1990 levels through the sale of Colstrip Generating Station and partial sale of Mojave Generation Station. Mojave Generating Station is now removed from service.
- Once-through cooling (OTC)
  - LADWP has reduced the use of once-through ocean water cooling 17 percent in its in-basin generation fleet. The current plan calls for a complete phase-out of ocean water cooling.

- Solar Incentive Program
    - LADWP encouraged the installation of over 22 MW of solar at over 2,700 customer locations through its ratepayer-funded Solar Incentive Program.
- Upgraded capacity on the Southern Transmission System (STS)
    - Five-hundred MW of additional capacity was added to the existing transmission line from Utah, allowing LADWP to increase procurement of renewable energy.
- Green Power Program
    - LADWP offers its customers an opportunity to participate in a Green Power Program (GPP). “Green Power” is produced from renewable resources such as wind energy and geothermal, rather than fossil-fueled or nuclear generating plants. Over 18,995 LADWP customers participated in the program in 2009. These participants increased LADWP’s procurement of renewable energy by 90,000 MWh annually. This number is expected to increase to approximately 100,000 MWh by 2016.

IV CHALLENGES AND CRITICAL ISSUES

LADWP faces major uncertainties in terms of legislative mandates, particularly those pertaining to reduction of GHG emissions and the amount of renewable energy that must be procured and integrated into its energy mix. At the same time, LADWP's generation portfolio contains a number of older, natural gas-fired generating units that are nearing the end of their service lives and are in need of replacement.

Following are the key issues and challenges addressed in this 2010 IRP.

Ensuring Reliability

LADWP will continue to maintain its historically high level of electric power service reliability. LADWP faces several challenges, including replacement of its aging generating facilities and transmission infrastructure.

This 2010 IRP reflects LADWP's long-standing policy of remaining a vertically integrated utility with control over its own generation, transmission, and distribution capacity. This has proven to be a successful strategy in ensuring reliability—especially during periods of volatility in the energy markets. Such conditions occurred in California at the beginning of this decade, and LADWP remained relatively insulated. This 2010 IRP calls for LADWP to continue this strategy.

LADWP's generating units sited within the Los Angeles Basin were primarily built in the late 1950s and early 1960s. While these units have undergone extensive upgrades, they are approaching the end of their service lives. Re-powering of these units began in 1994, and refurbishment is approximately one-third complete. Re-powered units will be substantially cleaner, more efficient, and more reliable than the units they are replacing. Furthermore, re-powering LADWP's gas-fired units will also assist in integrating intermittent renewable resources into LADWP's energy mix by providing quick–response, back-up generation

The procurement of significant amounts of intermittent renewable energy poses the challenge of integrating those resources into LADWP's energy mix. While research is underway to develop energy storage technologies such as batteries and compressed air systems, LADWP will primarily use the Castaic Pumped-storage Hydroelectric Plant in conjunction with its gas-fired generation fleet to integrate its intermittent renewable resources.

Further studies are required to determine maximum levels of intermittent energy resources that can be integrated reliably and the investments necessary to support the power grid and necessary information system.

Environmental Policies and Regulations

- Local air quality mandates

  The South Coast Air Quality Management District (SCAQMD) issued a Stipulated Order for Abatement in 2000 that required LADWP to reduce local air emissions through re-powering its less efficient in-basin generating facilities. Haynes units 5 and 6 and Scattergood unit 3 must be re-powered by 2013 and 2015, respectively.

- Once-through cooling

  Once-through cooling (OTC) is the process of drawing water from a river, lake, or ocean, pumping it through a generating station's cooling system, and discharging it back to the original body of water. Dry cooling will be used on all re-powered units included in this IRP. Compliance strategies that do not include re-powering with dry cooling will severely impact the reliability of the power system.

GHG Emissions

- Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006, calls for reducing the state's GHG emissions to 1990 levels by 2020. Although the regulation and implementation process is still being determined, compliance may be in the form of emissions credits, or allowances, that LADWP would need to purchase at market prices to achieve a specific emissions cap. Additionally, specific targets for renewable energy may be required. As noted earlier, LADWP has already achieved a 22% reduction in CO_2 emissions levels from 1990.

- SB 1368, the California Greenhouse Gas Emissions Performance Standard Act, also enacted in 2006, prohibits LADWP and other California utilities from importing new power that exceeds the GHG emissions performance standard. The GHG emissions level must be equal, or below, that of a gas-fired combined cycle units (i.e., 1,100 lbs. per MWh). This standard also applies to existing power plants for any life extension investments or contractual extensions.

  LADWP has historically relied upon coal for base load generation. The two LADWP plants affected are the Navajo Generating Station in Arizona and IPP in Utah. The Navajo plant contract expires in 2019 while the IPP contract is in effect until 2027.

- At the federal level, various bills have been introduced, such as the Waxman-Markey American Clean Energy and Security Act (HR 2454) and the Kerry-Lieberman American Power Act that address GHG emissions. A future federal regulatory program to address GHG emissions—if and when adopted—can potentially supersede any state program.

- The U.S. Environmental Protection Agency (EPA) has recently taken steps toward regulating GHG emissions under authority of the current Clean Air Act.

Renewable Energy

- The LADWP Board of Commissioners has adopted a policy to achieve 20 percent renewables by 2010, and 35 percent by 2020. The Board and City Council have approved projects and long-term power purchase agreements to achieve the 20 percent RPS goal by the end of 2010.

- The California Air Resources Board (CARB) approved regulations which will subject all utilities to a new Renewable Energy Standard (RES) of 33 percent by 2020, including the following interim targets:

    - Maintain at least 20 percent renewables between 2012 and 2014
    - Maintain 24 percent renewables between 2014 and 2017
    - Maintain 28 percent renewables between 2018 and 2019
    - Achieve 33 percent renewables by 2020 and maintain this level thereafter.

  The regulations were adopted by the Air Resources Board in September 2010 and will go into effect in early 2011. The regulations provide the full authority of CARB to issue significant penalties for failure to achieve the targets.

Competitive energy rates

While LADWP provides electricity at competitively low rates, several factors challenge the current rate structure. These factors include the volatility of natural gas and coal prices, the costs required to replace the aging portions of the Power System infrastructure, and new regulatory requirements such as the elimination of once-through cooling for several LADWP generating stations. Furthermore, the acquisition and integration of renewable energy resources along with the required transmission capacity upgrades will potentially exert upward pressure on energy rates. Because of these initiatives, it is expected that structural rate adjustments and amendments to the Energy Cost Adjustment Factor (ECAF) will be necessary to maintain appropriate debt ratios and bond ratings. Balancing the needs of reliability and environmental stewardship with efforts to maintain competitive rates will be an on-going challenge and goal of LADWP.

V STRATEGIES AND RECOMMENDATIONS

LADWP's recommended strategy set forth in this IRP for meeting its key objectives can be separated into two areas: regulatory and reliability initiatives and strategic initiatives. Regulatory and reliability initiatives ensure system reliability and compliance with regulatory and legislative mandates. Strategic initiatives achieve objectives established by the LADWP Board of Water and Power Commissioners and the Los Angeles City Council and reflect their vision and leadership. These mandates include, for example, establishment of LADWP's RPS, early compliance with SB 1368, and investing in local solar. The recommended strategy also reflects feedback from LADWP's community outreach efforts.

Regulatory and Reliability Initiatives

- Power Reliability Program (PRP) and system infrastructure investment
  LADWP must continue to invest in replacing aging transmission and distribution infrastructure in a systematic and sustained manner to ensure system reliability, especially during significant weather events. The PRP has a core level of investment included in the current financial plan to meet the following objectives: (1) Replace assets in-line with equipment life cycles, but focusing on the worst performing equipment first, (2) fix known problem areas, and (3) invest in equipment to satisfy local and regional load demands.

- Re-powering
  LADWP will continue to re-power older, gas-fired generating units at Haynes Generating Station and Scattergood Generating Station for the reasons discussed previously. These, and future re-powering projects, will mitigate the need for once-through ocean cooling.

- Demand Side Resources (DSR)
  LADWP must procure sufficient resources to meet load growth and maintain system reliability. Along with augmenting its generation portfolio, LADWP will implement Demand Response (DR) and energy efficiency (EE) measures to reduce energy demand. DR and EE programs are not only crucial for meeting customer load growth, they also represent the most cost-effective strategy for reducing GHG emissions, since the cleanest kilowatt-hour any utility can produce is one that is never generated.

- Load Growth
  DR and EE alone cannot meet projected load growth, and new gas-fired generation is necessary.

- SB 1368 Compliance
  Navajo and IPP must be compliant with the mandates established in SB 1368 by 2019 and 2027, respectively. IRP modeling determined that these units will be replaced with a combination of DR, EE, renewable energy, and conventional gas-fired generation.

- Castaic FERC Re-licensing Program
  LADWP and the Department of Water Resources (DWR) hold a joint co-license to operate the Castaic Pumped-storage Hydroelectric Plant. This license is set to expire in 2022. Both parties have initiated the joint re-licensing process, which will include completing preliminary studies, negotiating contracts, and preparing a filing strategy.

Strategic Initiatives

- RPS Percentage

  LADWP recommends a steady and continuous effort until 2020 to achieve an RPS of 33 percent renewables comprised of a diverse mix of renewable resources sited over a wide geographical region. Since wind and solar resources are intermittent and production depends on weather conditions, regional diversity will be important for ensuring a balanced and dependable energy supply. Legislation has been introduced twice to achieve a state-wide RPS of 33 percent and failed to pass—not because of the RPS percentage—but for technical requirements included in the legislation that limited compliance options. Additionally, CARB has currently approved a regulation to require 33 percent renewables as per the Governor's Executive Order, which will be reviewed by the Office of Administrative Law before it is finalized in early 2011. LADWP is including this as an optional policy action only in that this rule has not been finalized and near-term elections could alter the rule and its final approval. LADWP heard very clearly from the public outreach workshops that investments must be made with our customer's costs in mind. LADWP staff is recommending 33 percent renewables instead of the current Board-approved policy of 35 percent, which was established in 2008. This will reduce capital expenditures by up to $2.4 billion over the next 20 years.

  The current financial plan has no provision for LADWP to replace expiring short-term RPS contracts. Without replacing expiring contracts, LADWP projects the generation from renewables will drop from the current level of 20 percent to 13 percent in 2015. The ramp from 13 percent to 33 percent in five years is enormous and not prudent from an engineering, cost, technology, or integration standpoint. Additionally, the CARB regulation will require interim milestones to achieve 20 percent in 2012, 24 percent in 2015, 28 percent in 2018, and 33 percent in 2020. LADWP recommends that investments be made in long-term projects to maintain the RPS percentage at approximately 20 percent between 2010 and 2014.

- Early Compliance with SB 1368

  Comments from the public workshops indicated the desire to comply with SB 1368 as early as possible. Navajo must be compliant with SB 1368 by 2019. LADWP recommends divestment from Navajo by 2014. This will reduce LADWP's GHG emissions by 10.5 million metric tons and add about $350 million in capital investment.

  LADWP recommends modeling and planning for IPP to be compliant with SB 1368 by 2027. However, LADWP will continue to evaluate options in future IRPs. LADWP will continue to work with the Intermountain Power Agency (IPA) Board and the other participants to secure IPP as a renewable energy hub and provide replacement generation compliant with SB 1368. LADWP recommends no change in IPP until 2027 at which time the site would be reconfigured, providing LADWP with firm transmission capacity for potential renewable projects.

- Local Solar

  Comments received at the public workshops indicate local solar development should be a priority in LADWP's renewables procurement strategy. LADWP is recommending a policy action to allow approximately 40-50 percent of its solar resources be sited locally through initiatives including the Solar Incentive Program, feed-in tariffs, and installation of solar on City-owned properties. Local solar costs an estimated additional $50/MWh over utility-scale solar located outside the Los Angeles Basin, estimated to cost $150/MWh, primarily due to economies of scale and about 30% better solar insolation.

- Advanced Reliability Improvements

  LADWP is looking ahead to technologies that will enhance the reliability of its system, including smart grid technologies, enhanced information systems, automation of system functions, and advanced methods of outage management. These advanced system enhancements are recommended from a planning perspective to not only increase reliability, but also to better integrate local generation such as solar into the distribution network, enable smart charging of electric vehicles, and advance demand-side management technologies.

Table ES-1 illustrates the reliability, regulatory, and strategic investments included in this 2010 IRP.

Table ES-1: 2011-2020 Investments

ACTION	INVESTMENT
Power Reliability	$11 billion
Modernize Power Plants	$1.4 billion
Transition from Coal (Navajo GS)	$0.3 billion
Increasing Renewable Energy (includes cost of additional transmission)	$7 billion
Expand Local Solar	$1.2 billion
Increasing Energy Efficiency	$1.2 billion
Smart Grid Investments	$1 billion
SUB TOTAL	$23 billion
Basic Generation, Transmission and Distribution	$22 billion
TOTAL	$45 billion

Regulatory and Reliability Investments

Regulatory investments are investments needed to comply with various regulatory requirements, including eliminating once-through ocean cooling, reducing GHG emissions, and re-licensing certain power plants. Reliability investments are investments needed to maintain, refurbish, or replace aging infrastructure. These investments include pole, cable, and transformer replacements in addition to various initiatives established to ensure system reliability.

Strategic Investments

Strategic investments include procurement of additional renewable generation resources and associated transmission and early compliance with certain GHG emissions regulations. These investments would ensure LADWP is well positioned to implement various environmental policy objectives.

Strategic Case Options

The Draft 2010 IRP originally presented six strategic alternatives (or case options) to help evaluate the strategies and associated costs for meeting LADWP's key objectives. The six cases vary by two main factors: the amount and mix of renewable energy resources (RPS Strategy), and the timeframe for complying with SB 1368 (GHG Reduction Focus).

- Amount of Renewables—Solar and Wind Strategies
  This IRP studied different renewable energy mixes needed to achieve 35 percent renewables by 2020. For comparison purposes, cases setting a goal of 20 percent renewables by 2020 were also developed. Through initial screening, LADWP determined the renewable energy mix for each strategic case must include a certain and consistent amount of base load geothermal energy to ensure system reliability. Based on projected cost, resource availability, resource diversity requirements, and geographic diversity requirements, LADWP narrowed the list of potential strategic cases to two: one emphasizing solar resources, and the other emphasizing wind resources. These two strategic cases are referred to as the *RPS Solar Strategy* and *RPS Wind Strategy*, respectively.

- Accelerated GHG Reduction
  The second key factor in developing the strategic alternatives was whether LADWP should accelerate GHG reduction. The strategies that assumed accelerated compliance are referred to as "GHG Reduction Focus" strategies.

- Base Case

  The base case assumes that existing RPS contracts will not be replaced when they expire. This case represents a minimum expenditure level.

- Recommended Case Option

  After consideration of various factors, including comments received during the public outreach process, a Recommended Case was developed. The Recommended Case includes all required and regulatory actions.

Table ES-2 summarizes each strategic case.

Table ES-2: Resource strategy summary matrix

Case ID	Resource Strategy	2020 RPS Target	GHG or SB1368 Compliance Date	New Renewable Capacity (MW) 2011-2030			
				Geothermal	Wind[1]	Solar	Generic
Base	Required Actions Only	13%	2027	0	100	130	0
A	20% RPS Strategy	20%	2027	160	250	660	0
B	20% RPS Strategy – GHG Reduction Focus	20%	2020	160	250	660	0
C	35% RPS Wind Strategy - GHG Reduction Focus	35%	2020	320	1,300	660	0
D	35% RPS Wind Strategy	35%	2027	320	1,300	660	0
E	35% RPS Solar Strategy - GHG Reduction Focus	35%	2020	320	850	1,560	0
F	35% RPS Solar Strategy	35%	2027	320	850	1,560	0
Recommended Case	33% RPS	33%	IPP 2027 Navajo 2014	320	680	970	160

1. Adds Milford II

VI EVALUATION OF STRATEGIC CASE OPTIONS

Key assumptions were made when establishing and analyzing each strategic case option:

- EE/DR penetration
- Future energy demand
- Natural gas prices
- GHG emissions allowance prices.

Specific values used over the 20-year planning horizon for these assumptions are presented in Section 3 of this IRP.

Through rigorous analysis, this IRP assessed the reliability, economic impacts, and GHG reduction benefits of LADWP's alternative resource strategies. Production cost modeling was utilized to simulate LADWP's Power System operations under different scenarios with different generation resource portfolios. The production model evaluated each case over the IRP's 20-year planning horizon.

Reliability

Each case assumes an integrated strategy of renewables and the necessary infrastructure to ensure a reliable system. Quick response gas-fired generation along with customer DSR programs were added to maintain acceptable reliability levels, ensuring all case options have acceptable levels of reliability and conform to national reliability standards.

GHG Analysis

Projected GHG emissions for each strategic case were modeled and are presented in Figure ES-1.

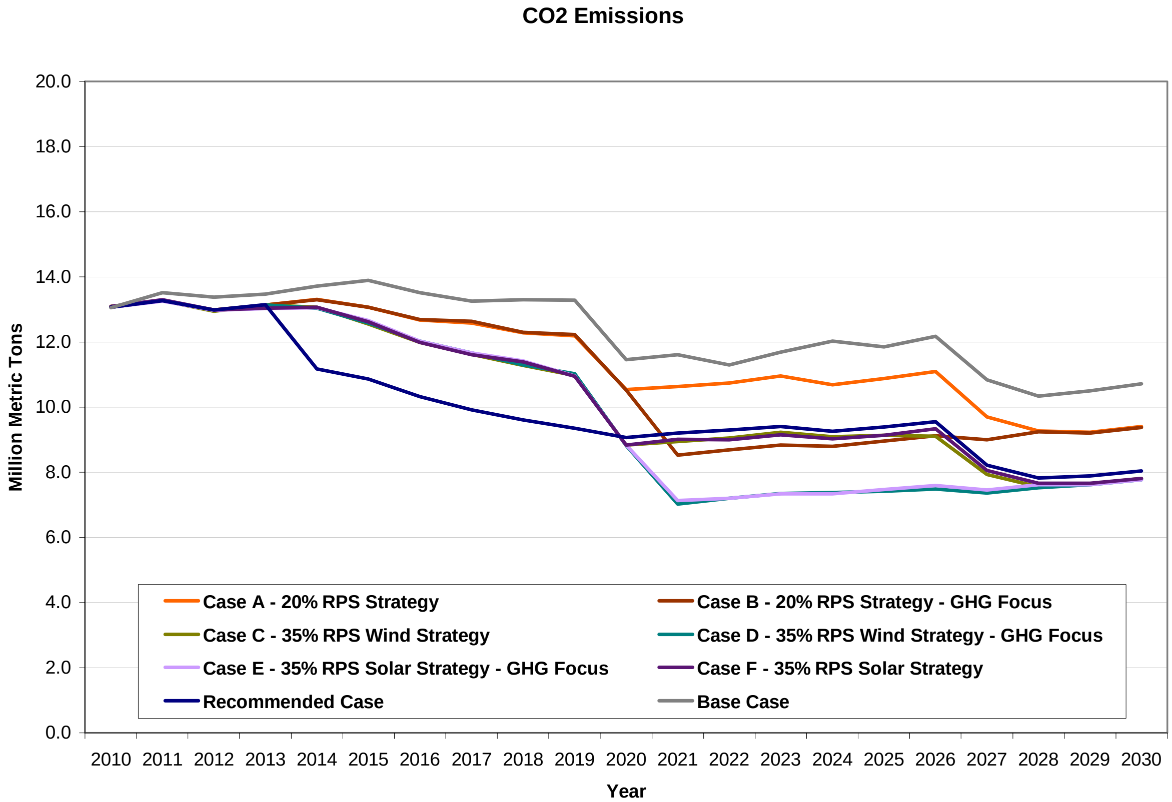


Figure ES-1: Projected GHG emissions for each strategic case

Financial Analysis

Financial analysis involves modeling each strategic case, accounting for their respective fuel expenses, purchased power expenses, and additional capital and O&M expenses. In order to ensure LADWP minimizes its financing costs, constraints are placed on several financial metrics. These constraints include maintaining debt service coverage of 2.25, adjusted debt service coverage of 1.75, full obligation coverage of 1.40, and a capitalization ratio not exceeding 60 percent. LADWP subsequently evaluated each strategic case and determined the rate adjustments required to satisfy these constraints.

LADWP retail revenue stems from three billing factors: (1) base rate, (2) energy cost adjustment (ECA), and (3) reliability cost adjustment (RCA) factors.

The ECA is used to cover fuel, purchased power, and RPS and energy efficiency-related expenses.

The RCA is used to cover power reliability related expenses.

The base rate is traditionally used to cover non-fuel, non-purchased power, and non-renewables related expenses.

Figure ES-2 shows the annual bulk power cost forecasted for each strategic case, including the Recommended Case.

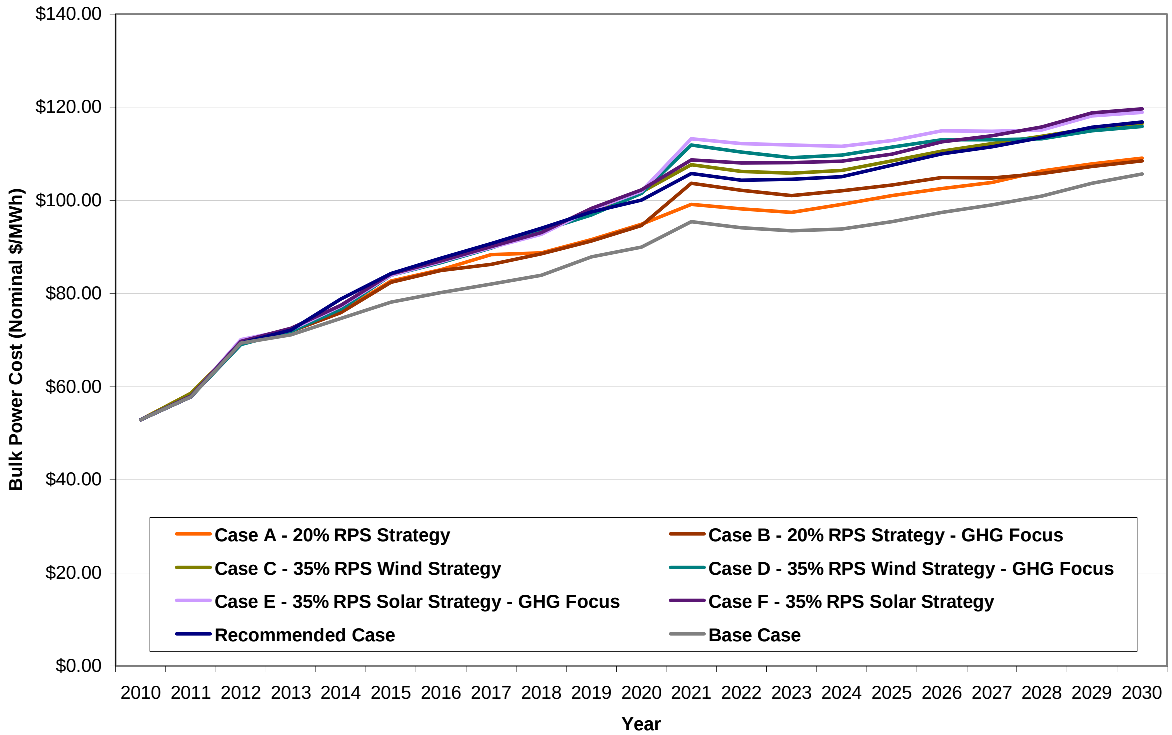


Figure ES-2: NPV of bulk power costs for each strategic case

The retail electric rates for all eight cases are shown on Figure ES-3 below. The retail rates incorporate all three billing factors discussed above. Factors driving the increases over the twenty-year period are: rising fuel price, increased power reliability program spending, replacement of aging basin generating units to meet South Coast Air Quality District emission requirements, replacement of coal generation to lower CO_2 emissions, installation of renewables generation according to legislative mandates, and payment for emission allowances due anticipated CO_2 cap-and-trade program requirements.

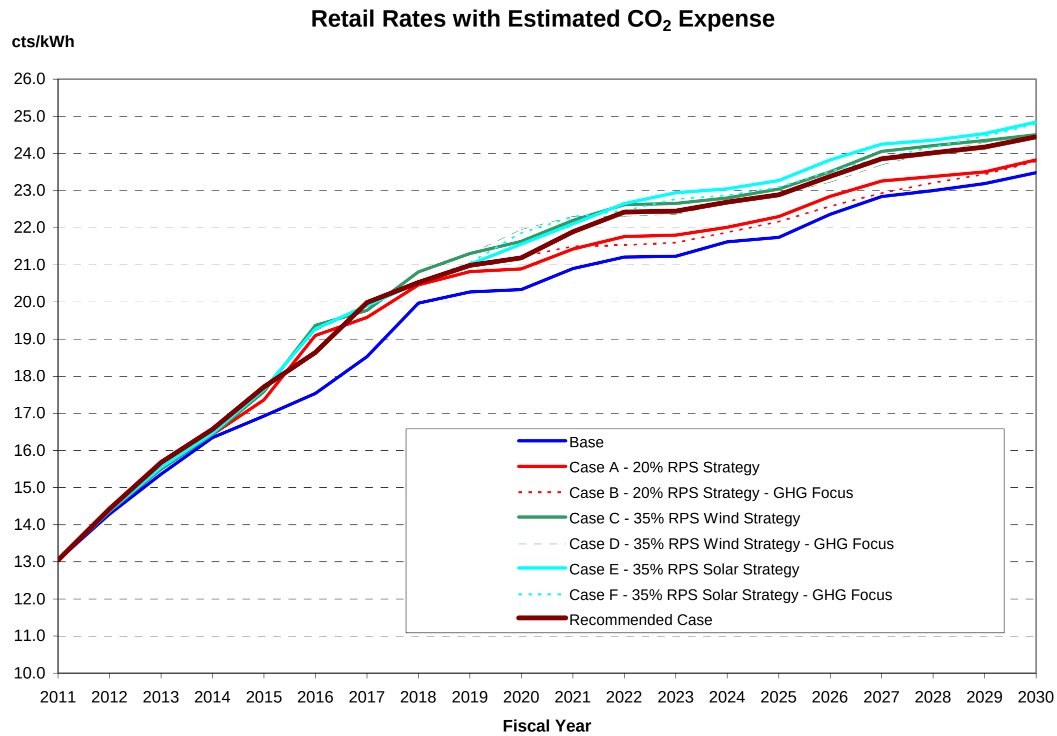


Figure ES-3: Electric rate impact for each strategic case (in nominal dollars)

Sensitivity Analyses on the Recommended Case

Assumptions used to model effects on CO_2 emissions and retail rates can change. In order to reflect the variability in model assumptions, a sensitivity analysis was performed to determine a realistic range of CO_2 emissions and rate impact trajectories for the Recommended Case.

Figure ES-4 shows the possible high and low range of CO_2 emissions in the study period for the Recommended Case. The high CO_2 emissions scenario analysis assumes

- Lower penetrations of energy efficiency programs
- High penetrations of plug-in hybrid electric vehicles

Conversely, the low CO_2 emissions scenario assumes

- Aggressive use of energy efficiency programs
- Low penetrations of plug-in hybrid electric vehicles

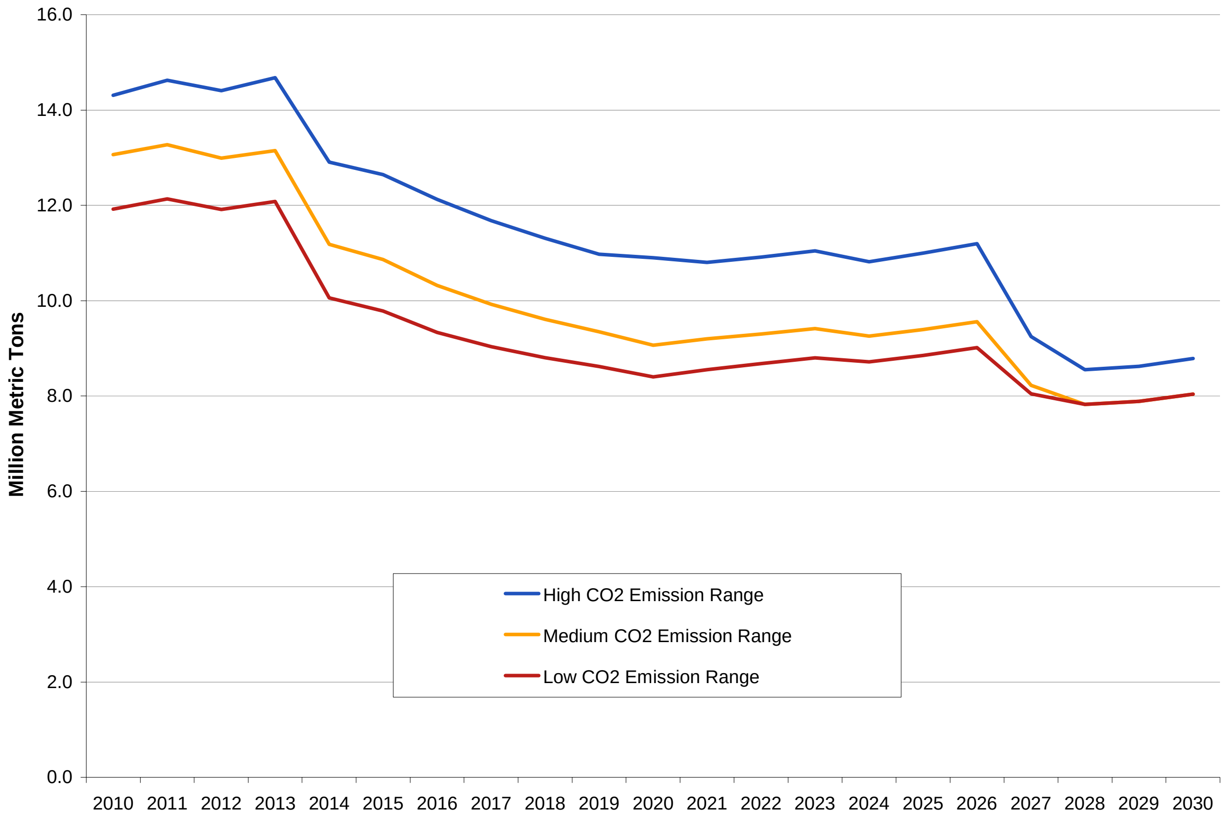


Figure ES-4: Recommended Case CO_2 Emission Scenarios

Figure ES-5 shows retail prices of the Recommended Case bounded by a high and low range. Electric rates are expected to rise between 5 percent and 8 percent over the next five years and between 2.8 percent and 3.7 percent over the next twenty years.

The high range assumes

- Higher natural gas prices
- Higher CO_2 costs.

The low range assumes

- CO_2 costs fall to zero
- Energy efficiency costs diminish
- Lower natural gas prices
- The Power Reliability Program is implemented at the lowest possible level
- Policy changes regarding financial metrics are enacted by the Board of Water and Power Commissioners.

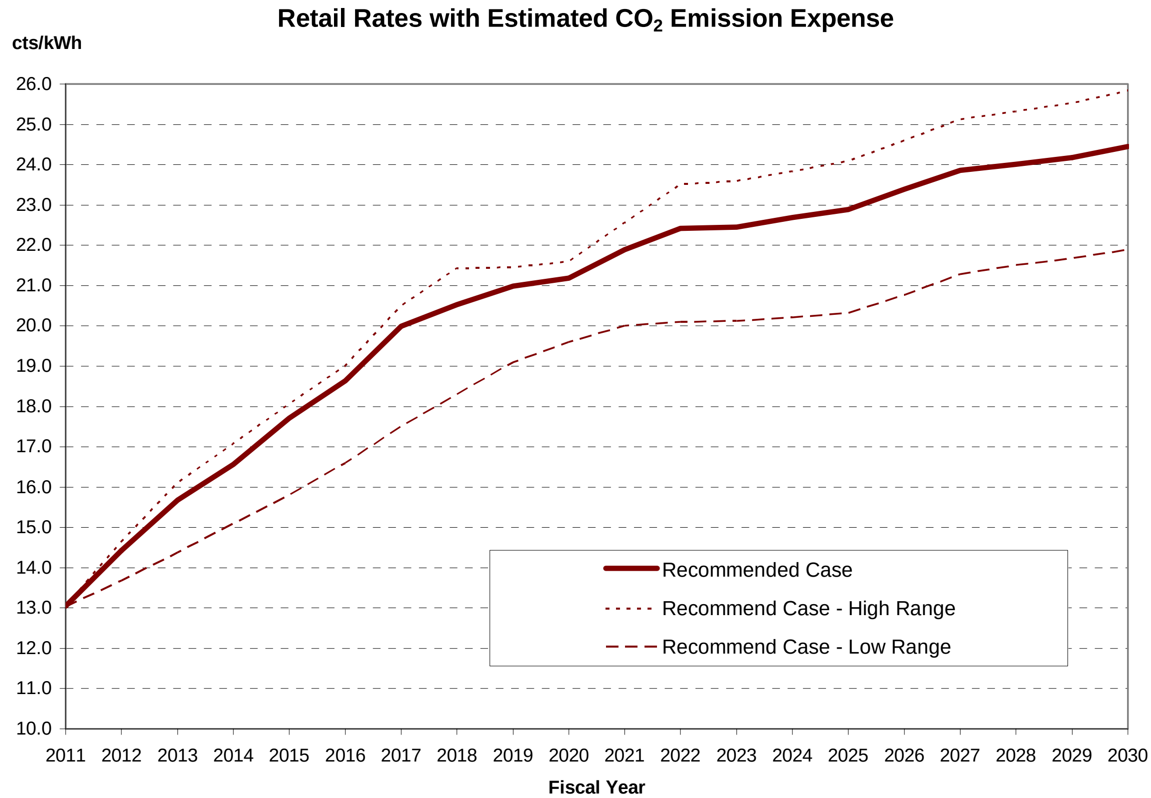


Figure ES-5: Retail price impact of the Recommended Case bounded by high and low range

VII SUMMARY

The IRP is one element of an overall LADWP Strategic Plan that identifies LADWP's strategic mission, values, and goals. The IRP is the plan to ensure that necessary investments are made in a timely manner to keep LADWP's system reliable through the best mix of generation resources to meet demand from a fully integrated system perspective. This IRP works with companion plans such as the Power Reliability Program plan, the 10-year Transmission Plan, and other tactical plans to fulfill the requirements of the Strategic Plan.

Beyond the basic generation, transmission, and distribution investments required under the IRP, the main drivers of further rate increases come predominately from investments in the electric infrastructure through the Power Reliability Program, investments in renewable energy sources to achieve the recommended RPS level of 33% by 2020, investments in energy efficiency and demand reduction, and funding for local solar programs. These investments will result in a more reliable electric system, greater diversity in the generation supply, substantial reductions in GHG, and will encourage job growth in the local economy.

Some elements of the plan will take five to ten years to implement. It is important to commit to a direction so that critical time and resources are not lost. Subsequent IRPs will refine the direction as additional information becomes available. The recommended plan allows for flexibility to incorporate necessary adjustments over time. It is also important to set a steady course and pace to allow for reasoned and deliberate action by LADWP staff, Board, or City Council to avoid situations leading to unfavorable pricing or rate impacts. The IRP implementation must be viable from a technical and financial perspective to best balance all the priorities of reliability, environmental stewardship, and cost.

This 2010 IRP identifies actions that are central to the continued reliability of LADWP's Power System, and will occur regardless of the composition of the long-range resource portfolio ultimately selected. LADWP staff will develop working-level tactical plans to implement the objectives of this IRP.

Integrated resource planning is an on-going process. LADWP will continue to adapt and refine the IRP as uncertainties are better understood, and policy direction and requirements are solidified. A new IRP will be issued in 2012, and every two years thereafter.

1.0 INTRODUCTION

1.1 Overview of the 2010 Integrated Resource Plan

This report presents the Los Angeles Department of Water and Power (LADWP) Integrated Resource Plan (IRP) for 2010. The IRP is a process by which electric utilities analyze the costs, benefits, and risks of all available energy resources. The goal of an IRP is to identify a portfolio of resources that meets future needs at the lowest cost and risk consistent with LADWP environmental goals. The IRP is an important planning process for electric utilities, and many states and regulatory agencies require development of an IRP prior to approval of procurement programs or electric rate increases.

This IRP serves as the roadmap for LADWP as it executes major new projects and programs to transform the Power System over the next 20 years. The purpose of this 2010 IRP is to provide a framework to assure the future energy needs of LADWP customers are met in a manner that balances the key objectives of:

- High reliability of electric service
- Competitive electric rates consistent with sound business principles
- Responsible environmental stewardship meeting all regulatory obligations

In balancing these key objectives, LADWP's strategic planning efforts must ensure a high level of system reliability, consider impacts to the local and regional economy, allow for volatility in fuel and emissions pricing, comply with state and federal regulations, and guarantee fiscal responsibility.

The integrated resource planning process develops several strategic planning cases, each with a distinct resource mix and set of constraints and goals. These cases are modeled to determine their respective operational, fiscal, and environmental impacts. This document presents the results of this analysis and recommends near-term actions and long-term goals to best meet the electrical needs of Los Angeles.

1.2 Organization of the IRP

This document begins with a brief discussion of the objectives of this IRP (Section 1.3).

Section 1.4 provides a brief overview of the current Power System—LADWP's electricity generation and transmission infrastructure. Power System upgrades are also addressed.

Section 1.5 summarizes LADWP's major recent accomplishments, underscoring LADWP's commitment to environmental leadership, maintaining a high level of electric service reliability, and competitive energy rates.

Section 1.6 summarizes the key issues and challenges facing LADWP. As the largest municipal utility in the U.S., LADWP faces unique challenges that are expected to become more complex and demanding over the timeframe considered in this IRP.

To ensure this document accurately reflects the needs of the City of Los Angeles (City)—as well as a wide range of stakeholders—LADWP conducted a public review process to encourage public participation and solicit feedback. Section 1.7 provides an overview of this process.

The remainder of this IRP is organized as follows:

- Section 2, "Load Forecast and Resources," provides forecasts of electricity demand, discusses the resources available or needed to meet that demand, and addresses the issues associated with each resource.
- Section 3, "Strategic Case Development," establishes potential alternatives available to LADWP to meet its projected electricity demand.
- Section 4, "Strategic Case Comparisons," addresses the operational modeling used to assess the impact of each alternative on cost, energy rates, and GHG emissions.
- Section 5, "Recommendations," provides an overview of recommendations, including near-term actions and long-term goals.

1.3 Objectives of the IRP

This 2010 IRP identifies several key objectives and establishes the actions LADWP will take to achieve them. These objectives include maintaining a high level of electric service reliability, exercising environmental stewardship, and keeping energy rates competitive.

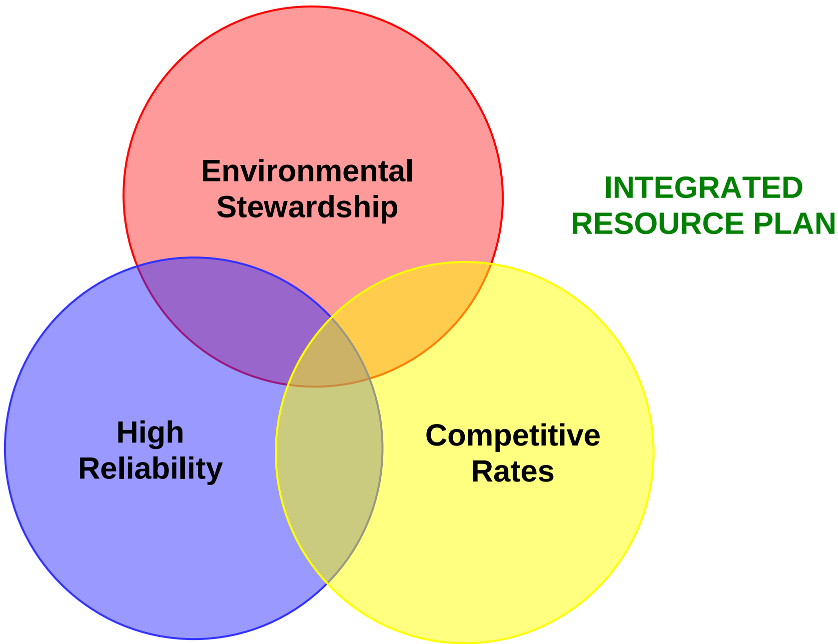


Figure 1-1: Objectives of this IRP

1.3.1 Reliable Electric Service

- <u>Self-sufficiency</u>

  LADWP intends to continue its successful policy of owning or controlling its transmission and generation resources to serve its native load customers. This policy has served the City of Los Angeles well. Because of this policy, Los Angeles avoided the rolling blackouts much of the state endured during the statewide energy crisis of 2000-2001.

- <u>CAISO/RTO</u>

  The California Independent System Operator or CAISO was established in 1998 as part of California's electric utility restructuring effort. CAISO was established as a non-profit corporation to provide an impartial link between power plants and utilities. LADWP is not a member of the CAISO but has submitted an application to the CAISO to become a trading partner.

- Reliability regulations

  LADWP will comply with all North American Electric Reliability Corporation (NERC) and Western Electric Coordinating Council (WECC) regulations regarding system reliability. NERC and WECC are electric utility organizations established to set reliability standards for the industry.

- Balancing authority

  LADWP is a registered balancing authority with NERC and is responsible for coordinating and balancing the generation and delivery of electricity through its system. LADWP will continue to maintain its presence as a balancing authority.

- Coastal power plants

  LADWP operates three coastal natural-gas-fired (or "gas-fired") power plants critical to its operations. These plants were built from the 1940s up to the 1970s. One of these plants was modernized in the 1990s, resulting in efficiency and reliability gains while reducing emissions and maintenance costs. As for the two remaining plants, one has begun modernization and the other will be modernized by 2016. LADWP must modernize these plants to comply with environmental regulations, improve efficiency, and better integrate renewable resources.

- Power Reliability Program

  LADWP has a comprehensive Power Reliability Program focused on improving its electric distribution system and electric service reliability. This program will continue as planned and budgeted.

- Smart Grid

  LADWP will continue to develop projects to improve power system monitoring, control, and automation to operate its assets more reliably, efficiently, and economically. These assets include power plants, transmission lines and stations, distribution lines and equipment, customer meters, and demand-side management resources.

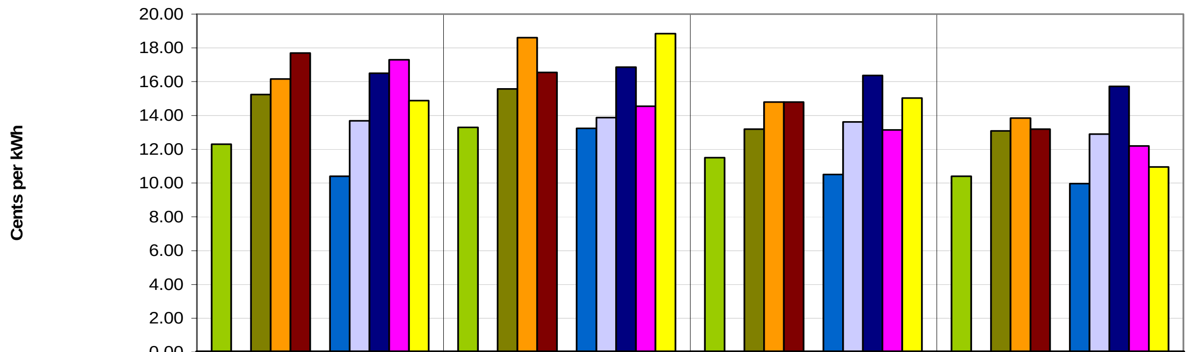
1.3.2 Competitive Rates Consistent With Sound Business Principles

- Energy rates

  LADWP will seek to maintain electric rates at a level lower than investor-owned utilities in Southern California.

  As shown on Figure 1-2, LADWP's average electric rates are typically lower than those of other utilities.

Annualized Rate Comparison for the Year of 2009



	RESIDENTIAL	SMALL COMMERCIAL	MEDIUM COMMERCIAL	LARGE C&I
LADWP (July 2009)	12.30	13.30	11.50	10.40
SCE	15.24	15.57	13.19	13.09
PG&E	16.16	18.60	14.80	13.85
SDG&E	17.69	16.54	14.80	13.19
ANAHEIM	10.40	13.24	10.51	9.97
BURBANK	13.68	13.87	13.61	12.90
GLENDALE	16.50	16.86	16.37	15.72
PASADENA	17.29	14.55	13.15	12.20
RIVERSIDE	14.88	18.84	15.03	10.95

Rate Class

While LADWP provides electricity at competitively low rates, several factors challenge the current rate structure. These factors include the volatility of natural gas and coal prices, the costs required to replace the aging portions of the Power System infrastructure, and new regulatory requirements such as the elimination of once-through cooling for several LADWP generating stations. Furthermore, the acquisition and integration of renewable energy resources along with the required transmission capacity upgrades will potentially exert upward pressure on energy rates. Because of these initiatives, it is expected that structural rate adjustments and amendments to the Energy Cost Adjustment Factor (ECAF) will be necessary to maintain appropriate debt ratios and bond ratings.

Figure 1-2: LADWP's average electric rates compared to other California utilities

- Financial metrics: objectives

    - Bond rating

      Maintain LADWP's current "AA" bond credit rating to keep financing costs as low as possible.

    - Debt service coverage

      Maintain a debt service coverage level of at least 2.25 times.

    - Adjusted debt service coverage

      Maintain a adjusted debt service coverage level of at least 1.75 times.

    - Full obligation coverage

      Maintain a full obligation coverage level of 1.5.

    - City transfer

      Maintain a level of net income sufficient to ensure stable transfer of funds to the City.

    - Operating cash target

      Maintain at least $300 million in operating cash.

    - Capitalization ratio

      Maintain a capitalization ratio of 60 percent or less.

1.3.3 Environmental Stewardship

- Renewable energy

  LADWP will continue efforts to expand the use of renewable energy resources to provide electricity to Los Angeles. LADWP will, at a minimum, comply with local, state or federal mandates for levels of renewable energy in its Renewable Portfolio Standard (RPS). The Board of Water and Power Commissioners has established a policy of 20% renewables by year 2010 and 35% by year 2020.

- Carbon dioxide (CO_2) emissions

  LADWP will reduce power generation CO_2 emissions to levels that, at a minimum, will comply with local, state, or federal mandates.

- Once-through cooling (OTC)

  LADWP's coastal generating stations use ocean water to provide plant equipment cooling. The State of California has proposed regulations to eliminate OTC that will adversely impact the operations of these plants. LADWP will continue to study options for complying with these regulations.

- Energy efficiency

  LADWP will continue to develop and administer customer energy efficiency programs to offset forecasted electricity consumption.

- Combined heat and power systems

  LADWP will investigate implementing programs to encourage customers to develop combined heat and power systems to increase energy efficiency at their facilities, particularly those that use both electricity and heat energy in their operations. At a minimum, LADWP will comply with local, state, and federal mandates in this area.

1.4 LADWP's Power System

LADWP's Power System serves approximately four million people and is the nation's largest municipal electric utility. LADWP experienced an all-time peak demand of 6,142 megawatts (MW), which occurred on September 27, 2010, and has an installed net dependable generation capacity of 7,125 MW. Its service territory covers the City and many areas of the Owens Valley, with annual sales exceeding 23 million megawatt-hours (MWh). Projected future demand growth for electricity is less than one percent per year. The current economic recession has reduced energy demand slightly over the preceding two years.

"Capacity" is an electric utility term referring to how much power a system can generate at a given instant in time, while "energy" refers to how much power the system generates over a given period of time. Capacity is expressed in megawatts (MW), while energy is expressed in megawatt-hours (MWh).

LADWP is a "vertically integrated" utility—both owning and operating the majority of its generation, transmission, and distribution systems. LADWP is fully resourced to meet peak demand but maintains transmission and wholesale marketing operations to keep production costs low and increase system reliability

Additional information on the Power System's generation and transmission assets can be found in Section 2.4.

1.5 Accomplishments to Date

A summary of major LADWP accomplishments consistent with the objectives of this IRP are presented below. These accomplishments promote the goals of maintaining high reliability and exercising environmental stewardship, while keeping rates competitive.

- Renewable portfolio standard

  Through the active procurement of renewable resources, LADWP has increased the renewable energy component of its resource mix from 3% in 2003 to an expected level of 20% by the end of 2010.

- Re-powering Haynes Generating Station units 3 and 4 and Valley Generating Station

  In 2003 and 2005, two combined cycle generating units were installed—one at the Valley Generating Station and the other at Haynes Generating Station. The new units are 30 to 40 percent more efficient than the units they replaced, and produce 30 to 40 percent fewer emissions.

- Energy efficiency

  LADWP continued its commitment to energy efficiency through numerous programs and services to customers, encouraging the adoption of energy-saving practices and installation of energy-efficient equipment. Since 2000, LADWP energy efficiency programs have reduced long-term peak period demand by approximately 271 MWs, resulting in 894 GWh of energy savings.

- Emissions reduction

  CO_2 emissions from power generation are 22% lower than 1990 levels through the sale of Colstrip Generating Station and partial sale of Mojave Generation Station. Mojave Generating Station is now removed from service.

- Once-through cooling

  LADWP has reduced the use of once-through ocean water cooling 17% since modernizing its in-basin generation fleet. The current plan calls for a complete phase-out of ocean water cooling.

- Castaic

  The seven units of the Castaic Pumped-storage Hydroelectric Plant are currently being rotated out of service for modernization. This multi-phase process began in 2004 and is expected to continue through 2013. To date, modernization of five units have been completed. The associated increase in efficiency is projected to add up to 80 MW of renewable qualifying capacity to Castaic. The increased capacity also results in more reserves available to reliably meet peak system demands.

- Power Reliability Program (PRP)

  The PRP is a comprehensive, long-term power reliability program developed by LADWP to replace aging infrastructure and make permanent repairs to generation, transmission, and distribution infrastructure that has failed during recent outages. Through the program, LADWP is accelerating the replacement of transformers, poles, underground cables, underground vaults, station transformers, distribution and receiving stations, and modifications to existing stations. LADWP is also installing new control, integrated central monitoring, and dispatch systems needed to facilitate reliable and secure system operations. Additionally, LADWP will increase staffing and modify its staff training programs accordingly.

- Green Power Program

  LADWP offers its customers an opportunity to participate in the Green Power Program (GPP). "Green Power" is produced from renewable resources such as wind energy and geothermal resources, rather than fossil-fueled or nuclear generating plants. Over 18,995 LADWP customers participated in the program during 2009. These participants receive approximately 90,000 MWh of renewable energy resources annually. This number is expected to increase to approximately 100,000 MWh by 2016.

- Solar Incentive Program

  LADWP encouraged the installation of over 22 MW of solar at over 2,700 customer locations through its ratepayer-funded Solar Incentive Program.

- Upgraded capacity on the Southern Transmission System (STS)

  Five-hundred MW of additional capacity was added to the existing transmission line from Utah, allowing LADWP to increase procurement of renewable energy.

- Combustion Turbines installed at Harbor and Valley Generating Station

  Six natural gas combustion turbine "peaker" units totaling 280 MW have been installed in the Los Angeles area. These quick-start peaking units are used to provide reliable sources of electricity during periods of peak demand. Five of the units are located at Harbor Generating Station, and one unit is located at Valley Generating Station.

- NOx reduction of In-basin Units

  Selective Catalytic Reduction (SCR) equipment to reduce NO_x emissions has been installed on all natural gas-fired generating units in the Los Angeles area. The SCR installations resulted in a 90% reduction in NOx emissions since 1989.

1.6 Key Issues and Challenges

As LADWP looks to the future, most of the issues influencing strategic and resource planning stem from its policy to address greenhouse gas emissions (GHGs)—specifically CO_2—and the development and integration of increasing amounts of renewable resources. Additionally, several gas-fired generating units are nearing the end of their service life and require re-powering. While this IRP makes recommendations in the best interest of the Power System and the City of Los Angeles, those recommendations must satisfy applicable laws and regulations.

1.6.1 GHG Emissions Reduction

LADWP's GHG emissions reduction strategy must comply with state and federal regulations. At the time of this writing, key legislation and regulations either promulgated or proposed include:

- Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006, calls for reducing the state's GHG emissions to 1990 levels by 2020. Although the regulation and implementation process is still being determined, compliance may be in the form of emissions credits, or allowances, that LADWP would need to purchase at market prices to achieve a specific emissions cap. Additionally, specific targets for renewable energy may be required. LADWP has achieved a 22% reduction in CO_2 emissions level from 1990.

- SB 1368, the California Greenhouse Gas Emissions Performance Standard Act, also enacted in 2006, prohibits LADWP and other California utilities from entering into long-term financial commitments for base load generation unless it complies with the GHG emissions performance standard. The GHG emissions level must be equal, or below, that of a gas-fired combined cycle units (i.e., 1,100 lbs. per MWh). This standard also applies to existing power plants for any life extension investments or contractual extensions.

  LADWP has historically relied upon coal for base load generation. The two LADWP plants affected are the Navajo Generating Station in Arizona and IPP in Utah. The Navajo plant contract expires in 2019 while the IPP contract is in effect until 2027.

- At the federal level, various bills have been introduced, such as the Waxman-Markey American Clean Energy and Security Act (HR 2454) and the Kerry-Lieberman American Power Act that address GHG emissions. A future federal regulatory program to address GHG emissions—if and when adopted—can potentially supersede any state program.

- The U.S. Environmental Protection Agency (EPA) has recently taken steps toward regulating GHG emissions under authority of the current Clean Air Act.

1.6.2 Increasing Renewable Resources

Initiatives to utilize renewable resources to generate electricity support the goal of reducing GHG emissions and lessen our reliance on fossil fuels.

- The LADWP Board of Commissioners has adopted a policy to achieve 20 percent renewables by 2010, and 35 percent by 2020. The Board and City Council have approved projects and long-term power purchase agreements to achieve the 20 percent RPS goal by the end of 2010.

- The California Air Resources Board (CARB) approved regulations which will subject all utilities to a new Renewable Energy Standard (RES) of 33 percent by 2020, including the following interim targets:

  - Maintain at least 20 percent renewables between 2012 and 2014
  - Maintain 24 percent renewables between 2014 and 2017
  - Maintain 28 percent renewables between 2018 and 2019
  - Achieve 33 percent renewables by 2020 and maintain this level thereafter.

  The regulations were adopted by the Air Resources Board in September 2010 and will go into effect in early 2011. The regulations provide the full authority of CARB to issue significant penalties for failure to achieve the targets.

1.6.3 Ensuring Reliability

LADWP will continue to maintain its historically high level of electric power service reliability. LADWP faces several challenges, including replacement of its aging generating facilities and transmission infrastructure.

This 2010 IRP reflects LADWP's long-standing policy of remaining a vertically integrated utility with control over its own generation, transmission, and distribution capacity. This has proven to be a successful strategy in ensuring reliability—especially during periods of volatility in the energy markets. Such conditions occurred in California at the beginning of this decade, and LADWP remained relatively insulated. This 2010 IRP calls for LADWP to continue this strategy.

LADWP's generating units sited within the Los Angeles Basin were primarily built in the late 1950s and early 1960s. While these units have undergone extensive upgrades, they are approaching the end of their service lives. Re-powering of these units began in 1994, and refurbishment is approximately one-third complete. Re-powered units will be substantially cleaner, more efficient, and more reliable than the units they are replacing. Furthermore, re-powering LADWP's gas-fired units will also assist in integrating intermittent renewable resources into LADWP's energy mix by providing quick–response, back-up generation

The integration of renewable energy into the grid poses major challenges. Integrating renewables may, paradoxically, require additional gas–fired generation. Because renewable resources like wind and solar produce electricity intermittently (i.e., only when the wind is blowing or when the sun is shining), integration of these resources requires back-up generator units to compensate for swings in energy production. The amount of energy production can fluctuate quickly from zero to full capacity and back. These swings present operational challenges and must be leveled by stable generation capable of equally quick changes of generation in the opposite direction. This stabilization is known as "regulation". A preferred solution would use energy storage to regulate delivery of energy and reduce the severity of integration problems. LADWP currently uses pumped water storage for surplus generation. Batteries and compressed air offer another storage solution, but those technologies are still in development and have not yet been proven at the scales needed for implementation.

Many of LADWP's generation stations are 50 to 60 years old and are experiencing maintenance challenges, which are impacting reliability. The replacement or refurbishing of older equipment is addressed in this IRP.

Further studies are required to determine maximum levels of intermittent energy resources that can be integrated reliably and the investments necessary to support the power grid and necessary information system.

Power Reliability Program (PRP)

Additionally, LADWP established the Power Reliability Program. The goals of the program include: (1) mitigating problem circuits and stations based on the types of outages specific to the facility, (2) implementing proactive maintenance and capital improvements that take into account system load growth and the inspections and routine maintenance that must take place to identify problems before they occur, and (3) establishing replacement cycles for facilities that are in alignment with the equipment's life cycle.

Power Reliability Program includes the following capital programs:

- Pole replacement
  Increase the number of poles replaced annually with the goal of achieving an overall replacement cycle of 60 years (3000 poles per year + 2000 changed from normal business). Use the Pole Replacement Contractor for near-term increase in replacements.

- Cable replacement
  Increase underground cable replacements from 40 miles per year to 60 miles, representing a 75-year replacement cycle. Establish pilot program to use Exempt Electrical Mechanics for this work. Also, for near-term, use Cable Replacement contractor for increased replacements. Underground Transmission is also planned to replace one 138-kV underground line per year.

- Distribution transformers
  A transformer management program has been developed to closely monitor transformer loading. Priority based transformer replacements take into account various factors such as loading, number of customers, age, and neighborhood conditions. Increase transformer inventories, replace transformers greater than 50 years old, and revise transformer specifications to more heat tolerant design.

- Load growth and drafting resources
  Construction of new lines and stations to support load growth is a very important infrastructure improvement, typically resulting in fewer outages. Increase construction resources to support the timely installation of new facilities. A 58,000 labor-hour backlog exists for various engineering records, and approximately 60,000 as-built drawings require processing. Increase drafting resources to reduce backlog and improve records for use by engineering, operations, maintenance and construction forces.

- Deteriorated vaults & obsolete equipment
  Over 900 substructures require some degree of repair or replacement. There is a backlog of work to install vault lid restraints. Increase Conduit Crews to reduce backlogs. Obsolete electrical equipment has been identified as needing replacement. The PRP puts substructures and equipment on a systematic replacement cycle. Establish a pilot program to use Exempt Electrical Mechanics for some of this work.

- Station transformers
  There are 846 main transformer banks in Distribution, Receiving and Switching stations, some over 60 years old. We are currently changing 2 Receiving Station transformer banks per year. We will move to a 50 year replacement cycle, and increase spare transformer inventory.

- Reliability engineering work group
  Establish this group and develop work processes for structured analysis of failure rates, outage rates, and testing data as input to prioritize the maintenance basis and capital jobs for T&D reliability, and to improve performance reporting.

- Generation reliability engineering
  Increase Generation engineering resources to improve analysis and evaluation of Generation Unit performance, improve preventative maintenance schedules, and provide engineering for other reliability related programs and projects.

- Distribution infrastructure undergrounding program
  In addition to aesthetic considerations, undergrounding overhead lines has a reliability benefit of reducing the frequency of outages to almost half that of overhead. This program will perform 8 miles of underground conversion per year.

Additional information on LADWP's PRP can be found in Appendix E.

1.6.4 Air Quality and Once-through Cooling

- Local air quality mandates

The South Coast Air Quality Management District (SCAQMD) issued a Stipulated Order for Abatement in 2000 that required LADWP to reduce local air emissions through re-powering its less efficient in-basin generating facilities. Haynes units 5 and 6 and Scattergood unit 3 must be re-powered by 2013.

- Once-through cooling

Once-through cooling (OTC) is the process of drawing water from a river, lake, or ocean, pumping it through a generating station's cooling system, and discharging it back to the original body of water. Dry cooling will be used on all re-powered units included in this IRP. Compliance strategies that do not include re-powering with dry cooling will severely impact the reliability of the power system. Figure 1-3 shows LADWP's reduction in once-through cooling.

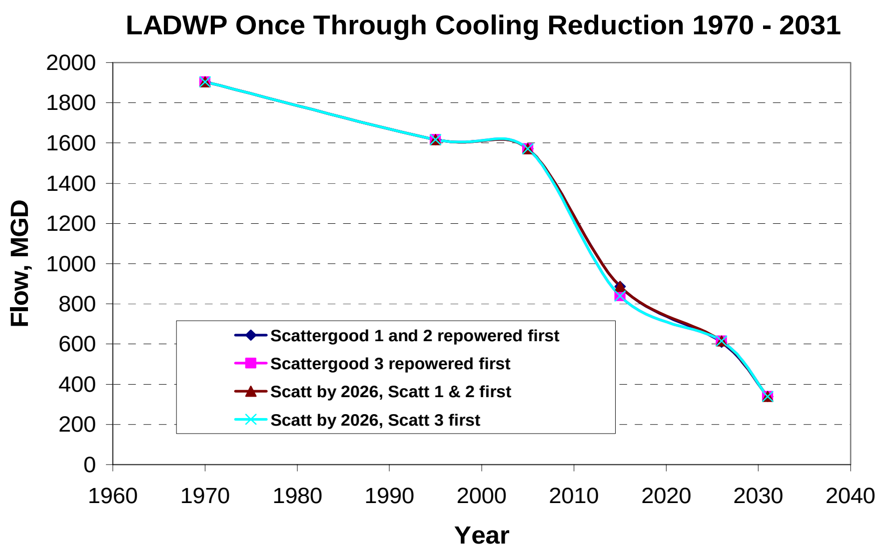


Figure 1-3: LADWP's reduction in once-through cooling from 1970 to 2031

1.6.5 Additional Challenges

As LADWP develops its plans for addressing these near-term and long-term issues, it must deal with technical and financial challenges.

- Coal-fired resources

  Currently, 39 percent of the energy delivered to LADWP customers is generated from two coal-fired generating stations: the Intermountain Power Project (IPP), located in Utah, and the Navajo Generating Station (Navajo), located in Arizona. These stations provide dependable, low cost base load generation to Los Angeles. Coal-fired generation, however, emits high levels of CO_2 (a major GHG), roughly twice as much as energy generated with natural gas.

- Environmentally preferred resources

  To meet the challenge of reducing GHG emissions and providing for future load growth, LADWP plans to

  - Reduce customer demand through Demand-Side Resources (DSR) including energy efficiency (EE) measures. To attain adequate levels of customer participation and market penetrations, DSR incentive programs must be sufficiently funded.

  - Change its generation mix by adopting more renewable resources (such as wind, solar, and geothermal). The challenges for renewable resources are: (i) obtaining local and environmental rights and permits for wind and solar farms and the associated transmission lines needed to deliver energy to Los Angeles; (ii) integrating reliably and cost effectively large scale wind or solar farms into the LADWP power grid through the addition of gas-fired regulation-capable generation; and (iii) developing geothermal sites with large capital costs, exploration risks, limited sites, and limited transmission line access. In addition, renewable resources are generally more expensive than conventional fossil fuel resources.

- Gas-fired resources

  To the extent that LADWP seeks to reduce its GHG footprint, but cannot meet all its future needs through renewable resources and EE/DSM programs, another cost-effective and reliable option for LADWP is burning additional natural gas to generate electricity. The downside of a resource mix heavily dependent on gas-fired generation is exposure to the potentially large volatility of natural gas prices.

- Re-powering existing resources

  Re-powering local generation to comply with SCAQMD requirements and aid in compliance with once through cooling is beneficial in that it will result in the replacement of older, inefficient units with newer, less polluting and more efficient generating units that will also contribute to increased system reliability.

- Integration of variable energy resources

  As variable energy resources become an increasingly larger percentage of the generation mix, the challenge of integrating those resources into the power system will become increasingly important. The intermittency of wind and solar poses a significant reliability concern to system operators. Future studies should be performed to review existing operating and planning procedures to evaluate the impact of a power system with higher amounts of variable energy resources.

Addressing all of these challenges requires considerable amounts of capital, which applies upward pressure on LADWP's electric rates. It is important to note that LADWP cannot compromise on its responsibility to ensure adequate reliability of its power system. As facilities age, they must be repaired and eventually replaced. Likewise, the effects of GHG emissions and other environmental impacts of power generation, if left unaddressed, will lead to increasing indirect costs that society must ultimately bear. LADWP is tasked with producing a plan that provides the proper balance of reliability, low rates, and environmental responsibility.

LADWP is focusing on both near-term and long-term solutions. While some actions are required over the next few years, many actions will not require immediate implementation. Many projects will require long lead times to acquire environmental permits and approvals. LADWP understands that the future holds many complex uncertainties and that its resource plan must be flexible to adapt if matters related to technology, legislation, and regulation change.

1.7 Public Process

To ensure that this 2010 IRP accurately reflects the needs of the City of Los Angeles and all of its various stakeholders, LADWP conducted a public review process to encourage public participation and solicit feedback from the community. LADWP's community outreach program, through a series of public workshops, allowed community members to provide valuable input and direction during the development of this IRP. Additionally, LADWP conducted a series of stakeholder meetings, with participants including representatives from neighborhood councils, environmental interests, and local businesses. The public review process provided immense value to the quality and completeness of the final IRP document and its recommendations.

LADWP's IRP public outreach program was designed to

- Prioritize transparency and inclusiveness in the 2010 IRP process.
- Receive feedback and public comments to be incorporated into the Final 2010 IRP document.
- Educate and create awareness about this 2010 IRP among stakeholders and community members.
- Communicate strategies for reducing carbon emissions and integrating renewable resources, while meeting forecasted demand, maintaining reliability, and keeping costs as low as possible.
- Communicate the potential impact on costs and customer rates for various alternative cases analyzed in the 2010 IRP.

To gather input that reflects the City of Los Angeles' geographic and demographic diversity, the public workshops were held throughout the city. The workshops were led by professional facilitators in order to encourage participation from all attendees, capture feedback, and analyze the input for LADWP's consideration and response.

LADWP also made this 2010 IRP available to the public on a dedicated website, www.lapowerplan.org. This website included interactive features designed to gather additional public comments. All comments received from the public workshops and website were carefully considered during development of the final 2010 IRP.

Several themes emerged from the comments and ideas LADWP received from its public outreach program:

- LADWP should emphasize a variety of energy resources
- LADWP should maximize energy efficiency and conservation
- LADWP should eliminate coal from its generation portfolio
- LADWP should emphasize local solar generation
- LADWP should avoid adverse impacts to vulnerable communities
- LADWP should clarify costs of IRP implementation and potential impacts to ratepayers
- LADWP should reduce environmental impacts
- LADWP should provide proactive leadership and transparency

How LADWP incorporated these ideas into its recommended strategy is presented in Section 5.

Appendix N contains a list of workshops and meetings held, as well as a compilation of written comments and responses.

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2.0 LOAD FORECAST AND RESOURCES

2.1 Overview

Through an IRP, utilities forecast the demand for energy and determine how that demand will be met. Meeting forecasted demand is accomplished by the planning and delivery of electric power generating ("supply-side") resources through transmission and distribution systems. Another key part of the IRP process is determining how to reduce energy needs and increase the efficiency of the utility customer's use of electricity, known as "demand-side resources."

LADWP Public Benefits Program

A program that affects all aspects of the IRP is the Public Benefits Program. In 1996, Assembly Bill 1890 restructured California's electric industry and established mechanisms to maintain the benefits of public purpose programs for energy efficiency, research and development, renewable energy and low-income services.

LADWP funds its own Public Benefits Program that concentrates on environmental conservation, community improvement and educational initiatives. Several initiatives address renewables technology, research and development, energy efficiency, and support of low income programs. The 2009-2010 annual budget for the Public Benefits Program is currently $92.8 million, collected from 2.85 percent of LADWP's retail Power Fund Revenues, plus any interest earned on those funds. LADWP's Board has voted to extend the Public Benefits Program through 2011. LADWP has not increased electric rates to fund this program.

Since the inception of the Public Benefits Program in 1998 through June 2009, the following expenditures have been made:

Program Expenditures (in millions)	
Demand Side Management, including Energy Efficiency	*$226*
Renewable	*$ 115*
Research & Development and Demonstration Projects	*$ 69*
Low Income & Lifeline, and Youth Services Academy	*$270*
Total Expenditures	***$680***

This section of the IRP addresses the following:

- Forecasting of future energy demand
- Demand-side Resources (DSR), including Energy Efficiency, Demand Response, and combined heat and power (CHP)
- Supply-side Resources
- Transmission/Distribution
- Reserve requirements

The discussions include the technical, regulatory, and economic factors that affect LADWP's planning and execution of programs and projects.

Data for this analysis came from publicly available reports from organizations like the California Energy Commission (CEC), California Public Utilities Commission (CPUC), the North American Electric Reliability Council (NERC), the Federal Energy Regulatory Commission (FERC), industry forecasts, and internal LADWP sources. Also highlighted in this IRP are additional studies that are either underway or will be performed in the near future to provide additional clarity regarding the boundaries and needs of the system.

2.2 Forecast of Future Energy Needs

For this IRP, LADWP developed a forecast of customer demand for energy over the next 20 years (the complete 2010 load forecast is included in Appendix A). Econometric models are used to forecast retail sales and peak demand. Net Energy for Load (NEL) is defined as the production necessary to serve retail sales. NEL, and its allocation across various times of the day, are functions of the retail sales and peak demand forecasts. The retail sales forecast is the sum of seven separate customer class forecasts. The classes are residential, commercial, industrial, plug-in hybrid electric vehicle (PHEV), intradepartmental, streetlight, and Owens Valley. The drivers in the retail sales models include normalized weather, population, employment, construction activity, and personal consumption. The NEL forecast is derived from the retail sales forecast by applying a normalized loss factor of 11.5 percent. Losses can vary depending on the sources of energy production. NEL load growth becomes a driver of the peak demand forecast. Peak demand is also a function of temperature, heat buildup, and time of year. The NEL forecast is allocated using the Loadfarm algorithm developed by Global Energy. The inputs into the algorithm are NEL, peak demand, minimum demand, and system load shape.

2.2.1 2010 Retail Electrical Sales and Demand Forecast

The effect of the recent recession depressed electricity sales by approximately 4 percent in 2009 and 2010. Losses in sectors such as construction, real estate, retail, and leisure are forecasted to recover as the economy expands.

The electricity consumption within LADWP's service territory is predicted to continue to decline slowly over the next two years by another 0.6 percent and start to increase slightly in 2012-2013 by 0.7 percent, which includes accumulated energy efficiency and customer solar savings. The load forecast predicts an increase of 1.6 percent in 2013-14 due to the expected completion of large mixed-use projects. The growth in annual peak demand over the next twenty years is predicted to be about 1.3 percent—approximately 100 MW per year—with less growth over the next few years due to the current recession. After 2016, some of the growth will not be realized at the meter depending on the adoption of energy efficiency and distributed generation technologies.

The April 2010 Forecast is LADWP's official Power System forecast. This forecast is used as the basis for LADWP Power System planning activities including, but not limited to, Integrated Resource Planning, Transmission and Distribution Planning, and Wholesale Marketing. The forecast is a public document that uses only publically available information.

Table 2-1 summarizes the data sources used to develop the forecast and where these data sources have been updated from previously published forecasts.

Table 2-1: Load forecast data sources

Data Sources	Updates
1. Historical Sales through March 2010 are reconciled to General Accountings Consumption and Earnings Report.	*Historical Sales, Net Energy for Load and weather data is updated through March 2010.*
2. Historical NEL, Peak Demand and Losses through March 2010 are reconciled to Energy Accounting data.	
3. Historical weather data is provided by the National Weather Service and Los Angeles Pierce College.	*Weather is updated through March 2010.*
4. Historical Los Angeles County employment data is provided by the State of California Economic Development Division using the March 2008 Benchmark.	*Employment data is updated through March 2010 using the March 2009 Benchmark.*
5. Historical population and forecasts is provided by the State of California Department of Finance.	Population data is updated through January 2009.
6. The long-term Los Angeles County economic forecast is provided by UCLA Anderson Forecast.	
7. The construction activity forecast is provided by McGraw-Hill Construction.	*Building permit data is updated through March 2010.*
8. The plug-in hybrid electric vehicle (PHEV) forecast is based on the CEC statewide PHEV forecast.	
9. The port electrification forecast is provided by the Port of Los Angeles.	
10. The housing forecast is informed by the City of Los Angeles “Housing that Works” plan.	

2.2.2 Five-year Sales Forecast

The Retail Sales Forecast through 2016 represents sales that will be realized at the meter. Available in-house is the Gross Forecast, which forecasts sales before the impacts of energy efficiency and solar rooftop program. The purpose of the Gross Forecast is to allow modeling of different energy efficiency and distributed generation scenarios.

In the forecast, energy efficiency and solar savings are expected to occur uniformly throughout the year as a simplifying assumption. Installation schedules are difficult to prepare because they rely on the customers allowing the installation to occur.

Energy efficiency and customer solar installations cause about a two percent drop in retail electricity sales. The remaining decreases in the next two years are attributed to economic conditions. Personal consumption should decrease as personal income flattens and savings and tax rates increase. Vacancy rates in the commercial sector are expected to increase short term. Manufacturing jobs are forecast to continue to decline. Retail electricity growth will lag growth in the economy somewhat. Businesses will become more efficient and begin to increase their operating margins as the economy turns. As shown in Figure 2-1, once the operating margins increase, new hiring will begin again and then retail electricity sales will begin to grow.

Table 2-2 shows projections of short-term retail sales growth.

Table 2-2: Short-term growth

Fiscal Year	Retail Sales		Additional Load if not for EE & Solar Savings
Ending June 30	(GWH)	YOY Growth Rate	(GWH)
2009-10	23,491	-4.2%	10
2010-11	23,493	0.0%	214
2011-12	23,586	0.4%	477
2012-13	23,814	1.0%	732
2013-14	24,093	1.2%	1,027

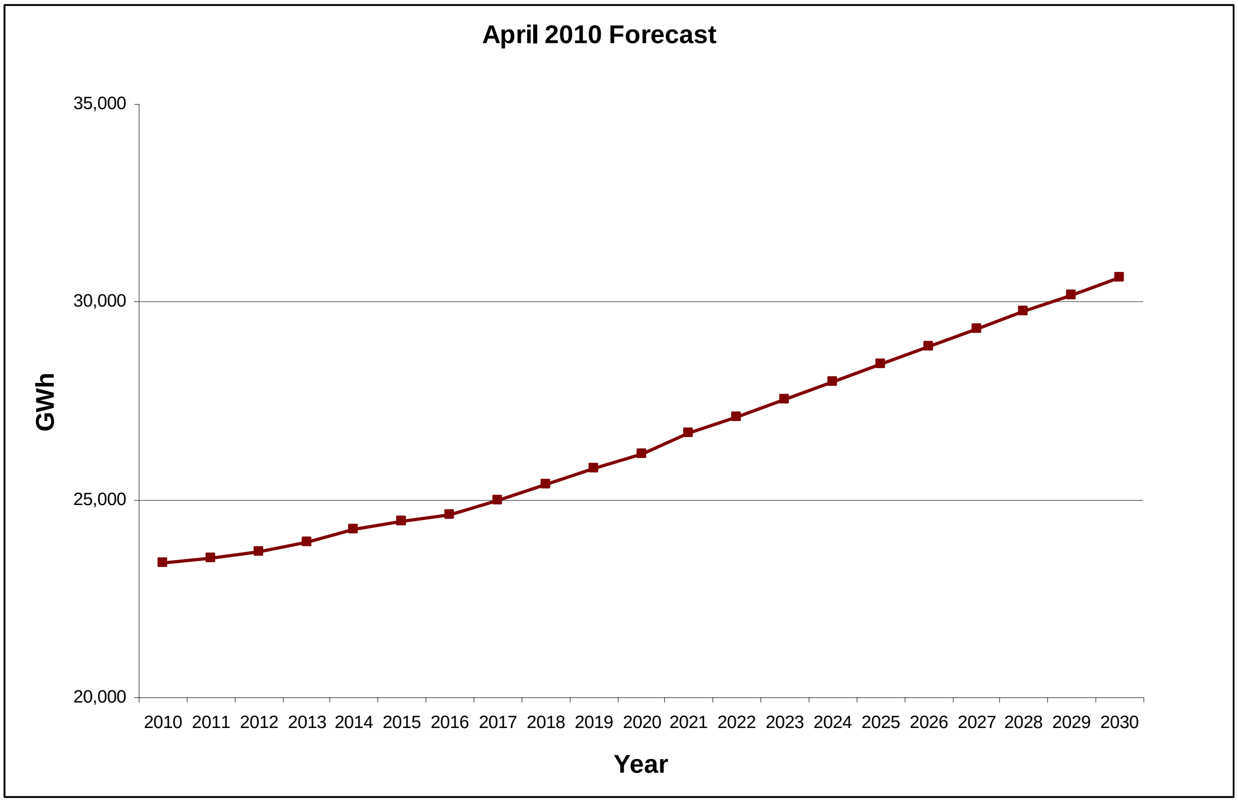


Figure 2-1: Retail sales net of energy efficiency and distributed generation

2.2.3 Electrification

A result of AB 32 will be to encourage increased electrification as a means to reduce GHG emissions. This has added a degree of uncertainty to the forecast of future electricity needs in terms of both additional resulting load and the speed of implementation of electrification programs.

In the transportation sector, fuel switching from diesel and gasoline to electric power can result in air quality improvements if the sources of electric power are clean. As indicated above, the advent of PHEVs will result in an increase in LADWP's load. Figure 2-2 shows the forecasted number of PHEVs within the LADWP service area over the next 20 years.

Other agencies in the LA air basin have initiatives underway for "electrification" to replace existing diesel fueled trucks and gasoline powered cars with electric power. In addition, planned expansions to light railway and the metro system would add additional electric load to the system.

One example of transportation sector electrification is the Clean Air Action Plan developed jointly by the Port of Los Angeles and the Port of Long Beach to reduce air pollution from their many mobile sources as well as some fixed sources. This includes trucks, locomotives, ships, harbor craft, cranes, and various types of yard equipment. One of the programs, Alternative Marine Power (AMP), allows AMP -equipped container vessels docked in port to "plug-in" to shore-side electrical power instead of running on diesel power while at berth.

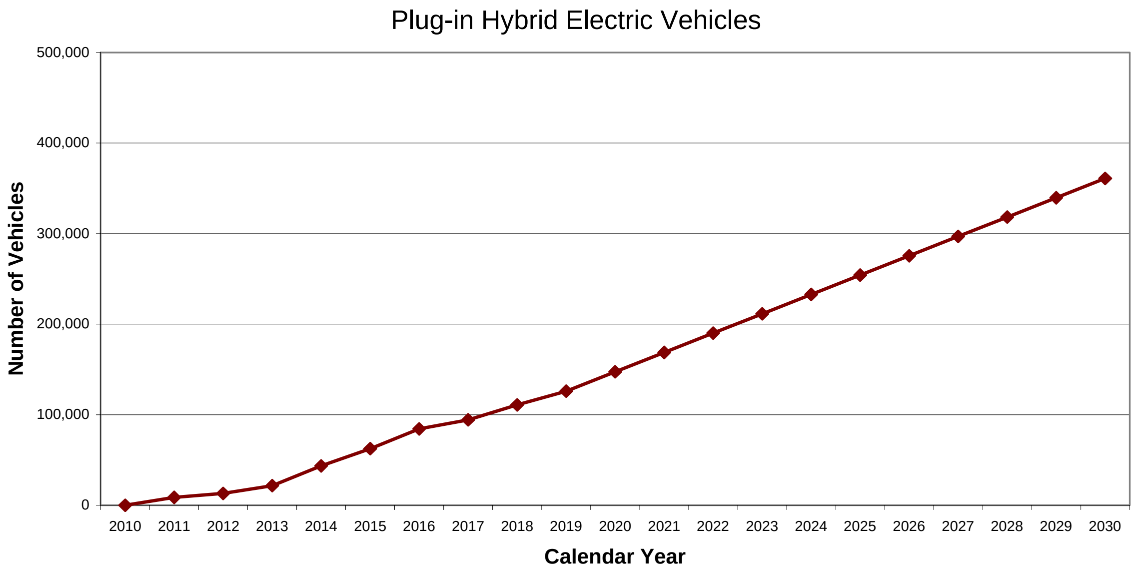


Figure 2-2: Forecasted number of plug-in hybrid electric vehicles.

2.2.4 Peak Demand Forecast

Growth in annual peak demand over the next ten years is 0.8 percent as shown in Table 2-3.

Table 2-3: Forecasted growth in annual peak demand

Fiscal Year End June 30	Base Case Peak Demand (MW)	Growth rate Base Year 2007-08	One-in-Ten Peak Demand (MW)
2009-10	5896[1]		6326
Forecast			
2014-15	6040	0.5%	6479
2019-20	6546	1.1%	6917
2029-30	7570	1.3%	8116
2039-40	8716	1.3%	9494

Note [1] – Weather-normalized. Actual peak was 5709 MW

In summer 2009, the Power System set its calendar year annual peak at 5709 MW on September 3, 2009. Figure 2-3, which presents the 1-in-10 peak demand forecast, is used for this IRP. The 1-in-10 case provides a ninety percent confidence that the forecasted peak demand will not be exceeded in any given year.

Climate change is reflected in the 1-in-10 peak forecast in two ways. First, consumers will react to the slow rise in mean temperature by purchasing more and larger air conditioning equipment. Air conditioning saturation in residential homes is lower in Los Angeles than the rest of the state. This is partially due to older housing stock in Los Angeles. Second, climate change will lead to longer, more frequent extreme weather events. Longer heat storms mean higher peak demands based on historical analysis.

Plug-in Hybrid Electrical Vehicles (PHEVs)

Large scale deployment of electric vehicles is one of the most important ways to achieve goals of energy conservation and renewable energy. It is estimated that by 2015, the United States will have one million EVs in deployment, 10% of which is expected to be in California. The introduction of electric vehicles in Southern California brings a challenging set of planning, regulatory and cost issues. Because EVs require a unique infrastructure, including specialized charging equipment and adequate electric service, it is essential to anticipate and predict the grid impact in Southern California from the EV deployment.

Regulated utilities in California are now responding to regulatory direction to submit plans for large-scale EV initiative with full delineation of costs and benefits. This regulatory initiative is an aggressive step, seeking to promote accelerated adoption of EVs. The EV deployments and the associated utility customer features are proceeding throughout the State of California. Energy needed for PHEVs will come partially from the utility electric grid. It is expected that the "fuel shift" from traditional transportation fuels will affect customers' demand for electricity from the electric grid.

LADWP will use a recent $62 million stimulus grant award from DOE to demonstrate the integration of electric vehicles into the LADWP-managed electric system. The demonstration will use internal fleet equipment and will include electric vehicle fleets from both UCLA and USC. These complementary fleets provide the opportunity to test EVs in both the controlled environment of a corporate fleet and the "real world" usage of individuals. These opportunities will test the integration of EVs into the grid, along with acquisition of EV communications to the grid management system.

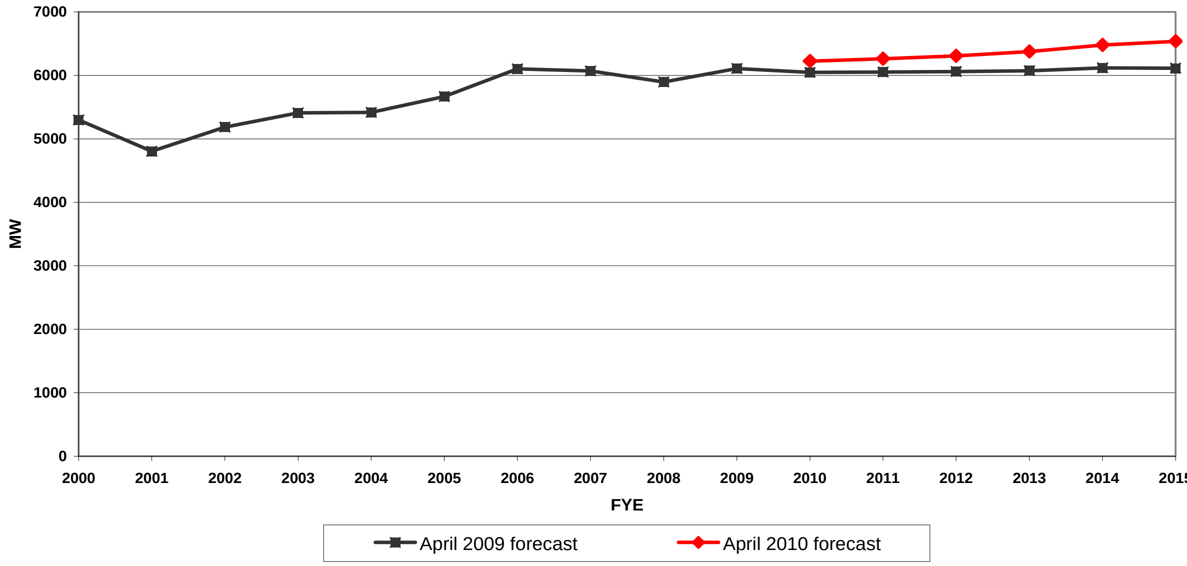


Figure 2-3: One-in-ten peak demand comparisons

2.3 Demand-Side Resources

Energy efficiency and demand response programs become essential as the cost of producing electricity increases. In addition to meeting future demand by building more physical generation assets, LADWP has implemented demand side resource (DSR) programs. Also known as Demand Side Management, LADWP DSR programs are divided into the following major categories:

- Energy Efficiency (EE)
- Demand Response (DR)
- Combined Heat and Power (CHP)

Key DSR data assembled for this IRP included

- The energy efficiency forecast, which was based on the Board-approved AB 2021 objectives, the City of Los Angeles Green Plan, and Demand Forecast Energy Efficiency Quantification Project working papers. Historical installation rates were referenced as part of the forecast.
- An estimate of the amount of solar rooftop and other distributed generation
- An assessment of existing and developing technological improvements in large scale battery systems for energy storage
- Information regarding the impact of "Smart Grid" technology on customer load profile and resource requirement.

2.3.1 Energy Efficiency

EE can be defined as programs that contribute to less consumption of electricity through efficiency gains. EE is the most cost-effective resource in LADWP's supply portfolio, and serves an important and multi-faceted role in meeting customer demand. One of the most widely recognized examples of EE is the replacement of incandescent lights with compact fluorescent lamp (CFL) bulbs. CFLs consume up to 75 percent less energy than incandescent bulbs while producing an equivalent amount of illumination and last up to 10 times longer. EE programs in fiscal year 2008-2009 set a Los Angeles energy savings record 318 gigawatt-hours (GWh).

LADWP offers numerous EE programs and services for residential, commercial, industrial, governmental, and institutional customers to promote the efficient use of energy through the installation of energy efficient equipment. Examples include:

- The Commercial Lighting Efficiency Offer (CLEO), which provides rebates for a variety of high efficiency lighting measures to retrofit existing buildings. The CLEO program enjoys sustained high rates of participation and has achieved 369 GWh of energy savings since 2000.

- The Chiller Efficiency Program, which provides incentives for customers to replace old electric chillers with new, high-efficiency units. Chillers provide space conditioning for larger buildings and the program has reduced associated peak electrical demand by more than 52 MW since 2001.
- The Small Business Direct Install (SBDI) Program, which assists eligible small businesses (A1 rate customers) in Los Angeles in becoming more energy efficient through free lighting assessments and free lighting retrofits (up to $2,500 in cost). SBDI began in 2008 and has achieved 145 GWh of energy savings since its inception.
- The Custom Performance Program, which provides performance-based incentives for energy efficiency measures not included on LADWP's menu-based EE programs. Measures supported include controls and control systems, high efficiency motors, and data server virtualization, The Custom Performance Program has achieved 131.7 GWh of energy savings since 2006.
- The Refrigerator Exchange Program, which delivers new Energy Star refrigerators to eligible residential customers, and picks-up/recycles customers' old, inefficient refrigerators. This program has replaced and recycled more than 53,000 refrigerators since 2007, achieving an energy savings of 40 GWh.
- A recent program, which distributed two free CFLs to LADWP's 1.2 million residential customers through direct-to-door distribution. The intent of the one-time direct-to-door distribution was to achieve cost effective energy savings and increase customer awareness of this inexpensive, yet effective, EE measure. CFLs are also distributed at events and in connection with other energy efficiency programs.

Since 2000, LADWP has spent approximately $187 million on its energy efficiency programs, and these programs have reduced long-term peak period demand and consumption by approximately 270 MW and 894 GWh, respectively. LADWP is committed to developing comprehensive programs with measurable, verifiable goals as well as implementing robust, cost-effective energy efficiency programs. Further information regarding LADWP's EE Program can be found in Appendix B.

Assembly Bill 2021 (AB 2021) became law in 2007, requiring Investor Owned Utilities (IOUs) and Publicly Owned Utilities (POUs), such as LADWP, to identify energy efficiency potential and establish annual efficiency targets that would result in the state meeting its goal of reducing total forecasted electricity consumption by 10 percent over the next 10 years. Pursuant to the requirements of AB 2021, LADWP supports the statewide goals and is committed to achieving related energy savings targets through its EE Programs. LADWP's Board of Commissioners has approved energy savings goals of one percent per year for a ten year period. EE staff believes that the recent success in achieving energy savings targets is sustainable in future years if the appropriate levels of program funding and staffing are provided and maintained.

Future energy efficiency savings forecasts, when used as the basis for electric system planning, are necessarily conservative, considering the critical need to maintain adequate generation resources. Therefore, the forecasts developed for this IRP reflect this approach, rather than following the established AB 2021 targets. This is intended to ensure supply reliability and does not reflect a reduced commitment to EE programs.

Individual utilities are required to conduct periodic “Market Potential” studies to establish and update EE targets and forecasts. LADWP is in the process of commissioning its latest study, which should be completed by late 2010. However, because results of this Market Potential Study were not available at the time of this IRP’s development, a separate EE review was conducted to determine an appropriate EE forecast for use in this IRP (future updates to the IRP will incorporate the most current information available). The EE review resulted in the development of a “high”, “low”, and “most likely” forecasts. These are shown in Figure 2-4, along with a 2006 Market Potential forecast from a California study, LADWP’s EE forecast from its April 2009 load forecast, and finally the EE forecast assumed for this IRP.

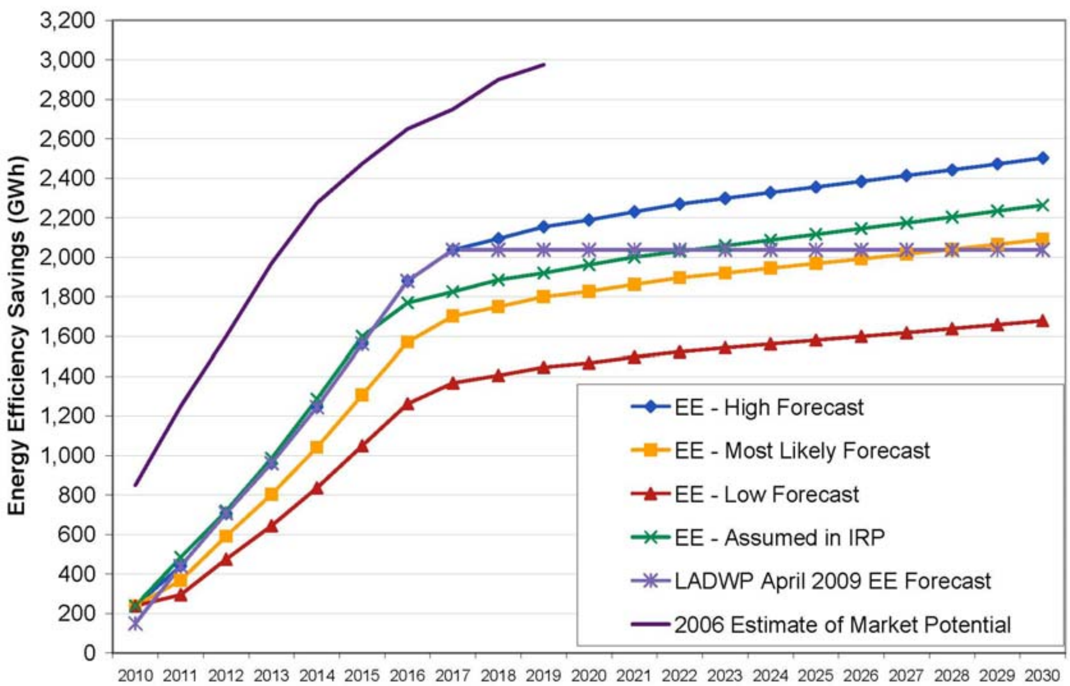


Figure 2-4: EE forecast

The market potential for EE identified in the California 2006 study is shown on Figure 2-4 as the dark purple line, illustrating a theoretical maximum technical potential and providing an upper bound of savings. It exceeds the amount of EE assumed in all of the forecasts.

The EE forecast contained in LADWP’s April 2010 load forecast is depicted in the graph above as the light purple line. This forecast is the same as the “high” forecast (shown as the blue line) until 2016. After this point, the “high” forecast continues its upward trend, whereas the prior assumption used by LADWP was that savings would remain static beyond 2016.

The “Most Likely” forecast was developed based on information regarding actual EE achievements to date. This is shown as the orange line on Figure 2-4.

The “Low” forecast is shown as the red line on Figure 2-4 and tracks actual program results, but proceeds along a more gradual slope to reflect the current economic downturn and its effect on local government spending—issues that may affect EE investments on the part of both LADWP and its customer base.

The green line shows what was included in the IRP production cost modeling.

2.3.2 Demand Response

Demand Response (DR) differs from Energy Efficiency (EE) in that DR strategies are designed to either reduce or shift demand from on-peak to off-peak times, while EE strategies may primarily reduce usage over the entire 24-hour period. Thus, the goal and purpose of DR programs at LADWP are to reduce the summer peak electric load during periods of high demand, which in turn minimizes or delays the need to build new supply-side alternatives, such as gas-turbine peaking resources.

Two new DR programs are being recommended in this 2010 IRP as described below. These programs entail temporary load reduction measures that will provide economic and operational benefits to LADWP. These programs also will reduce capital expenditure (for new power plants), provide for economic dispatch, reduce cost of service, and improve system efficiency and system reliability.

- Load Control or Dispatchable Interruptible Service Program.
  The load control or dispatch capabilities will match the demand response resources with actual system peaks. The goal of the dispatchable program is 200 MW by 2014 with a 10-minute dispatch capability.

- Peak Management Interruptible Service Program.
  The program would replace the XRT (experimental demand response contract) with a new contractual tariff for commercial and industrial customers to reduce or shut-off load. The goal of the peak management program is to dispatch 300 MW by 2030 with a 60-minute dispatch capability.

Actual demand reductions from these programs will depend on the level of customer participation, financial incentives offered, and the implementation of the Smart Grid technology to control the load.

2.3.3 Load Factor

Load factor represents how constant energy usage is over a given day. A 100 percent load factor means that the same amount of power is used off peak as on peak, so the system is getting full use of its generating resources. A low load factor results in generators being started more often to serve load for a few hours a day, which is not optimum. As an analogy, a car traveling at constant speed will get the best gas mileage and reduced wear and tear than a car in stop-and-go traffic.

From the 1990s through 2005, annual system load factors were trending slowly upward, which is a positive movement. Since 2006, System load factors are trending down. Some of this decline in load factor is due to the fact that much of the historic energy efficiency effort is directed at lighting, which has higher impact on sales when compared to peak. In the forecast, this downward trend is sustained. Again, a large share of the immediate future energy efficiency gains will be in lighting loads as CFLs replace incandescent lamps in the future. The other factor increasing the peak demand is that the electric vehicle forecast has increased and we are now forecasting that the PHEVs will have an impact on peak demand, even though most of the energy consumption and capacity demand increase will be seen off peak. It is imperative that LADWP implement tools to shift load from peak hours to off peak hours to reverse this trend and improve system performance.

To illustrate the effects of DR programs on LADWP's system LF, Table 2-4 shows how DR programs would have affected LF if applied during the past ten years.

Table 2-4: Impacts of DR programs on system LF

Year	Peak (MW)	Energy Sales (MWh)	LF	200 MW Reduction	LF	500 MW Reduction	LF
2000	5299	22,862,953	49.3%	5099	51.2%	4799	54.4%
2001	4805	22,373,457	53.2%	4605	55.5%	4305	59.3%
2002	5232	22,290,462	48.6%	5032	50.6%	4732	53.8%
2003	5410	23,044,089	48.6%	5210	50.5%	4910	53.6%
2004	5418	23,350,202	49.2%	5218	51.1%	4918	54.2%
2005	5667	23,401,416	47.1%	5467	48.9%	5167	51.7%
2006	6102	24,317,801	45.5%	5902	47.0%	5602	49.6%
2007	6071	24,317,290	45.7%	5871	47.3%	5571	49.8%
2008	6006	24,839,079	47.2%	5806	48.8%	5506	51.5%
2009	5709	23,786,772	47.6%	5509	49.3%	5209	52.0%

2.3.4 Avoided Costs

The obvious reason to pursue demand side resource programs is to reduce the need to build additional physical resources on the supply side. To evaluate the cost effectiveness of a demand side resource program the cost of implementation must be compared to the avoided cost of the marginal physical resource. The avoided cost derived from a successful demand side planning program can be quantified as the cost of marginal resource that was "avoided" as a direct result of the demand side resource program. In utility resource planning circles the cost of the marginal resource is generally assumed to be the levelized cost of new simple cycle combustion turbine because it represents the supply side technology with the lowest capital costs.

2.3.5 Combined Heat and Power

Combined heat and power (CHP) systems, also known as thermal cogeneration, capture and utilize excess heat generated during the production of electric power. CHP systems offer economic, environmental, and reliability-related advantages compared to power generation facilities that produce only electricity. Distributed power generation systems, which are frequently located near thermal loads, are particularly well-suited for CHP applications. LADWP is developing CHP target goals to incorporate CHP generation in its future resource mix

Currently, CHP installed in the LADWP Power System consists primarily of cogeneration projects that are owned and operated by industrial and commercial customers. These projects total approximately 265 MW of nameplate capacity operating in LADWP's service area. Some cogeneration projects sell excess energy to LADWP under interconnection agreements.

To encourage customer-developed CHP, shift demand from electric grid, and provide accurate price signals to customer, LADWP is currently offering a Standard Energy Credit (SEC) to its customers for excess energy they sell to LADWP. The SEC is based on LADWP's estimated system marginal generation cost and is updated and posted monthly.

In addition to customer-owned CHP projects, LADWP is considering development of the following self-owned projects:

- Terminal Island Renewable Energy Project (a fuel cell plant) to produce 4 MW of electricity and process heat using methane gas.
- Los Angeles Bureau of Sanitation Alternative Technologies Projects to convert waste to heat.

Further details regarding LADWP's CHP Program is provided in Section G.6 of Appendix G.

2.3.6 Smart Grid

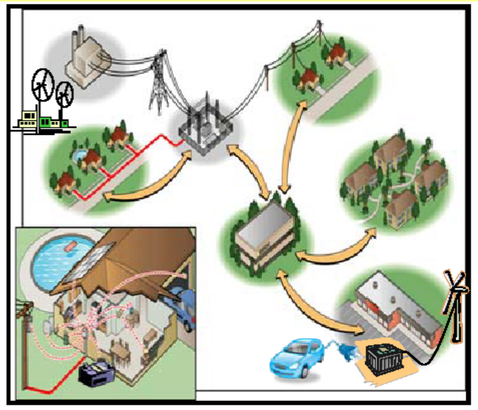
"Smart Grid" is a term used to describe a variety of advanced information-based utility improvements. Smart Grid is a major enabler for many existing and potentially new DSR programs. Smart Grid is a national policy evolving from the Energy Policy Act of 2005. Smart Grid refers to intelligent data gathering and advanced two-way digital communication capabilities overlaid on electric distribution networks to provide real-time data that enhances the utility's ability to optimize energy use.

Smart Grid technologies can turn every point in the existing network—including every meter, switch and transformer—into a potential information source, able to feed performance data back to the utility instantly. Smart Grid Technologies will provide utilities with the information required to implement real-time, self-monitoring networks that are predictive rather than reactive to instantaneous system disruptions. It can enable the utility and consumer to make decisions to optimize the use of energy, improve reliability, and reduce the consumption of fossil fuels.

LADWP is implementing eight Smart Grid initiatives:

A smart grid has the following characteristics:

- *Enables new products, services and markets*
- *Enables active participation by consumers through self-monitoring and more responsible consumption decisions*
- *Auto-selects safest and most efficient forms of storage and generation based on real-time energy needs and concerns*
- *Provides power quality for the digital economy*
- *Optimizes asset utilization and operates efficiently*
- *Anticipates and responds to system disturbances (self-heals)*
- *Operates resiliently against attacks and natural disasters*



1. Renewable integration
2. Transmission automation
3. Substation automation
4. Distribution automation
5. Advanced Metering Infrastructure (AMI)
6. Demand response
7. Advance telecommunications
8. System and data integration

These initiatives are described in more detail in Appendix L.

2.4 Generation Resources and Transmission Assets

The Supply-Side Resources discussed in this section include

- Generation Resources
  - Natural Gas
  - Coal Fired
  - Nuclear
  - Large Hydro
  - Renewable energy resources (small hydro, wind, solar, biogas, and geothermal)
- Spot Purchases
- Spot Sales

Also discussed are two critical components of the LADWP system:

- Transmission and distribution
- Reserve requirements.

The LADWP Power System has a diverse mix of generating resources. Figure 2-5 shows LADWP's Power System capacity and energy breakdown as of December 31, 2009, as well as what the capacity and energy mix was at the end of 2006.[1] The largest change between these time periods is the doubling of energy generated from renewable sources.

[1] "Capacity" and "Energy" are electric utility terms that distinguish between how much power the system is capable of generating at a given instant in time (capacity; in megawatts) and how much power the system generates over a given period of time (energy; in megawatt-hours). Capacity numbers are expressed in MW, and energy numbers are expressed in MWh.

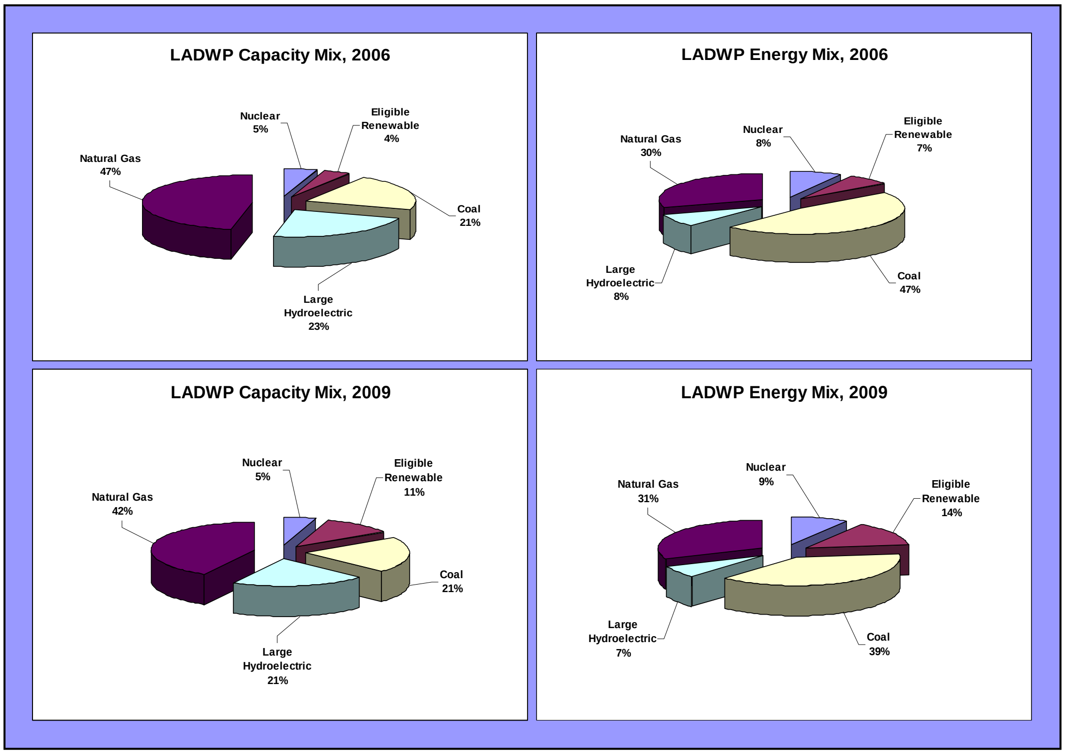


Figure 2-5: LADWP capacity and energy mix for 2006 and 2009.

2.4.1 Generation Resources

LADWP is vertically integrated, both owning and operating the majority of its generation, transmission and distribution systems. Generation resources that are not wholly owned by LADWP are available as entitlement rights resulting from undivided ownership interests in facilities that are jointly-owned with other utilities. Table 2-5 lists existing LADWP generation resources.

Table 2-5: Capability of existing LADWP generating resources

Name of Plant	Fuel Source	Unit No.	In Service Date	Age (Years)	Net Maximum Unit Capability (MW) [2]	Net Maximum Plant Capability (MW) [3]	Net Dependable Plant Capability (MW) [4]	Comments
Harbor Generating Station	Natural Gas	1	1995	15	82	466	461	Units 1, 2 and 5 operate as a combined cycle unit Once-through cooling (OTC)
		2	1995	15	82			
		5	1995	15	65			
		10	2002	8	47.4			
		11	2002	8	47.4			
		12	2002	8	47.4			
		13	2002	8	47.4			
		14	2002	8	47.4			
Haynes Generating Station	Natural Gas	1	1962	48	222	1555.6	1524	Units 8, 9 and 10 operate as a combined cycle unit OTC Unit 7 is used for auxiliary power only
		2	1963	47	222			
		5	1966	43	292			
		6	1967	43	243			
		7	1970	40	1.6			
		8	2005	5	250			
		9	2005	5	162.5			
		10	2005	5	162.5			
Scattergood Generating Station	Natural Gas	1	1958	52	183	817	796	Includes 16 MW for Hyperion digester gas OTC
		2	1959	51	184			
		3	1974	36	450			
Valley Generating Station	Natural Gas	5	2001	9	43	576	556	Units 6, 7 and 8 operate as a combined cycle unit
		6	2003	7	159			
		7	2003	7	159			
		8	2003	7	215			
Total Net Capability of Natural Gas Stations						**3415**	**3337**	
Intermountain Generating Station	Coal	1	1986	24	900	1202	1047	Reduced by current recall
		2	1987	23	900			
Navajo Generating Station	Coal	1	1974	36	750	477	477	
		2	1974	36	750			
		3	1975	35	750			
Mohave Generating Station	Coal	1	1971	39	0	0	0	Decommissioned on 12/31/05
		2	1971	39	0			
Total Net Capability of Coal Stations						**1679**	**1524**	
Palo Verde Generating Station	Nuclear	1	1986	24	1333	387	381	
		2	1986	24	1336			
		3	1988	22	1334			
Total Net Capability of Nuclear Stations						**387**	**381**	
Castaic Power Plant	Hydro	Various	1972-1978	32-38	1620	1247	1175	Pumped Storage
Hoover Power Plant	Hydro	Various	1936	74	491	491	446	
Total Net Capability of "Large" Hydro Stations						**1738**	**1621**	
Aqueduct System	Hydro	Various	1917-1987	23-93	126.7	83.1	24.2	11 Units total
Owens Valley System	Hydro	Various	1908-1958	52-102	16	12.5	1.2	7 Units total
Owens Gorge System	Hydro	Various	1952-1953	57-58	112.5	112.5	109.4	3 Units
Owned & Contracted Renewables	Renewable/DG	Various	1998-2009	1-12	1320	670	203	Note [5]
Total Net Capability of Small Hydro and Renewable / Distributed Generation						**878**	**338**	
Total Net Capability of LADWP Resources						**8097**	**7201**	
State's Capacity Entitlement (See Note[6])						-120	-76	
Total Net Capability of LADWP System						**7977**	**7125**	Note [7]

Notes:

1. Power source data are based on Power System Engineering Division's 2010 Generation Ratings and Capabilities Sheet and power purchase agreements for contract sources.
2. All units can attain maximum capability only when the weather and equipment are simultaneously at optimum conditions.
3. Reflects: water flow limits at hydro plants, sum of unit output at in-basin thermal or renewable plants, or LADWP contract entitlement of external thermal plants.
4. Reflects: year- round outputs adjusted for low-generation season. For hydro plants, winter is the low-generation season.
5. Owned or contracted renewable projects in wind, solar, hydro, landfill gas, biomass, and distributed generation in-service as of the end of 2009.

6. The maximum State (CDWR) Capacity Entitlement from Castaic Power Plant is 120 MW. The average for FY 07-08 was approximately 76 MW. The actual amount varies weekly.
7. Total Net Capability of LADWP System may vary due to unit outages, de-ratings and sales obligations. .

Natural Gas

LADWP is the sole owner and operator of the following four electric generating stations in the Los Angeles Basin (the "In-basin stations"):

- Haynes Generating Station, located in Long Beach
- Harbor Generating Station, located in Wilmington
- Scattergood Generating Station, located in Playa del Rey
- Valley Generating Station, located in the San Fernando Valley.

A map of the in-basin stations is shown in Figure 2-6.

Figure 2-6: LADWP in-basin generating stations

Each station consists of multiple generating units, with each unit ranging is size between 43 MW and 450 MW. A summary of each station's capabilities is shown in Table 2-5. Further detailed information is included in Appendix F.

While all of these stations utilize natural gas as a fuel source, a special arrangement has been made that enables the Scattergood Generating Station to also use digester gas from the adjacent Hyperion Sewage Treatment Plant. The digester gas currently accounts for 16 MW of Scattergood's generation output.

The major issues facing the in-basin stations include the need to rebuild or replace some of the older units that are approaching the end of their service life, compliance with regulations related to ocean water cooling and NOx emissions, and price volatility of natural gas. Aging infrastructure and regulatory compliance is discussed in Section 2.4.1. Natural gas fuel prices and procurement issues are presented in detail in Appendix H.

Natural gas-fired generation will continue to be the lynchpin for LADWP's generation due to the abundant supplies in the foreseeable future. The gas will be used to supply base load (as is currently used), and will also provide for the integration of intermittent renewable generation, and will serve as the eventual replacement for some coal-fired generation.

Coal

LADWP's coal generating capacity comes from the Navajo Generating Station and the Intermountain Generating Station (IGS). IGS is also referred to as the Intermountain Power Project (IPP). The amount of capacity available to LADWP's from these stations is 477 MW from Navajo and approximately 1202 from IPP. A summary of each station is included in Table 2-5. Further details and discussion is provided in Appendix F.

Contractual arrangements for power from these stations will expire December 31, 2019 for Navajo and June 15, 2027 for IPP.

Nuclear

LADWP has contractual entitlements totaling approximately 387 MW of capacity from the Palo Verde Nuclear Generating Station (PVNGS). PVNGS, located approximately 50 miles west of Phoenix, Arizona, consists of three generating units. Of the 387 MW capacity available to LADWP, approximately 159 MW is available through a power sales agreement with the Southern California Public Power Authority (SCPPA). Further details are provided in Appendix F.

Large Hydro

LADWP's large hydroelectric facilities include the Castaic Pumped-storage Hydroelectric Plant and an entitlement portion of the capacity of Hoover Dam. The Castaic Pumped-storage Hydroelectric Plant, located in Castaic, California, is LADWP's largest source of hydroelectric capacity and consists of seven units. Hoover Dam, located on the Arizona-Nevada border, consist of seventeen units. Details of these plants are provided in Appendix F.

A distinction is made between "Large Hydro" and "Small Hydro". Small hydro consists of numerous smaller units with less than 30 MW of capacity generally located along the Los Angeles Aqueduct. They also qualify as a renewable resource for electricity generation. For discussion purposes they are grouped within renewable resources.

Renewable Energy Resources

Over the last ten years, the California legislature has asserted itself in the development and utilization of renewable energy resources. In 2002, Senate Bill (SB) 1078 implemented a Renewable Portfolio Standard (RPS) with a goal of providing 20 percent of the energy sold to customers be generated using eligible renewable resources by 2017. In 2005, SB 107 stated a goal of accelerating the RPS to achieving the 20 percent goal by 2010. While SB 1078 specified that only investor owned utilities (IOUs) were required to comply with these goals, it directed municipal utilities to develop programs with similar targets and report back on progress to the CEC.

In 2009, the legislature passed AB 64 and SB 14, two bills that would have set a new statewide RPS of 33% by 2020 with gradually increasing interim targets between 2012 and 2020. This legislation was vetoed by the Governor, who then issued E.O. # S-21-09 on September 15, 2009, calling for a statewide RPS of 33% by 2020 and directing the CARB to adopt Renewable Energy Standard (RES) regulations by July 2010. On September 9, 2010, CARB adopted these goals, mandating the following RES procurement targets: 20 percent by 2012, 24 percent by 2015, 28 percent by 2018 and 33 percent by 2020.

2.4.2 Accomplishments to Date – Renewable Energy

The City of Los Angeles has made meeting or exceeding California's renewable energy goals a priority. The following are examples of significant environmental milestones LADWP has achieved.

- In May 1999, LADWP implemented the Green Power for Green LA program to increase renewable energy resource development and procurement through voluntary contributions by its customers.
- In August 2000, LADWP adopted an IRP that recommended the re-powering of ten Los Angeles Basin generating units, the installation of NOx emission controls, and the implementation of several renewable resource related programs and projects. Other goals included meeting 50% of projected load growth using Demand-Side Management (DSM), distributed generation, and renewable resources.
- In 2001, LADWP issued its first request for proposals (RFP) for renewable resources. The 120 MW Pine Tree Wind Project was one of the projects resulting from this RFP.
- In 2003, the Mayor and the City Council took several steps toward developing a new Renewables Portfolio Standard for LADWP. This included the creation of the Green Ribbon Commission by the Mayor, and convening a Renewable Energy Summit by the Commerce, Energy, and Natural Resources Committee.

- In 2004, the Los Angeles City Council adopted an LADWP Renewables Portfolio Standard Framework that requested the Board of Water and Power Commissioners "to adopt a Renewables Portfolio Standard of 20 percent renewable energy by 2017 setting applicable milestones to achieve this goal".
- In June 2004, LADWP issued a second RFP for Renewable Resources. The intent of this RFP was to obtain a sufficient amount of renewable energy per year to achieve the interim RPS goal of 13 percent by 2010.
- In June 2005, the City Council approved the City of Los Angeles Department of Water and Power's Renewables Portfolio Standard Policy, which was designed to provide 20 percent of its energy sales to retail customers from eligible renewable resources by 2017, with an interim goal of 13 percent by 2010.
- In December 2005, the LADWP Board of Water and Power Commissioners recommended that LADWP accelerate its RPS goal to obtain 20 percent renewables by 2010. This was approved by resolution in April 2007.
- In January 2007, LADWP issued a third RFP for renewable resources. The intent of this RFP was to obtain a sufficient amount of renewable energy per year to achieve the RPS goal of 20 percent by 2010.
- In March, 2009, LADWP issued a fourth RFP for renewable resources. The intent of this RFP was to obtain a sufficient amount of renewable energy per year to achieve the RPS goal of 20 percent by 2010 and 35 percent by December, 31, 2020.

As a result of the activities mentioned above, LADWP's percentage of energy from renewable resources increased from 7 percent to 14 percent between 2006 and 2009 and is expected to achieve its goal of 20 percent renewables in 2010.

Other accomplishments in support of LADWP's renewable resources program include:

- Ongoing construction of the STS DC Line from its existing rating of 1920 MW to 2400 MW. The upgrade is in conjunction with the Milford Wind Projects in southwest Utah. The planned in-service date of the upgrade is December 2010.
- The Barren Ridge Switching substation was completed in 2009. The plan is to upgrade and build a new transmission line from Barren Ridge Switching Station, located 15 miles north of Mojave, to Castaic Power Plant near Santa Clarita. The Barren Ridge Renewable Transmission Project (BRRTP) will enable LADWP to interconnect approximately 1400 MW of wind, solar, and other renewable resources, that will be available in the next several years, from the Mojave Desert and Tehachapi Mountain areas.
- Over 2,700 commercial and residential customers are participating in LADWP's Solar Photovoltaic Initiative Program from 2000 through September 2010. These total over 22 MW of solar photovoltaic installed.

2.4.3 Current LADWP Renewable Energy Projects

A detailed list of all current LADWP renewable resources is provided in Section F.2.5 of Appendix F. In summary, the renewable resources are made up of:

- Eligible renewable small hydro resources
- Wind resources
- Other resources, such as biogas, solar, and market purchases (including geothermal)

Figure 2-7 presents a breakdown of the current renewable resources in LADWP's portfolio.

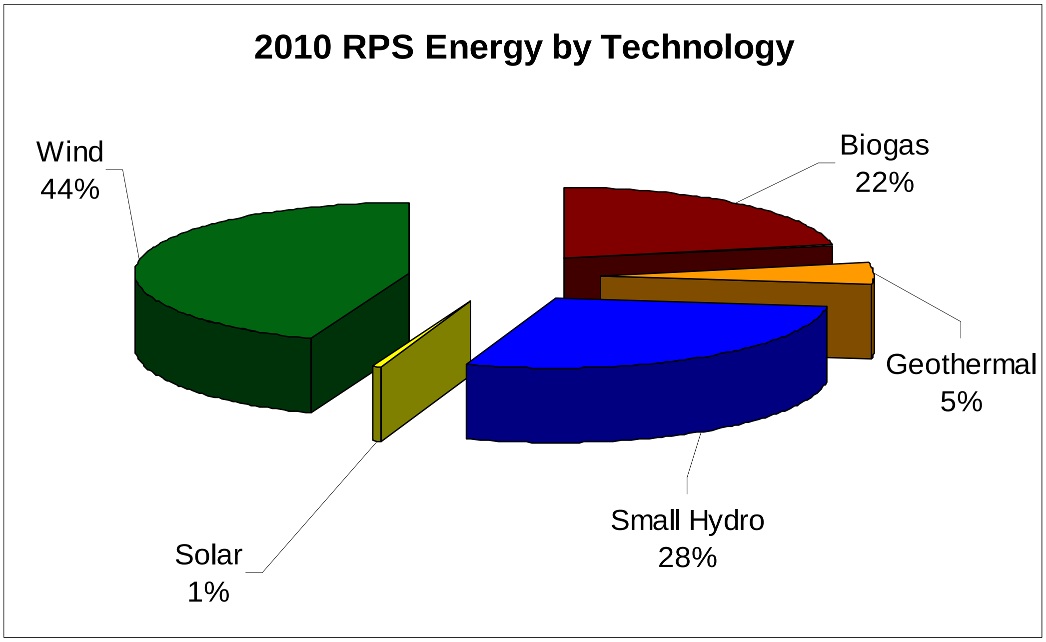


Figure 2-7: 2010 IRP renewable energy mix.

Note: Subject to change due to negotiations and construction schedules

Future Renewables for LADWP

The near-term projections for renewables is somewhat uncertain, pending the outcome of decisions related to rate increases that are required, in part, to fund the acquisition and/or purchase of renewable resources and energy. As of September 2010, LADWP is expected to achieve 20 percent renewables on average for 2010. This accomplishment is due to good wind and hydro production as well as a cooler than normal summer, resulting in lower electricity sales.

Long-term, this IRP process includes an assessment of alternatives to increase its renewable resource portfolio from the current 20 percent to as much as 35 percent by year 2020. This goal would satisfy Executive Order S-21-09, which requires at least 33 percent renewables by 2020. Sections 3 and 4 describe different strategic cases that would achieve this goal.

Further information regarding LADWP's renewable energy program can be found in Appendix D.

2.4.4 Major Issues Affecting Existing Generation Resources

Three major issues affecting LADWP's existing generation fleet are (1) the need to rebuild or "re-power" some of its in-basin generating units, (2) compliance with state and local regulations regarding once-through cooling and NOx emissions, and (3) the investigation of potential strategies to discontinue the delivery of coal-fired energy to accelerate GHG reductions.

2.4.5 Re-powering Program to Replace Aging Infrastructure

There is an urgent need to modify or replace some of LADWP's older gas-fired generation facilities located at the Haynes and Scattergood generating stations. These units were primarily built in the late 1950s and the early 1960s and are approaching the end of their service lives. New replacement units are necessary to maintain system reliability, to realize better efficiencies, and to enable the integration of renewable resources to LADWP's grid. The re-powering program will extend into the next ten years.

<u>Factors Driving the Re-powering Program</u>

- <u>System reliability</u>
  As facilities age, they require more maintenance and become more susceptible to operational problems and outages. The units to be replaced at the Scattergood and Haynes generating stations are between 43 and 52 years old, and are among the oldest remaining units in LADWP's generation fleet. To maintain system reliability, it is critical that these units be updated. Minimizing outages at these locations close to the system load center is especially important for voltage support of the in-basin electrical system. Variable resources such as solar or wind power can augment existing in-basin gas fired generation but do not serve as adequate replacements for purposes of voltage support.

- <u>Increased efficiencies</u>
  New units will operate more efficiently, generating more energy and less emissions with the same amount of fuel. Operational costs per energy output will decrease.

- <u>Integrating renewables</u>
  The new units will incorporate new technologies which will enable faster start-up and faster changes in generation output. This ability to increase or decrease generation on short notice, measured by what is termed "ramp rate", is an important requirement for integrating renewable resources. Wind resources produce power when the wind is blowing. When the wind suddenly stops blowing, the energy being delivered also stops but the load (the amount of energy the system requires) remains relatively the same. Solar photovoltaic resources are subject to even greater output variability as clouds pass overhead and vary the intensity of available sunlight. To compensate for these fluctuations, natural gas "peaker" units (which are included in the new unit configurations) are able to quickly ramp up and down so that the total energy generated matches the load. Integrating significant amounts of intermittent renewable

resources, such as wind and solar photovoltaic, will not be possible without the fast load-following capability that the re-powering program will provide.

While LADWP must move forward with these re-powering projects for the reasons stated above, these actions will also comply with local regulations related to Once Through Cooling and NOx emissions.

Regulatory Compliance

- Once-through cooling

  Once-through cooling (OTC) is the process where water is drawn from the ocean, is pumped through equipment at a power plant to provide cooling, and then is discharged back to the receiving water (such as a river, ocean or bay). A cooling process is necessary for nearly every type of traditional electrical generating station and an OTC process utilizing ocean water is a major reason why many electrical generating stations are located along the coastline. Typically, the water used for cooling is not chemically changed in the cooling process; however, the water temperature increases.

  LADWP owns three coastal generating stations – Scattergood, Harbor, and Haynes - that utilize OTC, with a combined net dependable capacity of 2,783 MW.

  LADWP's re-powering program, discussed above, will satisfy most of the OTC regulations. Aside from those generating units subject to the re-powering program, some additional units may require some forms of mitigation such as modifications to water intake structures, restricted flow rates, or a transition to alternative cooling methods. Appendix C discusses these issues in more detail.

- NO_X compliance

  In mid-2000, during the statewide energy crisis, LADWP predicted that NO_X emissions from the in-basin generating units would exceed the available supply of NO_X RECLAIM Trading Credits issued by the South Coast Air Quality Management District (SCAQMD). On August 29, 2000 the SCAQMD Hearing Board issued a "Stipulated Order for Abatement" to the LADWP. Under the terms of the Order, LADWP was required to perform a series of re-powering projects at its in-basin generating stations. The Stipulated Order was later superseded by a Settlement Agreement to accommodate schedule and other issues.

  A series of re-powerings completed since 2000 has satisfied a majority of the terms of the Settlement Agreement. Moving forward, LADWP's re-powering program will take care of the last four generating units (Haynes Units 5 & 6, and Scattergood Units 1 and 2) that are part of the Settlement Agreement.

- SB 1368 Compliant Coal-Fired Generation

As presented in Section 3, the analysis of future potential resource portfolios includes a set of strategic cases that accelerate compliance with SB 1368 of coal fired generation in year 2020. The feasibility of adopting and implementing this will depend on a number of factors, including 1) resolving contractual issues, 2) the cost of alternatives (and LADWP's ability to cover its costs) and 3) regulatory factors that today are uncertain.

SB 1368 compliant power will reduce the GHG emissions for LADWP, reduce regulatory compliance costs, and spur development of renewable resources in the western United States. SB 1368 established a greenhouse gas emissions performance standard that limits long-term investments in baseload generation by the state's utilities to power plants that meet an emissions performance standard (EPS), which was jointly established by the California Energy Commission and the California Public Utilities Commission. Subsequently, the Energy Commission designed regulations that establish a standard for baseload generation owned by, or under long-term contract to publicly owned utilities, of 1,100 lbs CO_2 per megawatt-hour (MWh). There is a wide range of policy proposals to limit greenhouse gas emissions within the U.S. At the Federal level, Representatives Waxman and Markey introduced the American Clean Energy and Security Act of 2009 (HR 2454).

LADWP's generation portfolio also includes the now-inactive Mohave Generating Station in Laughlin, Nevada that once operated as a coal-fired resource, but is currently being decommissioned. LADWP has a 10 percent ownership interest in the assets at Mohave and may reuse a portion of the site for the new purpose of meeting the City's future renewable energy needs.

There are several methods to achieve SB 1368 compliance, for example; replace coal generation with natural gas-fired generation, carbon sequestration, coal gasification, or other potentially emerging technologies.

Intermountain Power Project:

Intermountain Power Project (IPP) is a coal-fueled generating station located near Delta, Utah. It consists of two generating units with a combined capacity of 1800 MW. LADWP is the Operating Agent. LADWP is also the largest single purchaser and has a power purchase agreement for IPP output for 44.617 percent (803 MW). LADWP has additional purchase obligations for up to 22.168 percent (399 MW) of additional output. These additional obligations are dependent on the power usage of the Utah and Nevada participants. The Power Sales Contract for IPP expires in 2027.

In addition to the generating units, IPP includes four important transmission lines, a 500-kV DC transmission line from the Generating Station to Adelanto, California (a distance of 490 miles); two parallel 345-kV AC transmission lines from the Generating Station to Mona, Utah 50 miles away; and a single 230-kV AC transmission line from the Generating Station to the Gonder Switchyard near Ely, Nevada about 144 miles away.

At IPP, LADWP has no ownership rights. Rather, LADWP has a long-term power purchase contract which expires in 2027 and which also includes renewal option rights. With firm "take or pay" IPP contract obligations extending to 2027, LADWP has committed to continue to fulfill all contractual obligations while at the same time investigating ways to comply with SB 1368, thereby reducing GHG emissions. LADWP is reviewing several options.

LADWP has called for a Strategic Business Plan to be developed for IPP. This effort, which is currently underway, involves IPA as owners of the IPP assets and the 36 participants that have power sales contracts. This effort is seen as a way to focus on the current and future needs of the project owners and those with power contracts and seek ways to find mutually beneficial solutions. Many of the participants, including LADWP, would like to settle on solutions that can be implemented in the next few years thereby reducing uncertainty with regard to the future use of IPP.

The work product is expected to be completed and approved in 2010. After a series of Workshops and Executive Sessions, the IPP Strategic Business Plan is looking at several options in each of five focus areas:

- Developing an energy hub at the site
- Developing a plan for future generation
- Maximizing and optimizing project assets
- Developing new transmission
- Preparing advocacy efforts to assure future success.

<u>Navajo Generating Station</u>

Navajo is a coal-fueled generation station located near Page, Arizona. It consists of three units with a combined capacity of 2,250 MW. Salt River Project is the Operating Agent. LADWP has a 21.2 percent ownership share with many existing contracts, which expire starting in 2019.

Since Navajo currently operates as a 477 MW base load resource for LADWP, the first option would be to find a replacement that can also provide base load power around the clock while reducing the GHG emissions. Based on a review of potential resource options, the optimum option is to replace Navajo with a 500 MW combined cycle natural gas plant.

Mohave Generating Station

The Mohave Generating Station is a former coal-fired power plant located in Laughlin, Nevada. It was a two-unit plant with an output of 1,580 MW. The plant was shut down at the end of 2005 and is in the process of being decommissioned. All current buildings and other plant infrastructure are slated to be removed.
LADWP is investigating options for repurposing the site and deriving the remaining value or replacement of the assets at Mohave. For example, an option would be to enter into a joint development with some or all of the current owners on a new power plant that could address our need for more renewable energy and more flexible, dispatchable natural gas generation to help integrate the higher levels of renewable energy in our portfolio.

2.4.6 Spot Purchases

Although LADWP's policy is to be self-reliant and be capable of generating all of its energy needs from resources it owns or controls, it does participate in energy markets if it is in the City's economic interest. Periodically, capacity and energy is purchased from providers within the Western Electricity Coordinating Council (WECC) jurisdiction under short-term "spot" arrangements to be delivered to the LADWP transmission system. These purchases are used by LADWP in conjunction with other resources for economical Power System operation.

The availability of economical energy on the spot market has fluctuated greatly in recent years. Historically, LADWP has not been dependent on such purchases to meet its customers' needs. Although LADWP currently continues to find economical spot purchase opportunities (including some for renewable energy), it cannot predict the future availability of power from either the Pacific Northwest or the Southwest to purchase at prices below LADWP's costs for producing power from its own resources.

2.4.7 Spot Sales

LADWP often has a surplus of generating capacity and energy. Consistent with prudent utility practice, LADWP sells a portion of this surplus into wholesale electricity markets within the WECC, and normally at prices above LADWP's production cost. This way, LADWP's ratepayers benefit by receiving the lowest cost energy in the Power System, in addition to indirect rate relief resulting from the wholesale revenue stream.

2.4.8 Transmission and Distribution Facilities

Electricity from LADWP's power generation sources is delivered to customers over an extensive transmission and distribution system. To deliver energy from generating plants to customers, LADWP owns and/or operates approximately 20,000 miles of alternating current (AC) and direct current (DC) transmission and distribution circuits operating at voltages ranging from 120 volts to 500 kilovolts (kV). Major transmission lines connecting to out-of-basin generating resources are shown in Figure 2-6.

In addition to using its transmission system to deliver electricity from its power generation resources, LADWP transmits energy for others through its system when surplus transmission capacity is available and this transmission is permitted. LADWP uses its extensive transmission network to sell its excess energy and capacity into the California, Northwest, and Southwest energy markets. Revenues from these excess energy sales are used to reduce costs to ratepayers and for capital improvements. In the near future, LADWP anticipates that revenue from excess energy sales may be less due to aging facilities, anticipated load growth, and GHG emission regulations.

Existing transmission facilities available to LADWP are described in Appendix I. Additionally, three innovative projects under development or consideration are:

- <u>Barren Ridge Renewable Transmission Project</u>

  This project provides new transmission access and transmission line upgrades that would be needed to accommodate proposed wind projects in the Tehachapi area and solar thermal projects in the Mojave Desert. These proposed wind and solar projects total nearly 1,000 MW. The initial project was the construction of the Barren Ridge substation which supports the 120 MW Pine Tree Wind project. This substation interconnects with LADWP's existing 230 kV Inyo-Rinaldi transmission line (which was built to gain access to the renewable hydro-generated energy from LADWP's aqueduct system in the Owens Valley). The Inyo-Rinaldi transmission capacity needs to be increased in order to accommodate additional renewable energy projects. A full EIR process is currently underway on this project.

- <u>Southern Transmission System Upgrade Project</u>

  The purpose of the project is to modify existing equipment and install new equipment at IPP converter Station located at Delta, Utah and Adelanto Converter Station located at Adelanto, California.

  This project will increase the continuous power transfer level from the existing 1,920 MW to 2,400 MW. It also enhances the performance of the IPP HVDC link by replacing the existing control, protection and monitoring system with a new state-of-the-art system.

- <u>Pacific Direct Current Intertie (PDCI) Proposed Upgrade Study</u>

  The purpose of the PDCI transmission enhancement or the PDCI Upgrade would be to evaluate different options available for upgrading the line from the existing 3,100 MW to a maximum capability of 3,650 MW.

The intended benefits are

- To deliver additional amounts of renewable wind and hydro energy from the Pacific Northwest to Los Angeles
- To contribute to LADWP's RPS Policy goals
- To provide flexibility through a design based on open standards, thereby ensuring that multiple vendors would be available for future implementations, upgrades, or functional additions .

In order for LADWP and other major Western utilities to meet their renewable energy goals at the lowest cost, greater development of additional transmission lines to move high quality resources to load centers is needed. While the projects listed here are those that are currently in operation or are being evaluated in detail, this does not necessarily mean that these will be sufficient to meet future needs. LADWP will continue to evaluate transmission needs and opportunities as necessary.

The California Transmission Planning Group

The California Transmission Planning Group (CTPG) is a forum for conducting joint transmission planning and coordination in transmission activities to meet the needs of California consistent with FERC Order 890. FERC Order 890 specifies:

- Transmission providers participate in a coordinated, open and transparent planning process on both a local and regional level
- Each transmission provider's planning process meet the Commission's nine planning principles, which are coordination, openness, transparency, information exchange, comparability, dispute resolution, regional coordination, economic planning studies, and cost allocation
- Each transmission provider must describe its planning process in its tariff
- The Commission will allow regional differences in planning processes.

The CTPG includes transmission owners (SCE, SDGE, LADWP, PGE, SMUD etc.) with an obligation to serve, and transmission operators. These parties have the technical capability to perform detailed transmission planning. Currently, LADWP is on the executive committee of the CTPG and chairs the technical steering committee. CTPG members are committed to developing a California state-wide transmission plan to meet the state's 33% Renewable Portfolio Standard goal by 2020. This transmission plan cooperatively seeks to leverage a diverse portfolio of renewable energy generation technologies (wind, geothermal, hydro, biomass and solar) available to supply projected electricity demand in California from now to beyond 2020. In this effort CTPG is utilizing the Renewable Energy Transmission Initiative (RETI) conceptual plan as a starting point. Figure 2-8 shows LADWP's major out-of-basin generation resources and associated transmission lines.

Further detail regarding LADWP's transmission system is presented in Appendix I.

Figure 2-8: Major out-of-basin generating stations and major transmission lines

2.4.9 Reserve Requirements

Reliability of the electric power system is dependent upon two elements: “resource adequacy” and “security.” Resource adequacy refers to the availability of sufficient generation and transmission resources to meet customer’s projected energy needs plus reserves for contingencies. Security refers to the ability of the system to remain intact after experiencing sudden disturbances, outages or equipment failures.

LADWP, as part of the electric power grid of the western United States and Canada (and a small section of northern Mexico), is required to meet operational, planning reserve and reliability criteria, and the resource adequacy standards of the WECC and the North American Electric Reliability Corporation (NERC). These standards define the system reserve margin requirements and other criteria for which LADWP must plan and operate and are defined as follows:

Generation Capacity Requirement = Net Power Demand + System Reserve Requirement
System Reserve Requirement = Operating Reserve + Replacement Reserve
Operating Reserve = Contingency Reserve + Regulation

The “Net Power Demand” is the total electrical power requirement for all of LADWP’s customers at any time. The other reserve requirements are defined below, as well as numerically calculated.

The loss of the largest single contingency of generation or transmission, which could be the Haynes combined cycle unit or an IPP unit, is a key reserve margin determinant for LADWP and defines the Contingency Reserve as well as the Replacement Reserve requirements. Under the current WECC Minimum Operating Reliability Criteria (MORC), at least 50 percent of the Contingency Reserves must be Spinning Reserve. The Replacement Reserve requirement is to restore Operating Reserves within 60 minutes of a contingency event. The Regulation Requirement is currently comparatively small (25 MW) and is related to system load variations due to customer load changes (this regulation requirement will increase in the future as additional amounts of intermittent renewable generation are added to the generation mix). Given LADWP’s current total generation portfolio, the system reserve requirement is approximately 1,100 MW. Therefore, if the system demand is 5,000 MW, LADWP must have a total of 6,100 MW of stable and dispatchable generating capacity (and the transmission for that capacity) to meet the 5,000 MW demand.

It is anticipated that some renewable resources, particularly intermittent resources such as wind and solar photovoltaic, cannot be depended upon to meet peak demand conditions. As LADWP acquires a larger proportion of such resources, studies on the characteristics of these intermittent resources will need to be carried out to determine their effect on reserve and regulation requirement. Refer to Appendix J for additional information on issues associated with integrating intermittent energy resources.

The capacity value of a generating resource is based on its ability to provide dependable and reliable capacity during peak periods when the system requires reliable resources for stable operation. Resources that can provide firm capacity will have a higher capacity value than resources that cannot. For purposes of planning LADWP's reserves adequacy calculations, it was assumed that the dependable capacity of wind would be 10 percent of its nameplate capacity and the dependable capacity of solar photovoltaic would be 27 percent of its nameplate capacity.

Local Resources for Reserve Requirements

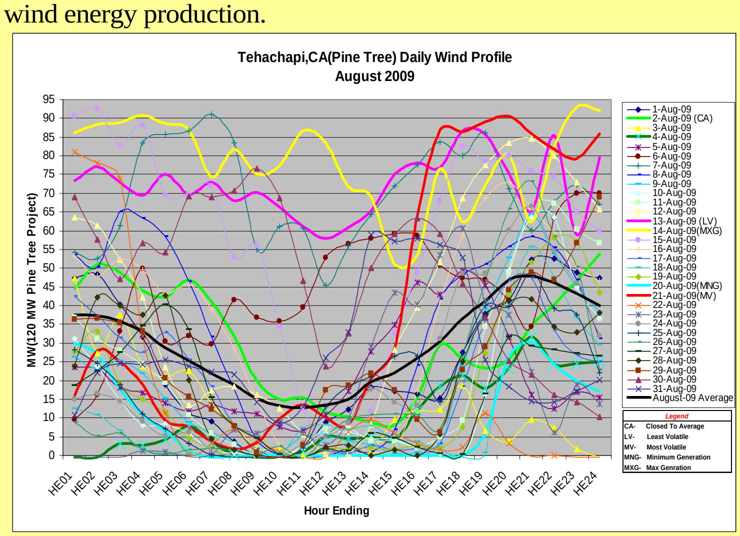
As a subset of the reserve requirements, LADWP has located a significant amount of generating resources within the Los Angeles (LA) area. The specific amount of capacity that needs to be located in the LA Basin is approximately 3,400 MW, but varies, depending on the combination of which units are operating and how much power is flowing on the transmission system at the time. By locating these generation sources within LADWP's service territory, it ensures that LADWP can produce electricity in the event of earthquakes or other situations that could interrupt the transmission

Integration of Intermittent Energy

One of the main responsibilities of power system operators is to maintain the balance between the total aggregate electrical demand of the systems customers and the amount of energy generated to meet that demand on an instantaneous basis. Conventional electrical generation technologies, such as nuclear, coal, natural gas and large hydro are controlled and dispatched by the power system operators throughout the day to maintain this instantaneous balance between demand and generation.

With the much higher percentage of renewables coming on line, a variety of modifications will need to be made to the Power System to successfully and reliably integrate these higher penetrations of renewable resources. In preparation, LADWP has conducted preliminary studies on integrating renewable resources, and has also reviewed many renewable resource integration studies published over the last several years.

Individual wind farms tend to have a high variability in the amount of energy produced (see figure below), but multiple wind farms located in diverse geographic areas are thought to reduce the overall variability in the amount of wind energy production.



Energy generated from Solar PV technology is highly sensitive to cloud cover. These PV systems can experience variations in output of ± 50 percent in 30 to 90 seconds, and ± 70 percent in five to 10 minutes. When a single large sized PV facility experiences these rapid changes in output, the power system must also be able to react just as quickly with other generation resources to accommodate such rapid changes. The capabilities of a power system's dispatchable resources will limit the size of a single PV facility.

See Appendix J for more details regarding integrating intermittent resources.

system from importing power from external sources.

This local requirement is particularly important in the context of deciding which plants that use Once Through Cooling need to be replaced. Los Angeles Basin plants such as Haynes and Scattergood that qualify towards the local area capacity requirement were assumed to be re-powered at the existing site in part to maintain the local capacity requirement.

3.0 STRATEGIC CASE DEVELOPMENT

3.1 Overview

To facilitate choosing the best resource procurement plan, LADWP developed and analyzed several strategic cases representing different potential resource portfolios. The development process addressed several issues, including accelerated GHG reductions, policy decisions on increasing the use of renewables, and which types of renewable resources should be acquired. Section 3-4 of this IRP describes the development of the candidate portfolios, while Section 4 provides a comparison of the various portfolios.

3.2 Strategic Case Alternatives

To achieve a high level of Power System reliability, minimize the impact on ratepayer energy prices, and comply with federal, state, and local regulations, LADWP developed different strategic cases centering on the amount of renewable resources procured and the amount of SB 1368-compliant generation retained in LADWP's portfolio. Each case includes a base assumption regarding future load requirements, natural gas prices, GHG emissions allowance prices, and contributions of EE/DSM to meet load. Other common assumptions include the implementation of LADWP's re-powering program (discussed in Section 2) and compliance with SB 1368 at the Navajo Generating Station and IPP. The study horizon for each case was 20 years, beginning in 2010.

The two primary parameters differentiating the cases are

- Amount of renewables

  LADWP is on schedule to achieve 20 percent renewables by the end of 2010. The LADWP Board of Commissioners has established a policy to reach 35 percent renewables by 2020. This IRP developed several different cases where this policy would be met by a mix of different renewable resources along with Demand Side Resources (DSR), including EE/DSM. Based on cost and resource diversity goals, these cases were narrowed down to two, each with a mix of wind, geothermal, solar, and DSR, but in different amounts. These were compared to a case where the 20 percent goal was only maintained—not increased—over 20 years for comparison purposes.

- GHG reduction

  Each strategic case addresses accelerated GHG reduction and/or compliance with SB 1368.

The following subsections describe the renewable resources that were considered and how the candidate portfolios were developed.

3.3 Renewable Technologies

The renewable technologies evaluated for potential LADWP use as part of this IRP were

- Solid biomass (direct-fired and co-firing)
- Biogas (anaerobic digestion and landfill gas)
- Solar PV
- Solar thermal electric
- Small hydroelectric
- Wind (on-shore and off-shore)
- Geothermal
- Ocean and wave

LADWP's observations on some of the technologies are as follows:

- <u>Biomass</u>

  Solid biomass power generation options include direct-fired biomass and co-fired biomass in existing coal boilers (Navajo and IPP). This IRP focuses on biomass combustion options for the utilization of solid biomass fuels. Biomass gasification options were excluded from this study, as direct combustion processes are employed for nearly all of the world's biomass power facilities.

- <u>Biogas</u>

  Based on the generation potentials developed by the California Renewable Energy Transmission Initiative (RETI), roughly 500 MW of generation from biogas projects in California may potentially exist. While, collectively, these projects may be significant, it is unlikely that individual projects would be much larger than 5 MW. Due to the small capacity of many of these projects, individual biogas opportunities will be considered on a case-by-case basis.

- <u>Solar</u>

  Both solar PV and solar thermal technologies convert sunlight to electricity. Solar PV converts sunlight directly into electricity. Power production depends on the material involved and the intensity of the solar radiation incident on the cell. Single or polycrystalline silicon cells are most widely used today. Thin film solar cells are made from layers of semiconductor materials only a few micrometers thick. These materials make applications more flexible, as thin film PV can be integrated into roofing tiles or windows.

Solar thermal technologies available for electricity generation include parabolic trough, parabolic dish, power tower, Compact Linear Fresnel Reflector (CLFR), and solar chimney. Thermal plants consist of two major subsystems: (1) a collector system that collects solar energy and converts it to heat, and (2) a power block that converts the heat energy into electricity. Compared to solar photovoltaic, solar thermal provides better reliability and an increase in dependable capacity. The process of turning heat into electricity utilizes a conventional steam turbine, providing a stable renewable resource with a reduced requirement for gas-fired regulation generation.

- Small hydroelectric

Small hydroelectric is projected to provide a limited portion of LADWP's renewable generating capacity. The RETI report demonstrates a limited availability of new small hydroelectric resources in Southern California, while transmission constraints limit the development of new resources in Northern California and the Pacific Northwest.

- Wind

Wind power has been among the fastest growing energy sources over the last decade, with considerable growth in worldwide capacity over the last five years. The U.S. wind market has been driven by a combination of growing state mandates and federal financial incentives for renewable power technologies. The American Recovery and Reinvestment Act of 2009 contained a number of provisions that have a significant impact on how U.S. renewable power projects are financed. Among these provisions are the production tax credit (PTC), the investment tax credit (ITC), and the ITC cash grant.

When evaluating wind technology, this IRP considers federal financial incentives for on-shore wind resources only. Although offshore wind generating potential exists, these resources are often located above deep water and are often economically infeasible to develop with current technology. Given the large generating potential for onshore wind in California, additional studies of offshore wind are not warranted at this point.

- Geothermal

Most of the known and most easily accessible geothermal resources in the U.S. are concentrated in the western and southwestern parts of the country. The National Renewable Energy Laboratory (NREL) estimates the total U.S. geothermal potential to be between 30 GW and 70 GW. This estimate only includes conventional hydrothermal resources, and additional potential may exist if deeper reservoirs and advanced geothermal techniques become available. Geothermal plants offer increased dependability and reliability due to their use of conventional steam turbines. Additionally, geothermal plants provide base load power, making them the easiest renewable resource to integrate into the grid.

- Ocean and wave

  Ocean and wave technologies are relatively new, and given the high cost of their development, these technologies were not considered in any renewable portfolio cases. LADWP, however, may evaluate opportunities in ocean and wave technology on a case-by-case basis.

3.4 Candidate Portfolios

A candidate portfolio is a set of renewable and non-renewable generation resources, DSR resources, regulatory constraints, policy goals, and assumptions that model strategic scenarios. Candidate portfolios were selected to cover a broad spectrum of possible scenarios, providing decision makers information on which portfolios are likely to be the most desirable. Additionally, each candidate portfolio was developed to ensure resource adequacy—LADWP's ability to meet total peak demand.

The first step in developing candidate portfolios is to determine how LADWP can meet its renewable energy policy goals: 20 percent renewables by 2010 and 35 renewables by 2020. The net short—the gap between renewable energy policy goals and current renewable generation—was calculated for each candidate portfolio, and the contribution of its renewable energy component toward resource adequacy was determined. Combined-cycle gas-fired peaking generation met the remaining deficiency in resource adequacy.

In addition, a Base Case portfolio was established for comparison purposes. This case assumed compliance with SB 1368 at the end of existing coal contracts and only minimal new renewable resources added to the portfolio. Lastly, a Recommended Case was added after the public outreach process was complete.

Beginning in 2001, LADWP issued several requests for proposals (RFPs) for renewable energy generation and gained a thorough understanding of the nature and availability of each technology. This knowledge was used in developing the candidate portfolios. Additionally, LADWP largely considered renewable resources within the Western Governors' Association's Western Renewable Energy Zones (WREZ). In the WREZ initiative, Qualified Resource Areas (QRAs) were defined as areas of dense, high-quality renewable energy resources, meeting various resource size, quality, environmental, and technical criteria. LADWP screened all resources to ensure they are located near available LADWP transmission infrastructure.

Assumptions were made for the cost and performance of each technology used to convert the renewable resources to electricity. A summary of the main assumptions made for biomass, geothermal, solar, and wind is presented in Appendix M. These assumptions were used in calculating the levelized cost of electricity.

A valuation process designed to provide a single ranking value to a resource was then applied. This process is intended to identify resources with the combination of lowest cost and highest value. The valuation approach is similar to the bid evaluation process many utilities use when procuring renewable resources. Specifics for the resource valuation methods are also covered in Appendix M.

For each candidate portfolio, after applying appropriate constraints, resources were selected and added progressively to its renewable resource mix based on lowest rank cost and transmission availability until the net short was mitigated.

3.4.1 Renewable Net Short

The renewable net short is the difference between LADWP's renewable energy goals and current renewable generation. This difference—the net short—represents how much additional renewable energy LADWP must procure if the targets are to be met.

The calculation for the net short was performed using the following equation:

Net Short (GWh) = (Forecasted Energy Sales) x (Annual Renewable Percent Goal) – (Operating Renewable Resources) – (Under Construction and Pre-construction Renewable Resources) – (Renewable Energy Purchases)

For this calculation, LADWP used its existing renewable energy generation in 2010 and renewable energy generation projected to be online in 2011.

The projected net short arising in candidate portfolios with a 20 percent, 33 percent, and 35 percent renewable energy goal by 2020 is presented in Figure 3-1. Without procurement of additional renewables resources, LADWP will be roughly 6,100 GWh/yr short of a 35 percent renewables target by 2020 and 8,300 GWh/yr short by 2030 (see Table 3-1).

Table 3-1: Expected Net Short for 20 percent, 33 percent, and 35 percent RPS portfolios

RPS	Net Short (GWh)	
	2020	2030
20 percent	2,300	3,700
33 percent	5,600	7,700
35 percent	6,100	8,300

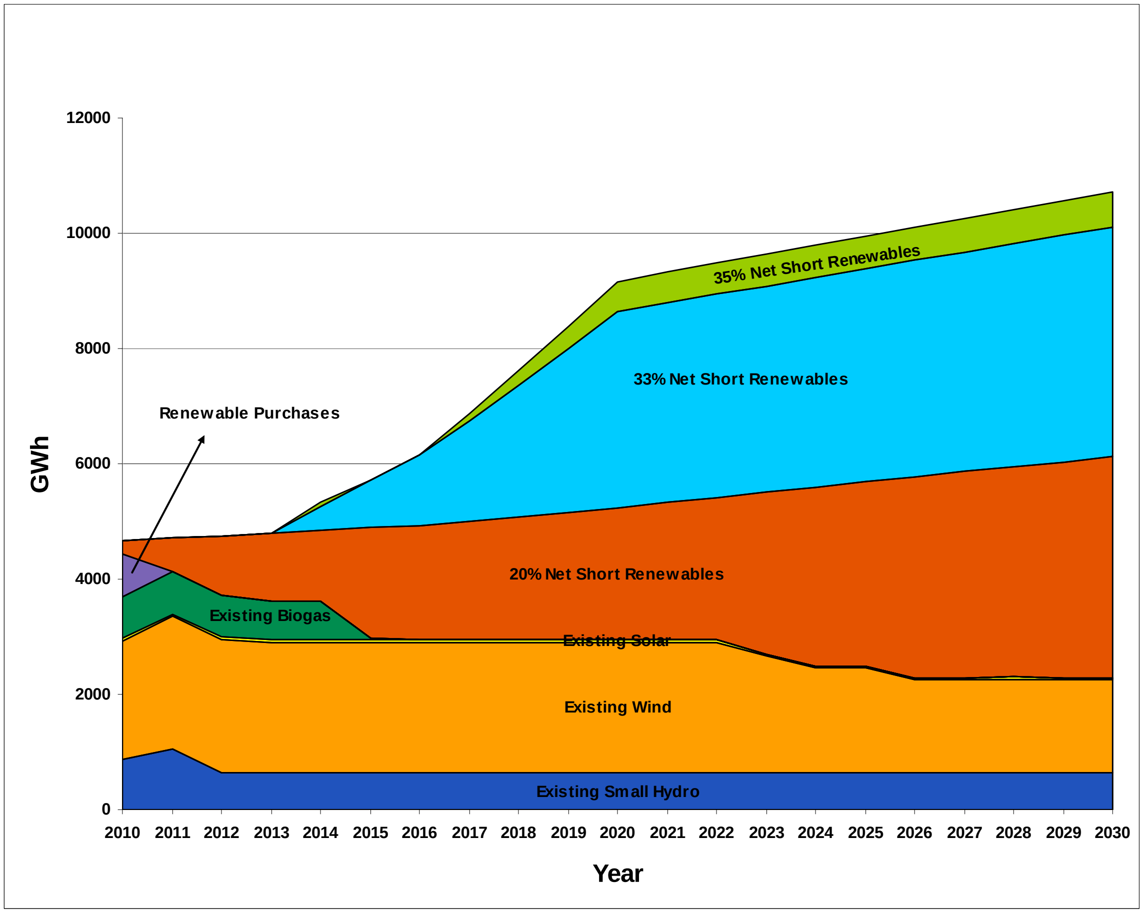


Figure 3-1: LADWP renewable energy net short

Projects already approved to be in place by 2020 include the following:

- Solar

  Approximately 30 GWh/yr of existing solar and customer/developer built solar.

- Wind

  Approximately 2,300 GWh/yr of LADWP owned or purchased power. Projects not owned by LADWP were assumed to have their contracts extended through 2030 if they were to expire during the analysis period.

- Hydro

  Sepulveda, Water System, Aqueduct, Owens Valley, and Owens Gorge projects.

LADWP is currently considering and negotiating a number of other resources for further renewable energy procurement. Because of the level of uncertainty for these projects, they were not included in the firm future capacity forecast. The intent of the IRP process is to identify the additional projects that can help meet the renewable energy goals at the lowest cost.

3.5 Strategic Cases Evaluated

Table 3-2 summarizes each candidate portfolio evaluated. Table 3-3 provides a description of each candidate portfolio evaluated.

Table 3-2: Candidate portfolios

		2020	GHG or SB1368 Compliance Date		New Renewables Installed Capacity (MW) 2011- 2020			New Renewables Installed Capacity (MW) 2011- 2030			
Case ID	Resource Strategy	RPS Target	Navajo Replacement	Intermountain Replacement	Geothermal/ Biomass	Wind	Solar	Geothermal / Biomass	Wind	Solar	Generic
Base Case	No More RPS	13%	12/31/2019	6/15/2027	0	100	130	0	100	130	0
A	20% RPS Strategy	20%	12/31/2019	6/15/2027	80	250	530	160	250	660	0
B	20% RPS Strategy – GHG Reduction Focus	20%	12/31/2019	12/31/2020	80	250	530	160	250	660	0
C	35% RPS Wind Strategy - GHG Reduction Focus	35%	12/31/2019	12/31/2020	320	1,000	530	320	1,300	660	0
D	35% RPS Wind Strategy	35%	12/31/2019	6/15/2027	320	1,000	530	320	1,300	660	0
E	35% RPS Solar Strategy - GHG Reduction Focus	35%	12/31/2019	12/31/2020	320	850	1,130	320	850	1,560	0
F	35% RPS Solar Strategy	35%	12/31/2019	6/15/2027	320	850	1,130	320	850	1,560	0
Recommended Case	33% RPS	33%	1/1/2014	6/15/2027	320	580	630	320	680	970	160

Table 3-3: Description of candidate portfolios

Base Case	No more RPS strategy – This case assumes limited additional renewable energy resources added. It also assumes coal resources being replaced with natural gas resources upon the expiration of coal contracts.
Case A	20% RPS Strategy – This case maintains 20 percent renewables throughout the study period and assumes energy from generating stations emitting high levels of CO_2 will continue energy production until 2027 or until the date mandated by SB 1368. New resources are required to satisfy increasing load.
Case B	20% RPS Strategy – GHG Reduction Focus – This case also maintains 20 percent renewables throughout the 20-year study period but assumes accelerated GHG or SB 1368 compliance by 2020. New resources are still required over time to satisfy increasing load.
Case C	35% RPS Wind Strategy – GHG Reduction Focus – This case increases the level of renewables to 35 percent by 2020 and assumes accelerated GHG reduction or SB 1368 compliance by 2020. The renewable resource mix is slightly favorable towards wind technologies.
Case D	35% RPS Wind Strategy – This case increases the level of renewables to 35 percent by year 2020 and assumes continued use of generating stations emitting high levels of CO_2 until 2027 or until the date mandated by SB 1368. The renewable resource mix is favorable towards wind technologies.
Case E	35% RPS Solar Strategy – GHG Reduction Focus – This case increases the level of renewables to 35 percent by 2020 and assumes an accelerated GHG reduction or SB 1368 compliance by 2020. The renewable resource mix is favorable towards solar technologies.
Case F	35% RPS Solar Strategy – This case increases the level of renewables to 35 percent by 2020 and assumes continued use of generating stations emitting high levels of CO_2 until 2027 or until the date mandated by SB 1368. The renewable resource mix is favorable towards solar technologies.
Recommended Case	33% RPS Balanced Strategy – This case increases the level of renewables to 33 percent by 2020, assumes replacement of the Navajo Generating Station five years early (2014), and assumes replacement of IPP in 2027.

DSR will play an integral role in LADWP's resource plan and is performing a study of potential DSR implementation to be completed in late 2010. For this IRP, it is expected that LADWP will continue with a policy of emphasizing DSR.

The renewable technologies readily available in the western U.S. at potentially economic prices are geothermal, biogas, solar, and wind. Advancements in these technologies are lowering their costs and increasing their capacity factors. Additionally, federal and state incentives can further reduce their costs. LADWP also recognizes that wind and solar are intermittent resources since their output can vary rapidly with changing wind and cloud cover. LADWP's policy is to assure that these variable energy resources can be integrated economically and reliably into its system.

3.6 General Assumptions and Price Inputs

In order to perform the computer-based modeling, a significant amount of model input data was developed and prepared. General assumptions and price inputs included:

- Load

  The hourly loads used in the modeling are based on the load forecast described in Section 2, "Load Forecast and Resources."

- Existing supply-side resources

  The expected availability of existing and planned resources was incorporated into an initial forecast of resource needs. A summary of the major assumptions made for renewable resources is shown in Table 3-4.

Table 3-4: Summary of supply-side resource assumptions

Resource	Levelized Cost ($/MWh)	Capacity Factors	Dependable Capacity
Solar Photovoltaic – PPA	$140	25%	27%
Solar Photovoltaic - LA Solar – Public/Private Partnership In-Basin	$200	21%	27%
Solar Photovoltaic – LA Solar – Public/Private Partnership Owens	$153	25%	27%
Solar Customer - Net-Metered	$190	19%	27%
Solar Feed-In Tariff	$190	20%	27%
Wind	$90	35%	10%
Geothermal	$120	90%	90%
New Combined Cycle Gas (310 MW)	$80	87%	100%
New Simple Cycle Gas (50/100 MW)	$124	< 10%	100%

- Demand side resources

  Existing and new LADWP EE programs are incorporated within the load forecast itself. New DR programs are included as capacity resources in the model.

- Candidate demand and resource options

  Resources used to meet peak demand and renewable energy goals include projected generation from future projects including customer-installed solar, as well as generation from existing projects (see Section 3.4).

- Financial metrics

  The modeling assumed general inflation of 1.5 percent over the forecast period, a discount rate, and a levelized fixed charges rate. Table 3-5 shows the assumed value of each of these financial metrics.

Table 3-5: Assumed financial metrics

Metric	Rate (Percent)
Inflation	1.50
Discount Rate	5.50
Levelized Fixed Charges Rate	6.70

3.6.1 Natural Gas Prices

High, low, and medium natural gas price forecasts were developed to test each portfolio against a range of potential natural gas prices. Three different natural gas price curves were developed by using a combination of the published natural gas forecasts and assuming a range of ±20 percent, as shown on Figure 3-2.

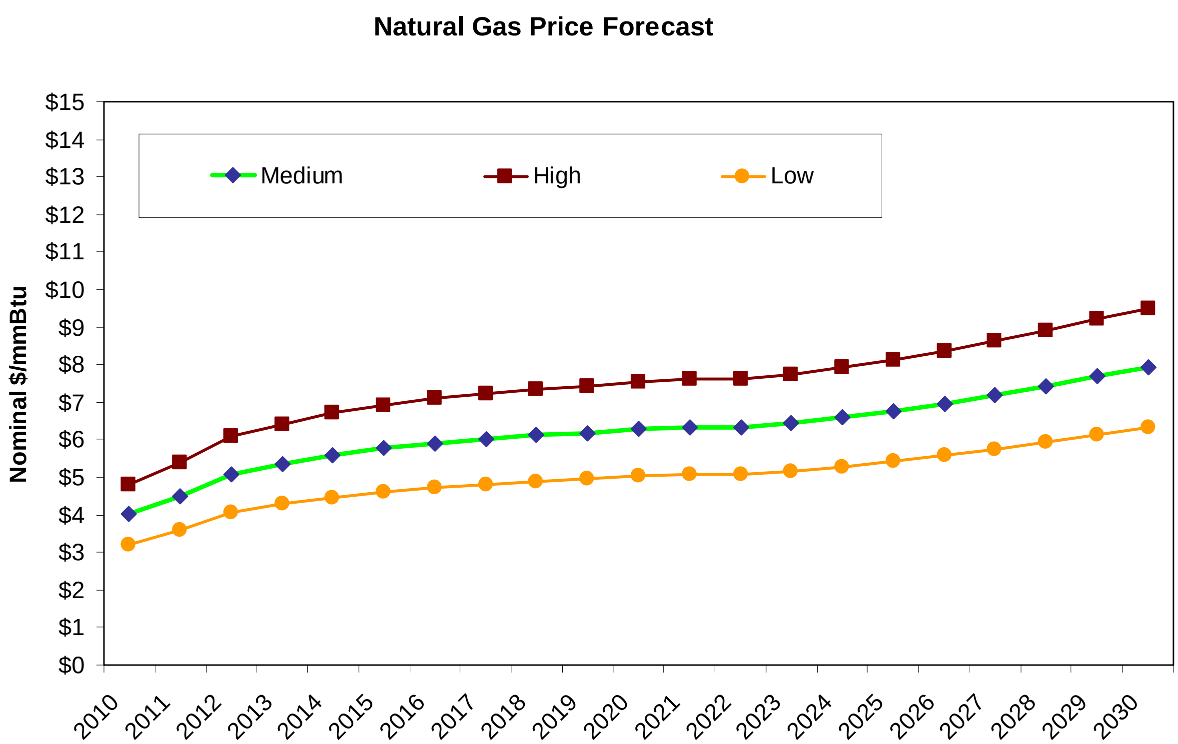


Figure 3-2: Natural gas price forecast

3.6.2 GHG Emissions Allowance Prices

Price scenarios were also developed and tested for GHG allowance prices using staff estimates from experience in utility and agency models as the template. This template assumed GHG pricing starting at $20/short ton in 2012 escalating to $40/short ton in 2020, then escalating at 2.6 percent annually through 2030. High and low GHG price cases were also analyzed. These cases assumed GHG pricing starting at $15 and $25 per short ton, respectively, and escalating to $30 and $50 per short ton, respectively, by 2020 with a continued escalation of 2.6 percent through 2030. Figure 3-3 depicts the GHG allowance prices used to evaluate the portfolios.

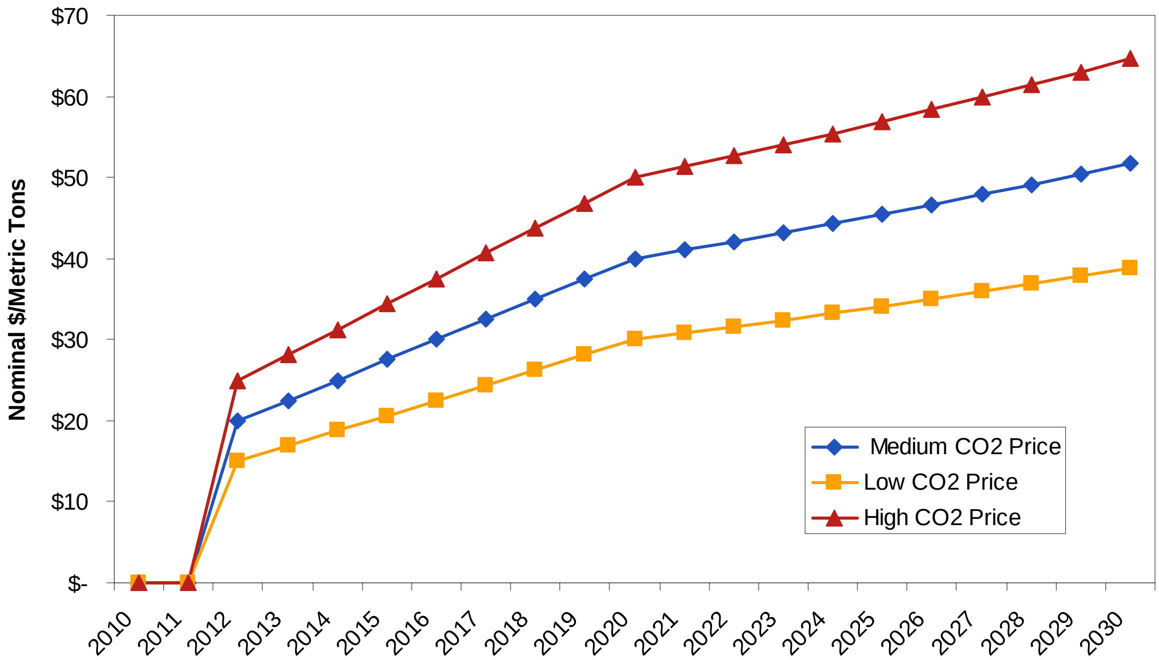


Figure 3-3: Assumed GHG emissions allowance prices.

4.0 STRATEGIC CASE COMPARISONS

4.1 Overview

In order to develop an Action Plan to assure the future energy needs of LADWP customers are reliably met at the least cost and consistent with the City's commitment to environmental stewardship, a rigorous analysis of six "book end" strategic cases was performed. An additional two cases were also added after input from the public during the public outreach period. These two cases were a base case and a recommended case. Both of these cases also underwent the same rigorous analysis. The analysis was performed on the generating resources using an hourly chronological production cost model. The model simulated the operation and electric loading of the LADWP Power System under different time frames and with different portfolios of generating resources. The objective function of the production cost model is to minimize system cost, which is achieved by finding the least cost method to meeting the electric system demand using specified generating resources.

The resources defined in the model consist of existing LADWP generating resources and generic types of future generating resources. The resource mix of renewable generating resources and thermal generating resources analyzed are called strategies. Each strategy targets a specified RPS percentage coupled with an additional strategy of accelerating or not accelerating the reduction of GHG emissions. The accelerated reduction of GHG emissions strategy is achieved by not taking power from high CO_2 emitting generation power plants. Model runs were performed for the 20 year planning horizon. Key results for each strategic case were tabulated and compared against other cases. Although, the production cost model used to evaluate the candidate strategic cases produces copious data for each model run, each strategy studied was ranked on average dollars per megawatt hour generation cost and the total million metric tons of CO_2 emissions. All of the strategic cases required electric system reliability per NERC and FERC regulations, which dictated either replacing or re-powering aged infrastructure or end-of-life generating power plants. The evaluation of each of the candidate strategic cases on those measures is described further in detail below.

The selection of the best case for LADWP ratepayers hinges mainly upon the load forecast, price of natural gas, the future price of GHG emissions, and the RPS targets mandated. The analytics performed for this IRP examined the associated costs, including GHG emissions costs, of each strategic case.

While these strategic cases look significantly different in the longer term, the actions needed in the next few years are very similar. Therefore, the two-year action plan described in this IRP can accommodate any of the longer term strategies. This section outlines the eight candidate strategic cases analyzed and describes the process by which a smaller set of preferable strategies was selected.

4.2 Strategic Case Runs

The evaluation of the different portfolios under different natural gas and GHG emissions pricing scenarios was first performed at a screening level to determine which portfolios would perform better relative to each other. For each modeling pass, assumptions were held constant so that a comparative analysis could be performed. After running several combinations of natural gas and GHG allowance price scenarios, a wide range of power costs for each portfolio was observed.

For the cases that were run targeting the 35 percent RPS standard (Cases D and F), it was observed that an environment of high natural gas and high GHG emission prices would not be a key driver in determining whether LADWP would be better off with either cases D or F.

The screening level portfolios were developed to provide a basis for selecting the resource building blocks needed to construct an economically viable resource expansion plan needed to meet both resource adequacy and RPS goals. The screening level process identified the need to provide diversity in generating resources (a combination of geothermal, wind, biogas, and solar) which are near existing LADWP transmission lines. These resources and their proximity to existing transmission lines are the common building blocks. Other generating resources were also evaluated but not selected as candidate resources because they were either too expensive, lack diversity, or not technically feasible.

4.2.1 Model Used and Approach

Planning & Risk (PROSYM)

Simulations were performed using Planning & Risk (PAR), a third-party software program sold and distributed by Ventyx Corporation based in Atlanta, GA. PAR is an hourly chronological production cost model that commits and dispatches resources to minimize the cost of serving electric load. PAR is a widely used production cost model used by many utilities across the US and the world to help plan and optimize power systems. Additional information on the model can be found in Appendix M.

Energy Pricing and WREZ Model

As discussed in Section 3, WREZ data was used to conduct a broad resource assessment. To determine which resources may be best to meet future LADWP needs, further screening criteria were used. A buffer of 50 miles was placed around AC transmission lines and around the terminals on DC transmission lines. This was overlaid with renewable resources in order to determine which resources should be included for consideration in the IRP portfolios.

For each case except the local distributed solar, the resource model developed by the WREZ project was used to determine the renewable resources that would meet the requirements of each portfolio. For each of these portfolios, after the appropriate constraints were applied, resources were largely selected based on lowest rank cost and transmission availability until the net short was reached. Information on the valuation process and details on the resources considered are provided in Appendix M.

For purposes of the model, future renewable resource supply options were based on: (1) Power Purchase Agreements (PPAs) that provide for the purchase of bundled energy: (2) renewable projects developed by third parties, with LADWP project purchase either at Commercial Operation Date or at a later date after COD; and (3) LADWP self-developed and built projects, that will be financed by LADWP using long-term debt.

Project or resource pricing used in the model was based on information from: 1) its existing PPA's, both directly with third parties and through agreements with the Southern California Public Power Authority (SCPPA); 2) data from recent Request for Proposal (RFP) offered prices; 3) and on-going PPA negotiations. The WREZ process, although an useful tool in identifying candidate renewable resources, only provides guidance on capital costs of specific resource types for self-development.

The decisions on financing and project structure will be influenced by many factors; including the availability of future federal tax grants or tax credits, tax-exempt vs. taxable financing options, and other potential renewable energy financing options. As federal and California tax laws change continuously, those decisions will need to be made based on the rules applicable to the market at that time. As a public power entity, future LADWP and/or SCPPA RFP's will be used to obtain the best possible renewable energy projects and pricing. Future California and/or Federal RPS laws may also influence the type, location, and transmission delivery constraints under which renewable resource options will need to procured.

Case Scorecard

The evaluation of each combination of portfolio and scenario yielded a tremendous amount of information about the LADWP power system. In order to organize and interpret the results of modeling each portfolio, a scorecard system was developed to rank and check the results of the output. The scorecard is a very detailed and complex Microsoft Excel based spreadsheet that summarizes all the important inputs and outputs that include metrics such as total system power costs, plant generation, CO_2 emissions, and fuel costs.

4.2.2 Optimized Portfolio Development

A systematic approach to ranking, optimizing, and testing each portfolio was performed for this IRP. The first screening level batch of portfolios such as the all wind, all geothermal and all solar cases provided the IRP team with invaluable insight on how each portfolio would impact the LADWP Power System. Conclusions that solar would be the most expensive resource and geothermal or wind would be less were determined using the screening portfolio results. Portfolios that included all wind, all geothermal, or all solar were not selected as the recommended portfolio because they lacked diversity and presented potential integration issues. Early on in the portfolio screening process, it was determined that geothermal resources were a lower cost renewable resource with the added benefit of being a baseload resources. The 35 % RPS Wind and Solar Strategies incorporated an achievable amount of geothermal resource and could potentially be developed along with wind and solar resources to make up the rest of the renewable net short.

4.3 Detailed Case Analysis

The resource portfolios were analyzed in detail after an initial screening process to narrow down the appropriate mix of candidate renewable resource technologies. The resource strategies were developed to meet a range of reliability, renewable, and GHG emissions reduction goals. Each of the six strategic cases share common resource attributes for planning purposes that reflect the cost and performance assumptions of those that will likely be used by LADWP in the future. The following inter-related resource activities are in various phases of development and were assumed to occur in each of the six resource strategies:

- Haynes units 1 and 2 re-powering
- Scattergood re-powering
- Energy efficiency penetration of approximately 2,000 GWh by 2030.

Of the eight Strategic Cases, five assume that LADWP will wait until 2027 for the contract with Intermountain Power Plant to terminate, and the other three assume that LADWP will develop and implement a strategy to stop taking power from Intermountain Power Plant by the end of 2020. The strategies that assume that LADWP will be able to stop taking coal power from Intermountain Power Plant by the end of 2020 are described as the strategies with the "GHG Reduction Focus". The recommended case uses a different GHG reduction strategy of replacing the Navajo Coal Power Plant in 2014 rather than waiting until that contract expires in 2019.

Table 4-1 is a matrix of the different strategic cases analyzed. Each resource strategy was constructed to test sensitivities to RPS percentage goals, high CO_2 emitting generation plants replacement schedules, and different renewable resource technology mixes. Table 4-1 also shows the total amount of new renewable capacity added over the study period.

Table 4-1: Strategic case summary matrix

		2020	GHG or SB1368 Compliance Date		New Renewables Installed Capacity (MW) 2011- 2020			New Renewables Installed Capacity (MW) 2011- 2030			
Case ID	Resource Strategy	RPS Target	Navajo Replacement	Intermountain Replacement	Geothermal/ Biomass	Wind	Solar	Geothermal / Biomass	Wind	Solar	Generic
Base Case	No More RPS	13%	12/31/2019	6/15/2027	0	100	130	0	100	130	0
A	20% RPS Strategy	20%	12/31/2019	6/15/2027	80	250	530	160	250	660	0
B	20% RPS Strategy – GHG Reduction Focus	20%	12/31/2019	12/31/2020	80	250	530	160	250	660	0
C	35% RPS Wind Strategy - GHG Reduction Focus	35%	12/31/2019	12/31/2020	320	1,000	530	320	1,300	660	0
D	35% RPS Wind Strategy	35%	12/31/2019	6/15/2027	320	1,000	530	320	1,300	660	0
E	35% RPS Solar Strategy - GHG Reduction Focus	35%	12/31/2019	12/31/2020	320	850	1,130	320	850	1,560	0
F	35% RPS Solar Strategy	35%	12/31/2019	6/15/2027	320	850	1,130	320	850	1,560	0
Recommended Case	33% RPS	33%	1/1/2014	6/15/2027	320	580	630	320	680	970	160

The long term strategy in each of the cases above was purposefully developed to be wide ranging to provide a more robust analysis. This type of analysis attempts to capture as many future trajectories as possible. The strategies evaluated represent a "best guess" view of how the future power system might look like under a particular planning environment. However, the future is full of uncertainty and as more information is known about the future, LADWP will be able to adjust its resource strategies accordingly.

There are many different methods to evaluate and select a resource strategy. In this study each resource strategy was evaluated on reliability, economics, GHG emissions, and taking into consideration any actionable trade-offs.

4.4 Reliability, Economic, and GHG Emissions Measures

4.4.1 Reliability Measures

The renewable resources were mostly added to meet the renewable generation requirements to satisfy the RPS, whereas natural gas fired resources were added to meet both load growth and planning reserve margin targets. Throughout the energy industry there is an on-going debate on how much variable energy resources can be relied upon during the summer system peak. Table 4-2 lists the net dependable capacities, of the different resource technologies, assumed for this IRP analysis.

Table 4-2: Net dependable capacity assumptions for new resources

Plant Technology	Net Dependable Capacity
Natural Gas Combined-Cycle	100%
Natural Gas - Gas Turbine	100%
Wind	10%
Solar PV	27%
Solar Thermal	68%
Geothermal	100%

The intermittency of variable energy resources could potentially have significant reliability and economic impacts to the power system. One method to account for the intermittency of variable energy resources is to build quick-start natural gas-fired peaking resources as a backup. A wind plant rated at 100 MW would count 10 MW towards the planning reserve margin target which means that 90 MW of additional natural gas-fired peakers would be needed to supplement the 100 MW wind plant for capacity purposes.

Another method of securing dependable capacity from intermittent resources is energy storage. However, energy storage technologies have not yet been economically proven the scales needed for implementation. More discussion on energy storage is provided in Appendix K.

Resource strategies are not designed to totally avoid the chance of a power outage due to inadequate supply resources. Such a strategy would be very expensive and would mean that some resources would be built with a small chance of ever operating, or would have an unacceptably low capacity factor. Most power outages are distribution based (e.g.,. a winter storm that knocks down local distribution lines) and not a result of insufficient generation resources. The NERC reliability standard of “1 day in 10 years” attempts to quantify what is an acceptable amount of loss of load (i.e. a power outage). While there are several different interpretations of the NERC reliability standard the widely accepted explanation of the criteria is that a system is considered reliable if there are no more than a total of 24 hours of loss of load in a 10 year period (87,600 hours). This interpretation of the “1 day in 10 years” reliability standard translates to a 0.03 percent chance that load will not be served.

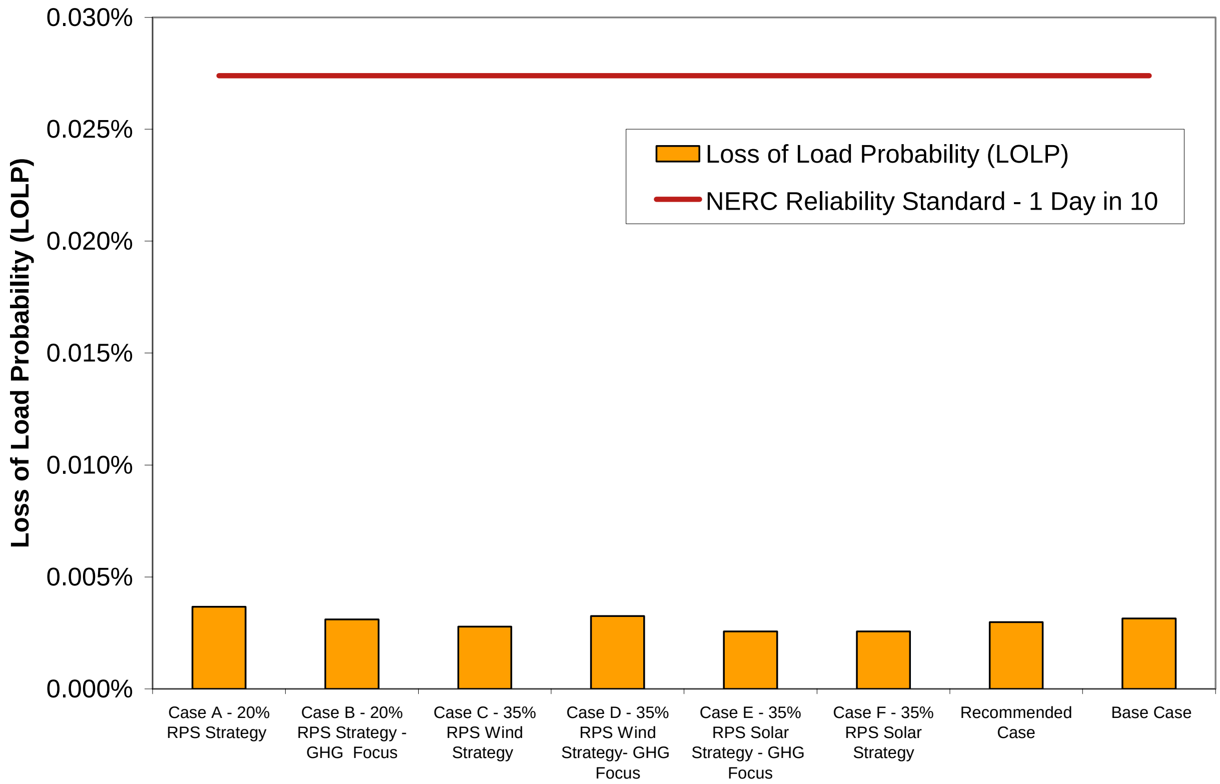


Figure 4-1: Summary of strategic case reliabilities

Based on the reliability calculation, no single resource strategy is significantly more or less reliable than another strategy, and all strategies meet the NERC reliability standard (see Figure 4-1). The economic aspects of each of the resource strategies are only valid if the resource strategy meets the NERC reliability standard of "1 day in 10 years." For this initial evaluation on reliability, each resource strategy was considered equal in terms of the reliability criteria.

4.4.2 Economic Measures

Since all the resource strategies are equally acceptable when measured on reliability, the selection of the preferred plan should be decided based upon the trade-off between the economic and GHG emissions reduction criteria. In terms of economic impacts the Base Case is the lowest cost resource strategy on a present value basis. However, the trade-off for the lowest cost strategy is that the Base Case has the highest amount of GHG emissions. The Base Case relies predominantly on natural gas and coal-fired resources based on moderate GHG emission costs to meet future energy supply needs.

Figure 4-2 summarizes the present value power cost impacts for each of the strategic cases.

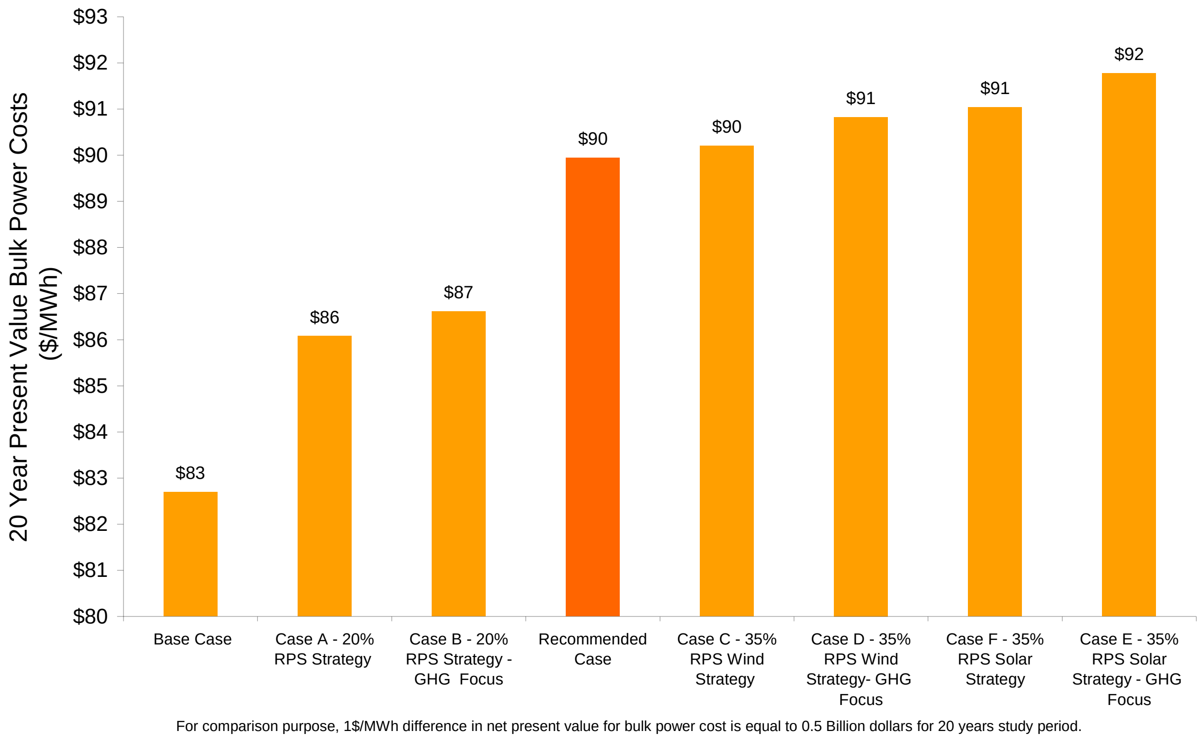


Figure 4-2: Summary of bulk power costs for each strategic case over the next 20 years

Figure 4-3 below shows the annual bulk power cost forecasted for each strategic case, including the Recommended Case.

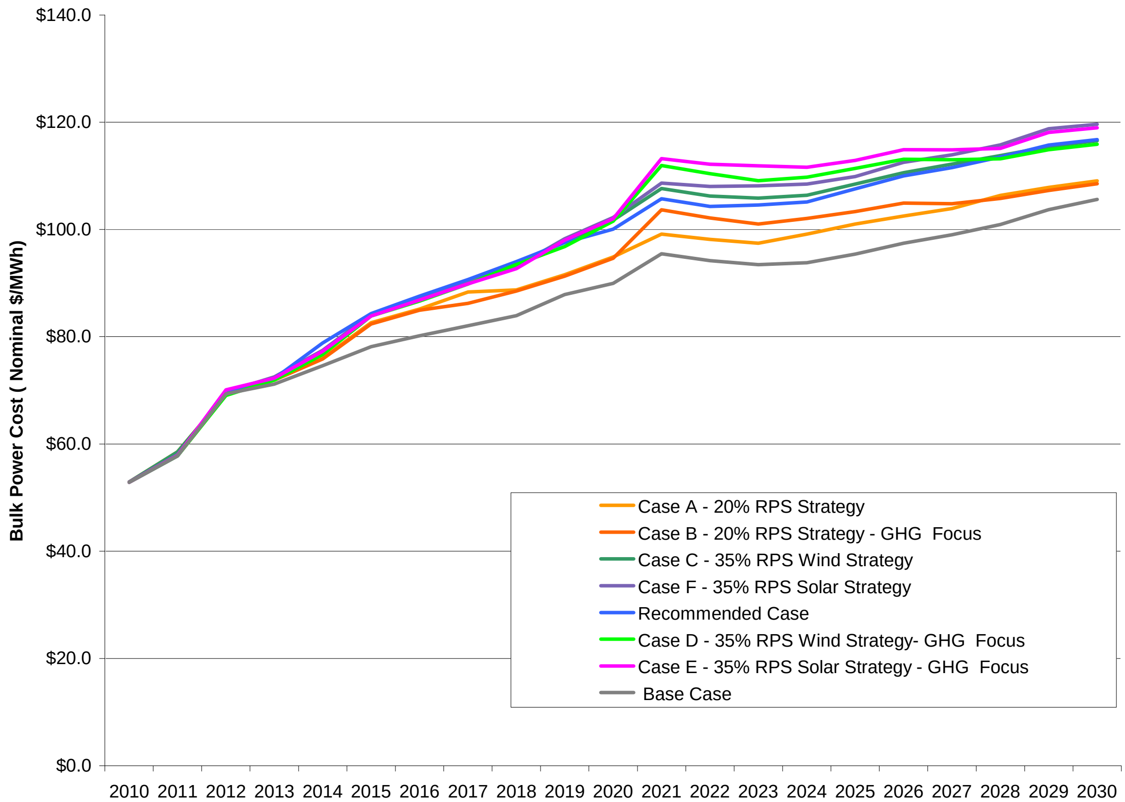


Figure 4-3: Comparison of annual bulk power costs for each strategic case

Two solar strategies assume that close to 1.6 GW of solar resources will be built over the next twenty years to meet and maintain a 35 percent RPS from 2020 and beyond. The 35 percent RPS Solar Strategy with the GHG Reduction Focus is the most expensive resource strategy because of the higher relative projected cost of solar. Among the strategies that target a 35 percent RPS, the 35 percent RPS Wind Strategy is the least costly.

4.4.3 GHG Emissions Reduction Measures

While the Base Case appears the least cost assuming moderate GHG emission costs, it fails to make significant progress toward the reduction of GHG emissions goals set forth by LADWP and may not be feasible due to pending policies that would establish a more aggressive RPS target by 2020. Executive Orders S-14-08 and S-21-09, currently pending in legislation, would require LADWP to obtain at least 33 percent of its energy from renewable resources by 2020. The Recommended Case will achieve this RPS goal. The 35 percent RPS Wind and Solar strategies would meet and exceed the proposed 33 percent RPS by 2020 requirement. The 35 percent RPS Wind and Solar strategies with the GHG reduction focus offer the highest amount of environment benefits because those strategies minimize the amount of GHG emissions over a twenty year period. The wind and the solar strategies exhibit approximately the same amount of GHG emissions which is primarily driven by the 35 percent RPS target. The tangible difference in GHG emissions is reflected in the decisions to no longer take power from the high CO_2 emitting generation plants by the end of 2020 and the percentage of energy procured from renewable resources.

Figure 4-4 below summarizes the total amount of GHG emissions forecasted over the 20 year study period for each of the resource strategies. The 35 percent RPS Wind Strategy – GHG Reduction Focus and 35 percent RPS Solar Strategy - GHG Reduction Focus emit the least amount of GHG emissions over the study period.

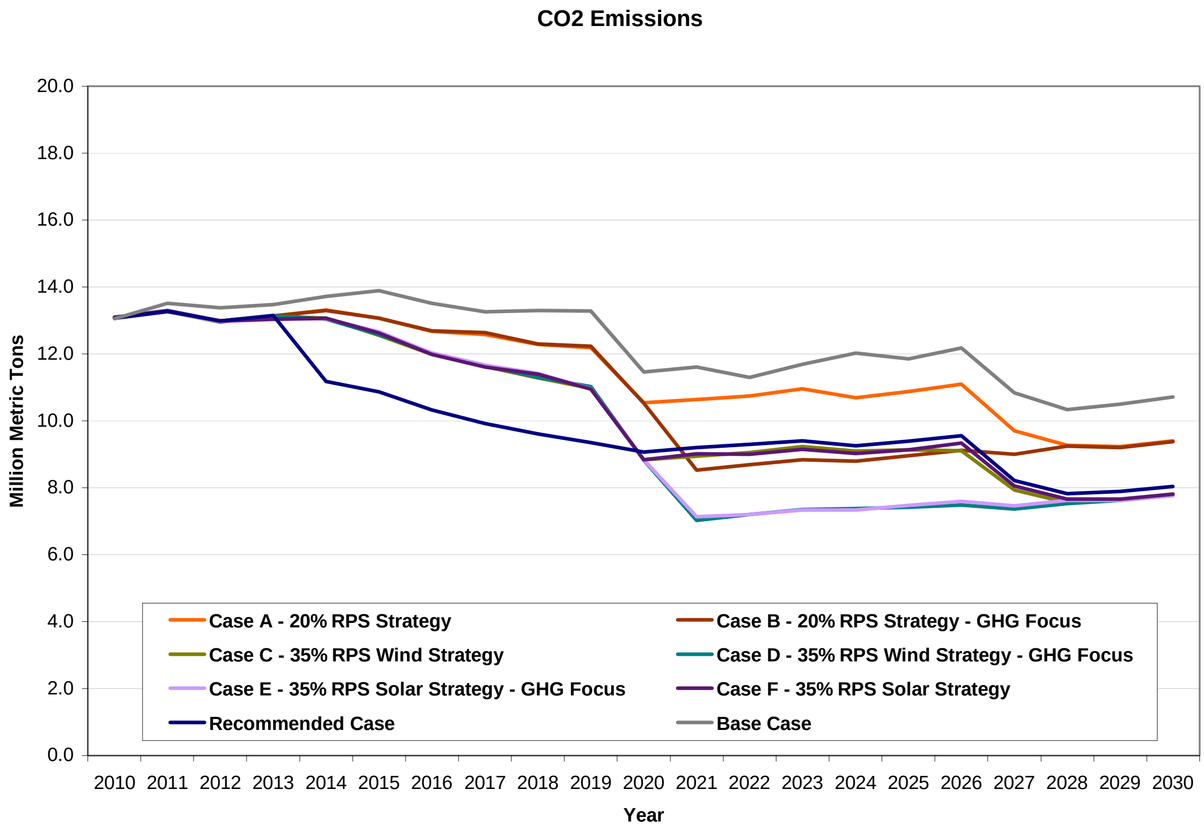


Figure 4-4: Summary of GHG emission for each strategic case

Figure 4-5 compares GHG emissions and costs for each strategic case.

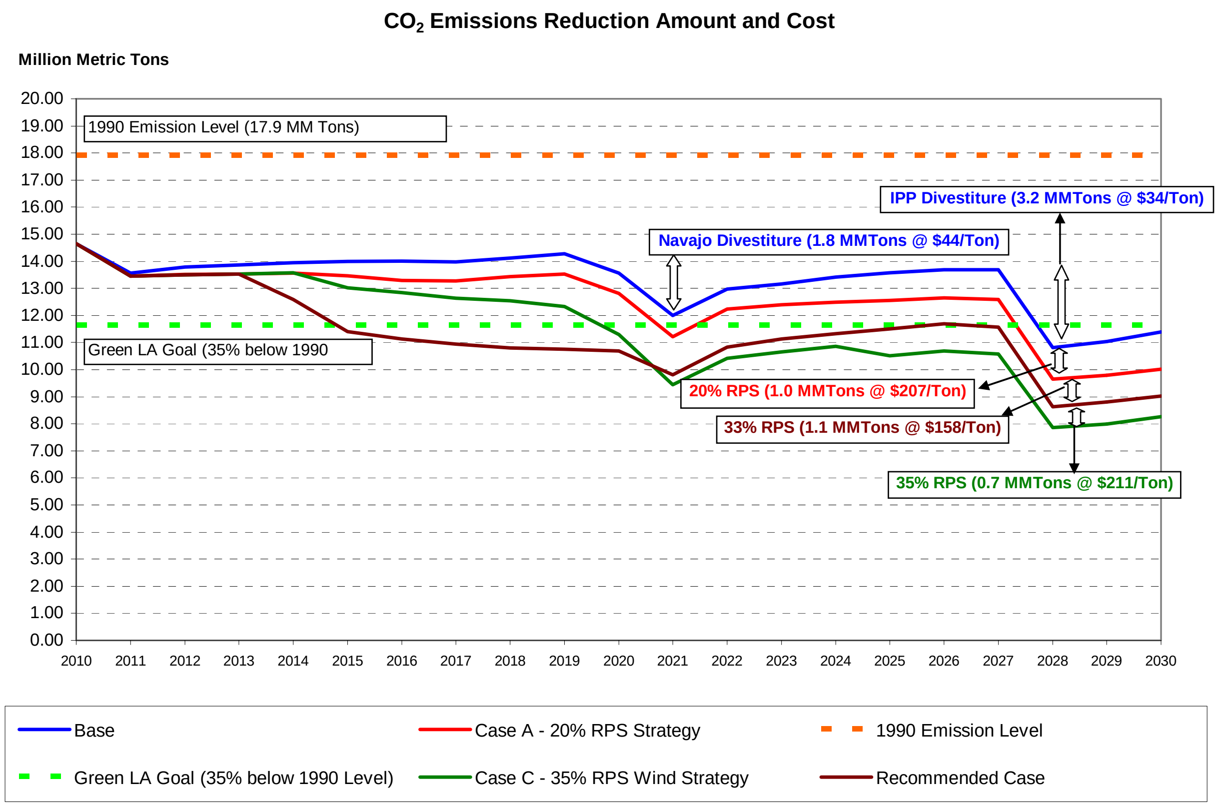


Figure 4-5: Comparison of GHG emissions reduction and cost for each strategic case

4.5 Overall Selection Criteria

Assuming that Executive Orders S-14-08 and S-21-09 are eventually codified into law, both of the 20 percent RPS Strategic Cases would not be in compliance. LADWP's desire to stop taking power from coal generation by the end of 2020 would eliminate the strategies without a GHG Reduction Focus. The results from this analysis suggest that selecting the options that focus on GHG Reduction may increase overall cost to the system, but that increase in cost is offset by a measurable amount of GHG emissions reductions over the study period.

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5.0 RECOMMENDATIONS

5.1 Overview

LADWP's recommended strategy set forth in this IRP for meeting its key objectives can be separated into two areas: (1) Regulatory and Reliability Initiatives, and (2) Strategic Initiatives. Regulatory and Reliability Initiatives are required actions to ensure system reliability and compliance with regulatory and legislative mandates. Strategic Initiatives are policy actions to achieve objectives established by the LADWP Board of Water and Power Commissioners and the Los Angeles City Council, and reflect their vision and leadership. These mandates include, for example, establishment of LADWP's RPS, early compliance with SB 1368, and investing in local solar. The recommended strategy also reflects feedback from LADWP's community outreach efforts.

Regulatory and Reliability Initiatives

- Power Reliability Program (PRP) and system infrastructure investment

  LADWP must continue to invest in replacing aging transmission and distribution infrastructure in a systematic and sustained manner to ensure system reliability, especially during significant weather events. The PRP has a core level of investment included in the current financial plan to meet the following objectives: (1) Replace assets in-line with equipment life cycles, but focusing on the worst performing equipment first, (2) fix known problem areas, and (3) invest in equipment to satisfy local and regional load demands.

- Re-powering

  LADWP will continue to re-power older, gas-fired generating units at Haynes Generating Station and Scattergood Generating Station for the reasons discussed previously. These, and future re-powering projects, will mitigate the need for once-through ocean cooling.

- Demand Side Resources

  LADWP must procure sufficient resources to meet load growth and maintain system reliability. Along with augmenting its generation portfolio, LADWP will implement DSR and EE to reduce energy demand. DSR and EE programs are not only crucial for meeting customer load growth, they also represent the most cost-effective strategy for reducing GHG emissions, since the cleanest kilowatt-hour any utility can produce is one that is never generated.

- Load Growth

  DSR and EE alone cannot meet projected load growth, and new gas-fired generation is necessary.

- SB 1368 Compliance

  Navajo and IPP must be compliant with the mandates established in SB 1368 by 2019 and 2027, respectively. IRP modeling determined that these units will be replaced with a combination of DSR, EE, renewable energy, and conventional gas-fired generation.

- Castaic FERC Re-licensing Program

  On January 31, 2022, the Federal Energy Regulatory Commission's (FERC) license to operate Castaic Pumped-storage Hydroelectric Plant will expire. The license is a co-license between LADWP and the Department of Water Resources (DWR) and includes a number of hydro power plants along the California Aqueduct. Both parties have initiated the joint re-licensing process that, on average, requires ten years to complete. Through 2015, LADWP expects to complete preliminary studies, contract negotiations, and prepare a filing strategy. In 2016, LADWP expects to file a notice-of-intent (NOI) and initiate the formal studies and applications. Based on reviews of re-licensing activity for similar projects, LADWP could expect cumulative expenditures of approximately $10 million prior to filing the NOI and approximately $80 million before the license expires. From DWR's recent experience at re-licensing of Oroville Dam, they have informed LADWP that future mitigation cost could exceed $1 billion dollars for a new 50-year license period.

Strategic Initiatives

- RPS Percentage

  LADWP recommends a steady and continuous effort until 2020 to achieve an RPS of 33 percent renewables comprised of a diverse mix of renewable resources sited over a wide geographical region. Since wind and solar resources are intermittent and production depends on weather conditions, regional diversity will be important for ensuring a balanced and dependable energy supply. Legislation has been introduced twice to achieve a state-wide RPS of 33 percent and failed to pass - not because of the RPS percentage - but for technical requirements included in the legislation that limited compliance options. Additionally, CARB has currently approved a regulation to require 33 percent renewables, which will be reviewed by the Office of Administrative Law before it is finalized in early 2011. LADWP is including this as an optional policy action only in that this rule has not been finalized and near-term elections could alter the rule and its final approval. LADWP heard very clearly from the public outreach workshops that investments must be made with our customer's costs in mind. LADWP staff is recommending 33 percent renewables instead of the current Board-approved policy of 35 percent, which was established in 2008. This will reduce capital expenditures by up to $2.4 billion over the next 20 years.

LADWP recommends that investments be made in long-term projects to maintain the RPS percentage at approximately 20 percent between 2010 and 2014. The current financial plan has no provision for LADWP to replace expiring short-term RPS contracts. Without replacing expiring contracts, LADWP projects the generation from renewables will drop from the current level of 20 percent to 13 percent in 2015. The ramp from 13 percent to 33 percent in five years is enormous and not prudent from an engineering, cost, technology, or integration standpoint. Additionally, the CARB regulation will require interim milestones to achieve 20 percent in 2012, 24 percent in 2015, and 28 percent in 2018.

- Early Compliance with SB 1368

Comments from the public workshops indicated the desire to comply with SB 1368 as early as possible. Navajo must be compliant with SB 1368 by 2019. LADWP recommends divestment from Navajo by 2014. This will reduce LADWP's GHG emissions by 10.5 million metric tons and add about $300 million in net capital investment cost.

LADWP recommends modeling and planning for IPP to be compliant with SB 1368 by 2027. However, LADWP will continue to evaluate options in future IRPs. LADWP will continue to work with the Intermountain Power Agency (IPA) Board and the other participants to secure IPP as a renewable energy hub and provide replacement generation compliant with SB 1368. LADWP recommends no change in IPP until 2027 at which time the site would be reconfigured, providing LADWP with firm transmission capacity for potential renewable projects.

- Local Solar

Comments received at the public workshops indicate local solar development should be a priority in LADWP's renewables procurement strategy. LADWP is recommending a policy action to allow approximately 40-50 percent of its solar resources be sited locally through initiatives including the Solar Incentive Program, feed-in tariffs, and installation of solar on City-owned properties. Local solar costs an estimated additional $50/MWh over utility-scale solar located outside the Los Angeles Basin, estimated to cost $150/MWh, primarily due to economies of scale and about 30% better solar insolation.

- Advanced Reliability Improvements

LADWP is looking ahead to technologies that will enhance the reliability of its system, including smart grid technologies, enhanced information systems, automation of system functions, and advanced methods of outage management. These advanced system enhancements are recommended from a planning perspective to not only increase reliability, but also to better integrate local generation such as solar into the distribution network, enable smart charging of electric vehicles, and advance demand-side management technologies.

5.1.1 Incorporating Public Input

Through its public outreach efforts, LADWP received various suggestions from the community including increasing energy efficiency and conservation, eliminating coal from LADWP's resource mix, emphasizing local solar generation, maintaining competitive rates, and increasing transparency. This input played a key role in shaping the recommendations set forth in this IRP. A discussion of these themes is presented below.

- Theme: Emphasize a variety of energy resources

  Related IRP Recommendations

  - LADWP will procure 160 MW of generic renewable resources, potentially including biomass, ocean tidal power, and other emerging technologies.
  - LADWP will also continue to seek a diversified energy portfolio as well as continue to diversify its portfolio regionally to enhance system reliability.

  Discussion

  As LADWP continues to work towards attaining its RPS goals, it is also imperative that the renewable energy technologies support LADWP's objectives of providing reliable service at competitive rates while maintaining environmental stewardship. Of the aforementioned renewable technologies, those believed to be available in large quantities in the western US at competitive prices are geothermal, wind, biogas, and solar, which make up a bulk of LADWP's renewable portfolio. Recent advancements in these technologies have resulted in an increase in their capacity factors, therefore providing more energy at lower cost as well as benefiting from large economies of scale. Consumption of natural gas, which is already a major component of LADWP's generation resource portfolio, will likely increase to support increasing amounts of intermittent renewable resources and to help supply baseload power as LADWP transitions away from coal. Nuclear power, which makes up about nine percent of LADWP's energy mix, would likely remain at current levels in the next decade. In addition to "traditional" renewable resources such as wind and solar, LADWP will certainly consider up and coming technologies such as algae and wave power as these technologies become more mature and economically competitive.

- Theme: Maximize Energy Efficiency and Conservation to Meet Future Energy Needs

  Related IRP Recommendations

  - LADWP is recommending to increase energy efficiency to reduce at least seven percent of the total load by 2020 (three percent was achieved prior to 2010). Additionally, over the next year, LADWP will complete a study of the maximum potential of energy efficiency deployment and address this potential in future IRPs.
  - LADWP is recommending 500 MW of demand-side management/response programs to shift load away from peak hours or to control load during peak hours. Tactical plans will be developed that may utilize smart grid technology, incentives, and rate designs to meet this objective.

  Discussion

  LADWP's Demand Side Management program, which includes the Energy Efficiency, Demand Response, and Combined Heat and Power programs, plays an integral role in shaping power system planning. With the goals of lowering overall energy consumption and shifting peak demand loads to off peak periods, the need to build additional generation is reduced, resulting in capital and fuel cost savings as well as emissions reduction. As discussed in this 2010 IRP, LADWP is expanding its DSM program to better target these goals, formulating viable tactics accordingly. At the same time, LADWP is conducting a comprehensive system wide study to determine grid losses and inefficiencies, and will take steps to correct such problems.

  LADWP is exploring ways which would educate and empower ratepayers to reduce energy consumption, whether that is in the form of technology, incentives, and programs, or a combination of these. Future installation of two-way smart meters will facilitate real time pricing based on current supply and demand, and customers will be able to make smarter choices on energy use based on market driven Time of Use rates. LADWP is formulating strategies that will include new incentives and Time of Use tiered rate structures allowing ratepayers to fully participate on the demand side of the equation. To increase efficient buildings, LADWP offers a incentive program to building owners and developers for construction of new buildings to conform to high efficiency LEED standards, which are 25 percent to 35 percent more energy efficient than regular buildings. Moreover, this 2010 IRP is recommending a free residential home energy audit program that would identify actions residential customers can implement to realize immediate efficiencies and cost savings.

- Theme: Eliminate Coal from LADWP's Energy Portfolio

  Related IRP Recommendations:

  - LADWP is recommending a policy action to replace Navajo Generating Station by 2014—four years ahead of the SB 1368 requirement. The Intermountain Power Project is modeled in this IRP through 2027, but LADWP is open to a mutually agreeable early compliance plan between the project participants that preserves the site and transmission for compliant fossil and renewable generation.
  - LADWP is currently 22 percent below 1990 levels of GHG emissions and is planning further emissions reductions.

  Discussion

  Recommendations set forth in this 2010 IRP include making the transition away from coal to other forms of generation earlier than the contract termination date, such as terminating the Navajo contract in 2014 instead of 2019 and the Intermountain contract before 2027. Depending on the outcome of legislation which may impose GHG emission taxes and cap and trade requirements, it may be prudent for LADWP to divest away from coal resources early and replace it with a combination of renewable technologies and combined cycle units. Securing renewable resources early may also substantially save LADWP and its ratepayers money, before demand for renewables increase as a result of new environmental legislation.

  Since coal generation is a baseload resource, the optimal solution is to replace the coal generation with geothermal, a renewable baseload resource. However given the disparity between the amount of available geothermal resources and the amount of coal generation that needs to be replaced, the remainder would need to be made up of other renewable sources such as wind and solar with natural gas powered combined cycle plants to act as backup maintaining constant level of generation when the wind is not blowing and when the sun is not shining. Fast ramping combined cycle plants allows for a high penetration of intermittent renewable resources by providing instant backup, and is necessary in maintaining grid reliability. Natural gas plants are also much more environmentally friendly than coal plants, emitting only half as much CO_2.

- Theme: Emphasize Local Solar Generation

  Related IRP Recommendations:

  - LADWP is recommending a policy action to allow approximately 40-50 percent of its solar resources be sited locally through initiatives including the Solar Incentive Program, feed-in tariffs, and installation of solar on City-owned properties. LADWP recommends this as a balanced approach between the benefits of local solar and the benefits of large, controllable solar projects connected to LADWP's transmission lines. The actual percentage will vary based on the success of the local programs.

Discussion

As outlined in this 2010 IRP, LADWP has designated 40 percent of solar development to be in-basin, or approximately 400MW, enough to power almost one hundred and fifty thousand homes. In-basin solar eliminates transmission issues and losses, and improves local grid reliability. LADWP realizes that developing in-basin solar fosters local economic growth, and will utilize incentive programs, Feed-in-Tariff schemes, and other stimulus in order to promote development. LADWP is also exploring ways to improve existing incentives for solar and will keep the public involved in future decision-making processes.

- Theme: Avoid Adverse Impacts to Vulnerable Communities

  Related IRP Recommendations:

  - LADWP will continue to implement a low-income electric rate program.
  - LADWP will develop plans that address energy efficiency deployment and other incentive programs that effectively reach out to low income communities that may help mitigate impacts of future rate increases.
  - Local geographic diversity is critical to maintain high reliability of the electric grid, and LADWP will continue this policy so that no single community will experience an inequitable share of impacts from energy facilities.

Discussion

Even though acquiring more renewable resources may result in potential future rate increases, this may not necessarily translate into higher bills for customers. Increased adoption of Demand Side Management techniques would most likely offset any rate increase, and may even result in lower bills. LADWP strives to provide low-income ratepayers as much assistance as possible, and will continue to offer a lower rate to those that are economically disadvantaged. LADWP also proposes to conduct free residential energy audits to low income customers first, so that additional savings achieved by increased energy efficiency could be realized immediately. An example of this is that such audits may provide low income ratepayers free energy efficient refrigerators, funded by the LADWP Energy Efficiency Program.

Having geographical diversity in generation is important at both the regional and local levels. At the regional level, having resources that are geographically dispersed provides LADWP additional reliability, and results in efficient resource utilization and lower cost. For example, LADWP's system interconnects to BPA's network in the Pacific Northwest, fostering a symbiotic relationship that allows abundant inexpensive hydroelectric power to be delivered to LADWP in the spring and summer, when BPA's demand is low and LADWP's demand is high, at the same time enabling LADWP to sell excess power to BPA in the winter when BPA's demand is high and LADWP's is low. At the local level, it would be technically advantageous to distribute solar installations evenly throughout the LA basin, so that circuits will not be overloaded. This would ensure that there will be no unequal impact to any one community, since an equal distribution of distributed generation sources is necessary to maintain reliability.

- Theme: Clarify Costs of IRP Implementation and Potential Impacts to Ratepayers

Related IRP Recommendations

- LADWP will incorporate a detailed financial analysis into the IRP development process to identify the costs of various planning alternatives and recommendations using computer modeling software.

Discussion

Seven Strategic Case Alternatives with different combinations of renewable resources (i.e. wind, solar, geothermal) and levels of greenhouse gas reduction were modeled to determine the annual average bulk power costs associated with each strategy as described in Section 4.4. Computer modeling software was used to develop and quantify the bulk power costs with each Strategic Case Alternative and is further described in Appendix M. This is not particularly useful information from a ratepayer's perspective because bulk power cost is only one of the three major components that comprise the rates for electricity (the other two components are transmission and distribution). Nevertheless, bulk power costs are very useful for internal planning purposes. In future IRP's, LADWP will consider providing a more detailed synopsis such as breaking down the costs into the three components to more completely identify the major cost elements that make up electricity rates.

Impacts of the Strategic Case Alternatives including the recommended case on electricity rates, as well as the strategic, regulatory and reliability investments recommended in this IRP are included in Section 5.4. Included in the rate analysis is a sensitivity analysis that considers the variability in model assumptions including CO_2, energy efficiency, and natural gas costs.

While there are secondary costs associated with environmental and health impacts of fossil fuel plants, LADWP is not in a position to quantify these costs since there are governing bodies at the federal and state levels responsible for setting standards and legislation that would address these concerns. However, LADWP is working to make the transition from coal to renewables and clean natural gas earlier than originally scheduled so that GHG emissions can be curtailed sooner.

As discussed previously, potential future increases may not necessarily translate into higher bills nor impact low-income communities. As for improved transparency and accountability, the Board of Water and Power Commissioners recently approved the establishment of an independent ratepayer advocate whose responsibility is to review, analyze, and provide expert independent advice to policy makers regarding utility rates and proposed rate changes, and to provide ongoing review and analysis regarding rate-related and budgetary issues.

- Theme: Reduce Environmental Impacts

Related IRP Recommendations

  - To minimize environmental impacts, LADWP will maximize the use of existing transmission and facility infrastructure to generate and deliver energy. All projects will have the proper environmental review and impacts on the environment will be mitigated as necessary.

Discussion

Being a good environmental steward is one of LADWP's main objectives, and we strive to meet that standard with the construction and maintenance of each and every project. As we look to making the transition away from coal, one strategy that we have adopted is to procure and develop renewable resources in close proximity to the coal plant, so that we can take advantage of the existing transmission infrastructure. For solar, we would maximize the use of rooftops as installation sites. This principal of siting new generation facilities on existing brownfield sites and reusing existing structures not only minimizes environmental impact but is also very cost effective.

- Theme: Provide Proactive Leadership and Transparency

Related IRP Recommendations

  - LADWP will develop plans to better educate ratepayers on progress related to this IRP (e.g. energy efficiency) and will continue the IRP process of biannual updates to provide transparency on its long-term goals.
  - LADWP will improve its system operations and run its power grid as effectively as possible. LADWP is completing a study on how it can increase the efficiency of the power delivery grid through advanced reliability improvements.
  - This 2010 IRP sets forth LADWP's long-term plans and objectives, clarifying implementation of various initiatives and their potential impacts on ratepayers. A discussion of rate impact is included in Section 5.4 of this IRP

Discussion

LADWP will take steps to expand public outreach programs to better educate the public about the critical roles that energy efficiency and conservation have on the power system.. LADWP is also instituting programs to improve operations and system reliability, performing system wide technical studies, as well as identifying ways to incorporate smart meters. As discussed previously, a ratepayers' advocate would help facilitate transparency and accountability in any new actions undertaken by LADWP. As for the IRP, a biannual public outreach process similar to this one will be implemented to ensure that sufficient public input has been obtained.

5.2 Recommended Strategic Case

Based on the results of LADWP's stakeholder meetings and public outreach effort, and rigorous cost-benefit analysis, LADWP has developed a Recommended Case for this 2010 IRP that includes the following:

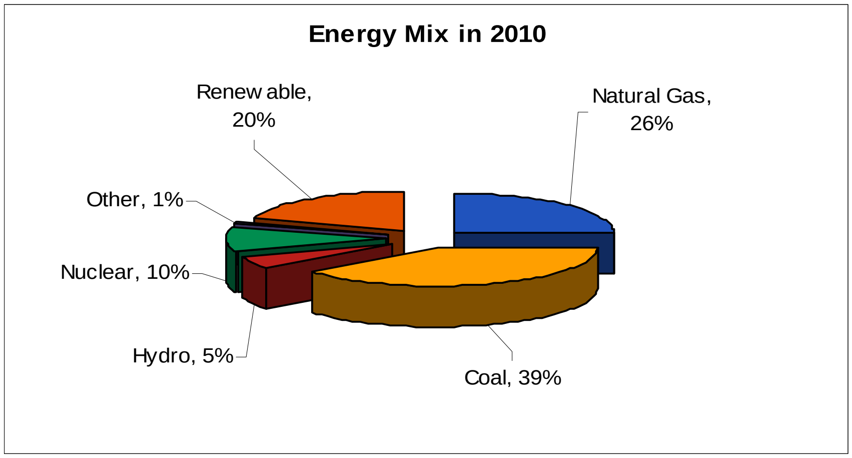
- At least seven percent of Los Angeles' electric needs will be met through customer energy efficiency measures by 2020.
- At least 500 MW of capacity reduction through Demand Response programs by 2030.
- Generate at least 33 percent of its electricity from renewable resources by 2020 and maintain that level through 2030. Although this IRP studies various levels of solar, wind, and geothermal resources that could be added to LADWP's portfolio to achieve a 33% RPS, LADWP will not limit itself to only these types and amounts of resources to achieve its goals and needs flexibility in resource development for the best fit for the electrical system.
- Diversify LADWP's RPS through incorporating 160 MWs of generic renewable resources by 2030. These resources could be technologies such as biomass, ocean tidal power or other emerging technologies.
- Diversify LADWP's energy portfolio through a variety of fuels, technologies and power plant sites throughout the western United States to maintain a high level of reliability.
- Replace the Navajo Generating Station by 2014, 5 years ahead of the legally mandated date. IPP is recommended to be replaced in 2027 at the end of its contract, however LADWP is open to a mutually agreeable early compliance for GHG reduction between project participants that preserves the site and transmission for compliant fossil and renewable generation.
- Implement advanced reliability improvements.
- Emphasize local solar by proposing approximately 40 to 50 percent of solar capacity being proposed to be locally sited in Los Angeles. This will be accomplished through programs such as the Customer Solar Incentive Program, Feed-in tariffs, and Solar on Los Angeles properties under public/private partnership.

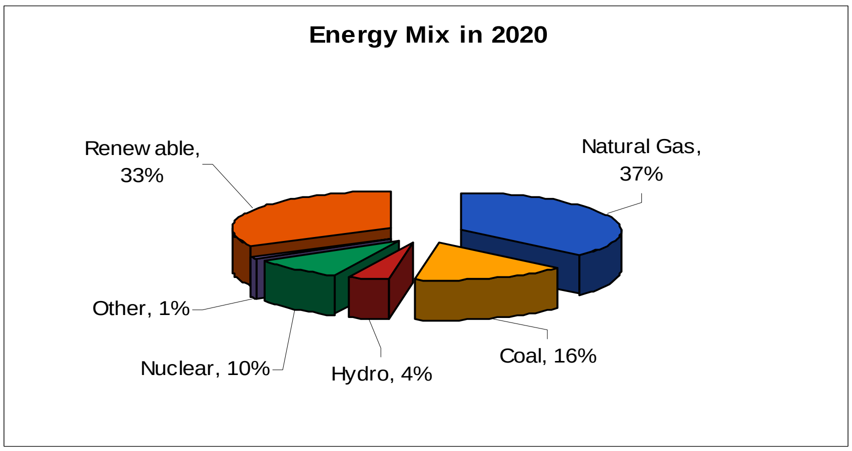
This case is summarized in Table 5-1.

Table 5-1: Recommended strategic case

		2020	GHG or SB1368 Compliance Date		New Renewables Installed Capacity (MW) 2011- 2020			New Renewables Installed Capacity (MW) 2011- 2030			
Case ID	Resource Strategy	RPS Target	Navajo Replacement	Intermountain Replacement	Geothermal/ Biomass	Wind	Solar	Geothermal / Biomass	Wind	Solar	Generic
Recommended Case	33% RPS	33%	1/1/2014	6/15/2027	320	580	630	320	680	970	160

Figure 5-1 illustrates the changing generation resource percentages for 2010, 2020, and 2030 based on the Recommended Case. Energy efficiency measures reduce customer demand and are not included as part of the generation resource mix shown below.





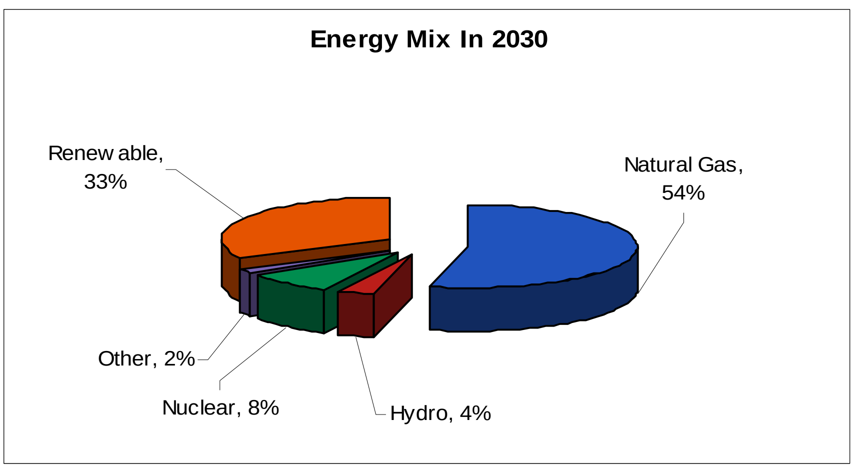


Figure 5-1: Generation Resource Percentages for 2010, 2020, and 2030

Figure 5-2 shows the renewable resource mix of the Recommended Case.

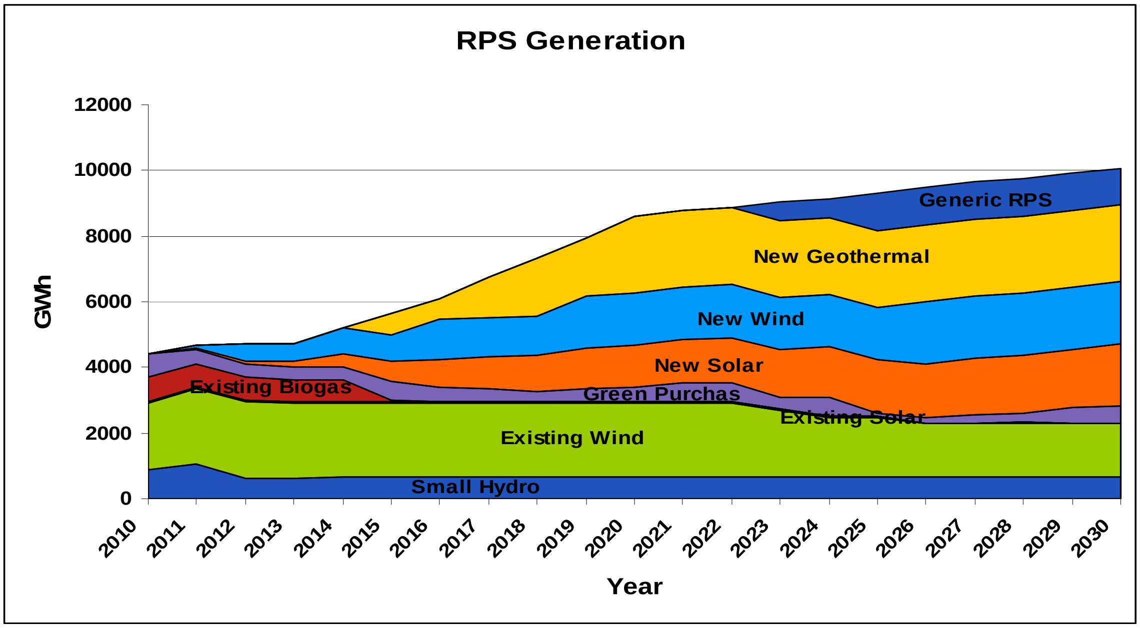


Figure 5-2: Recommended Case generation by technology type

The Recommended Case will meet the LADWP combined objectives of maintaining a reliable power system, being environmental stewards, and minimizing ratepayer impacts. The Recommended Case provides a roadmap for the LADWP to achieve its long term planning goals, while providing the required reliability and necessary flexibility to adapt to dynamic economic, environmental, and regulatory conditions. The Recommended Case will put upward pressure on retail rates, but will conversely reduce the amount of GHG emissions released into the environment.

5.3 Recommended Strategic Case Scenarios

The analysis to develop the Strategic Cases used a "best guess" assumption on the price of natural gas and the GHG emission allowance prices. There is a large amount of uncertainty related to the long-term price of natural gas and GHG allowance prices. These two input assumptions are key drivers in the decision making process to implement a particular resource strategy. This section examines the impact of a high and low scenario on the Recommended Case as it relates to natural gas and GHG emission allowance prices.

Table 5-2 below defines the high, and low range scenarios evaluated for the Recommended Case. The medium range of the Recommended Case should fall somewhere in between the High and the Low Range.

Table 5-2: Natural gas and GHG emission allowance price scenarios

Scenarios	Natural Gas	GHG Emission Prices	Free GHG Allowances
High	High	High	No
Low	Low	Low	Yes

The selection and ranking process for the eight Strategic Cases was performed using a scenario in which medium natural gas prices and medium GHG emission allowance prices were assumed to most likely to occur. The High scenario combines the high natural gas, high GHG emission allowance prices, and the assumption that no free GHG emission allowances would be allocated to LADWP. The Low scenario combines the low natural gas, low GHG emission allowance price. The bracketing of base case using the high and low scenarios provides the extreme range of possible power costs resulting from the Recommended Case.

Figure 5-3 below shows the annual range of power costs for the Recommended Case under the high and low scenarios.

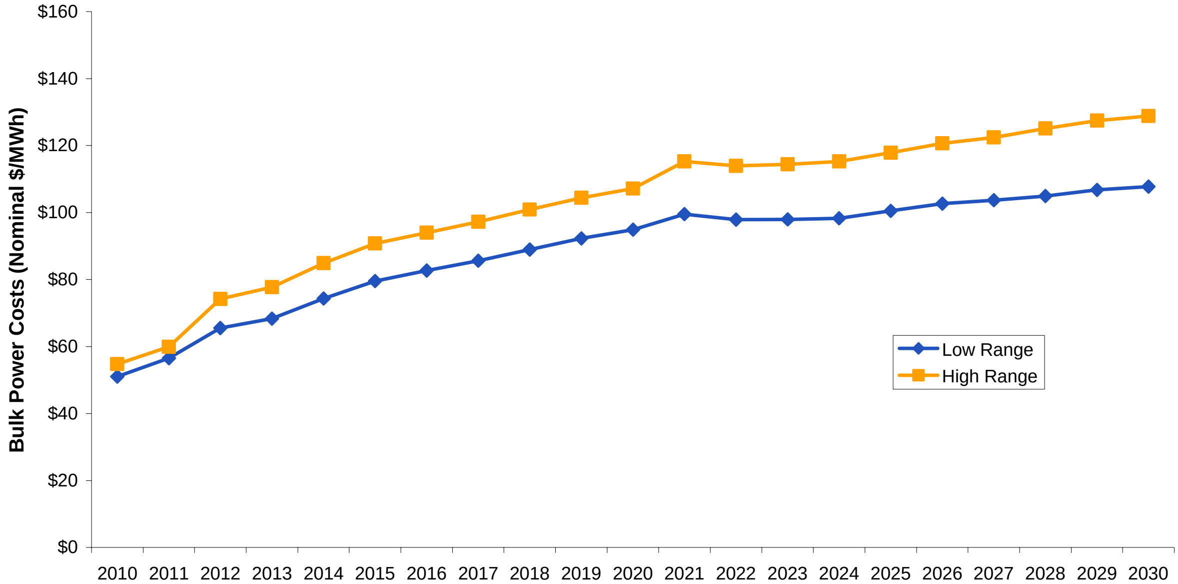


Figure 5-3: Recommended Case: Annual bulk power cost scenarios

Figure 5-4 below summarizes the high, medium and low power cost ranges scenarios on a 20-year present value basis, for the Recommended Case. The scenario analysis indicates that on a present value basis the range of bulk power costs could vary from $85/MWh to $97/MWh under various natural gas and GHG emission allowance price and allocation scenarios

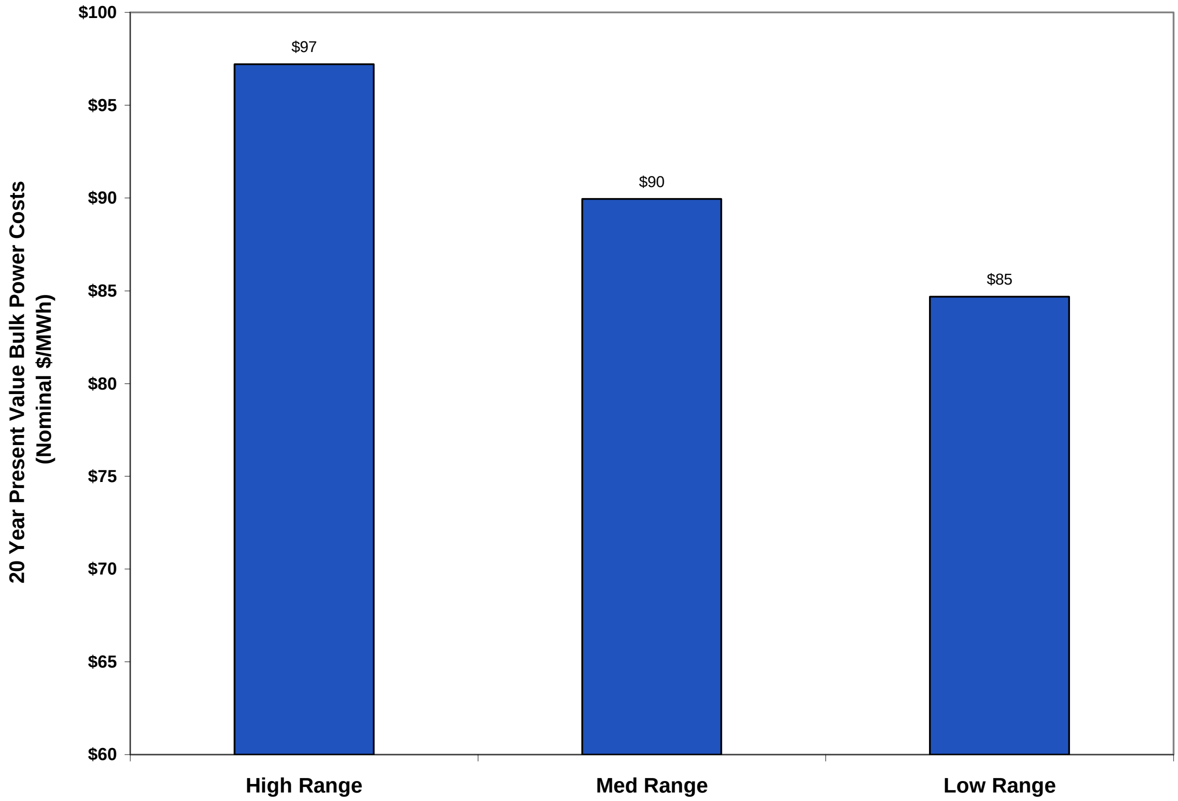


Figure 5-4: Recommended Case present value bulk power costs for high, medium, and low scenarios

5.4 Rate Impact Modeling Process

LADWP currently uses an Excel-based financial model that has been developed and used for over a decade. This financial model has been used to develop forward-looking Power System financials for the Board of Water and Power Commissioners' annual budget approval and for rating agency presentation for debt issuances during the similar period.

The model is modified to analyze the eight strategies with their respective fuel expense, purchased power expense, and additional capital and O&M expenses for any new LADWP-owned resource additions as well as off-balance sheet resource additions. The eight strategic cases are overlaid on existing capital and O&M expenses for the approved FY10-11 budget data, which contains forward-looking budget data up until FY18-19. For years beyond FY18-19, general capital and O&M expenses are escalated at 3 percent per annum.

LADWP retail revenue comes from three billing factors: (1) base rate (2) energy cost adjustment (ECA) and reliability cost adjustment (RCA) factors. The interplay of these three factors is described briefly below.

The ECA is used to cover fuel, purchased power, RPS and energy efficiency-related expenses. The ECA is adjusted quarterly and currently has an adjustment cap of 0.1 cts/kWh (i.e., increasing by no more than 0.1 cts per kWh).

The RCA is used to cover power reliability related expenses. The RCA is adjusted annually and has a maximum factor of 0.3 cts/kWh. This maximum has been reached in FY10-11 and cannot be adjusted any higher. Since reliability related expenses are not projected to go lower than FY10-11 spending levels, significant RCA under-collection may exist.

The base rate is used to cover non-fuel, non-purchased power, and non-RPS related expenses. Base rate is used to cover expenses from debt service arising from capital projects except RPS projects, operational and maintenance expense except RPS related, public benefit spending, property tax, and pro-rated portion of the city transfer.

Since LADWP needs to sell substantial amounts of bonds in the near future to sustain its capital expenditures, maintaining an "AA" credit rating is essential to minimize financing costs. To maintain such a rating, the Board of Water and Power Commissioners set the following policies: (1) maintain debt service coverage of 2.25, (2) maintain a minimum of $300 million of operating cash-on-hand, and (3) maintain a capitalization ratio not exceeding 60 percent. It is recommended that the Board of Water and Power Commissioners approve policies to also: 1) maintain adjusted debt service coverage of 1.75, and (2) maintain full obligation coverage of 1.50. To mitigate potential rate increases, it is also recommended the Board of Water and Power Commissioners approve policies raising the minimum capitalization ratio to 65 percent and requiring LADWP to maintain a minimum 110 days of operating cash-on-hand.

Debt service coverage is the amount of cash available from operation divided by the debt service amount. The debt service amount contains only LADWP's direct debt. Adjusted debt service coverage has the debt service amount containing regular debt and off-balance sheet debt. Full obligation coverage deducted the city transfer from the cash available from operation and then divides the amount over the total of regular and off-balance sheet debt. Off-balance sheet debt is the debt owned by a third party, but LADWP will be responsible for the debt payment; for example, debt raised by Intermountain Power Agency and Southern California Public Power Authority. Capitalization ratio is the ratio of the total direct debt divided by the total asset. Days cash-on-hand is the cash available at any moment divided by the average daily operating expenses (excluding depreciation and capital expenditures).

To achieve these various financial coverage parameters, the base rate factor will need to be increased as necessary to meet the objectives of this IRP.

5.4.1 Impact on Electric Rates

The retail electric rates, including estimated CO_2 emission expenses, for all eight strategies are shown on Figure 5-5 below. Factors driving the increases over the twenty-year period are: rising fuel price, increased power reliability program spending, replacement of aging basin generating units to meet South Coast Air Quality District emission requirements, replacement of coal generation to lower CO_2 emissions, installation of renewables generation according to legislative mandates, and payment for emission allowances due to anticipated CO_2 cap-and-trade program requirements.

The capital cost and the associated O&M expense of any new generation resource is priced at 2010 dollars with 1.5 percent escalation except for certain solar projects, which are priced at levelized 2010 dollars due to anticipated pricing declines.

For each year, the retail rate through either the base rate or the energy cost adjustment factor is raised sufficiently high enough to meet the various financial ratios recommended by financial advisors to maintain LADWP's "AA" bond rating.

Under the Recommended Case, customer rates will increase on average 5 percent to 8 percent per year over the next five years, and 2.8 percent to 3.7 percent per year over the next 20 years (see Figure 5-5).

From Figure 5-5, one can draw the conclusion that, besides rising fuel price, there is also a significant cost to comply with various environmental regulations.

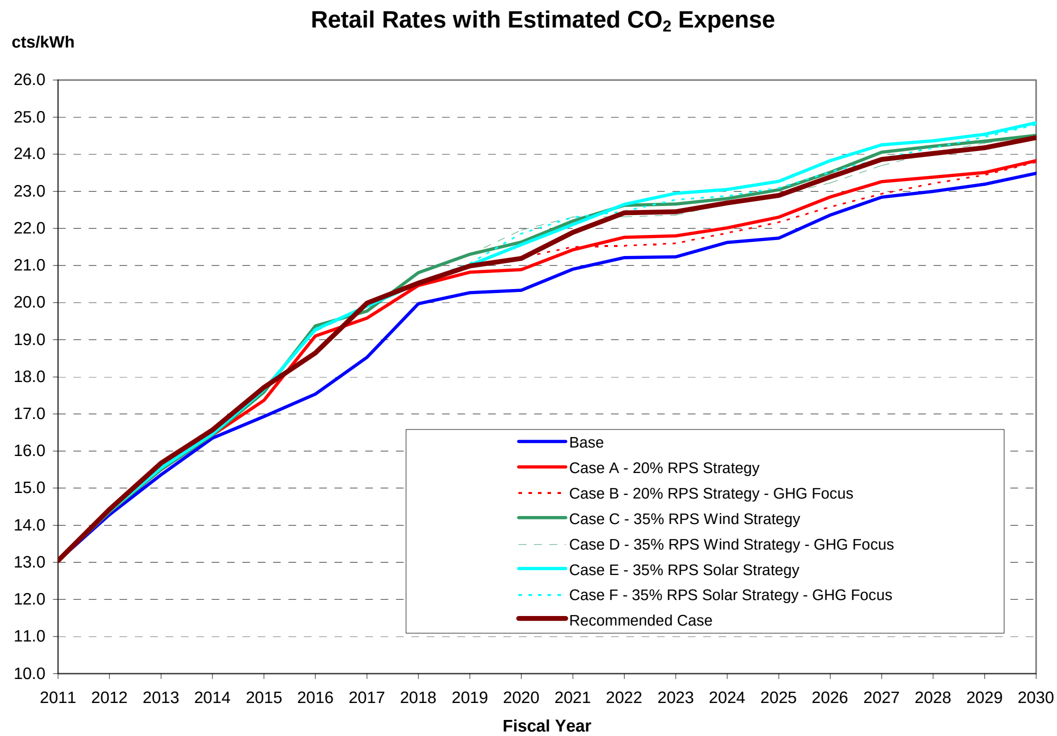


Figure 5-5: Electric rate impact with estimated CO_2 emission expense for various strategies

The CO_2 emission allowance price is estimated to range from $20 per Metric Ton in 2012 to $52 per Metric Ton in 2030.

Since it is difficult to accurately predict the cost of CO_2 emission allowance, the CO_2 expense was removed to better isolate the cost component of each regulatory and reliability improvement. Also, two additional cases were added to isolate the cost due to coal divestment and PRP: (1) No More RPS (NMRPS) and Coal Forever with Basic PRP and (2) NMRP and Coal Forever with Best PRP.

The retail rates without CO_2 expense are shown in Figure 5-6, which also included two additional cases to evaluate the impact of coal divestiture and two levels of reliability improvement spending.

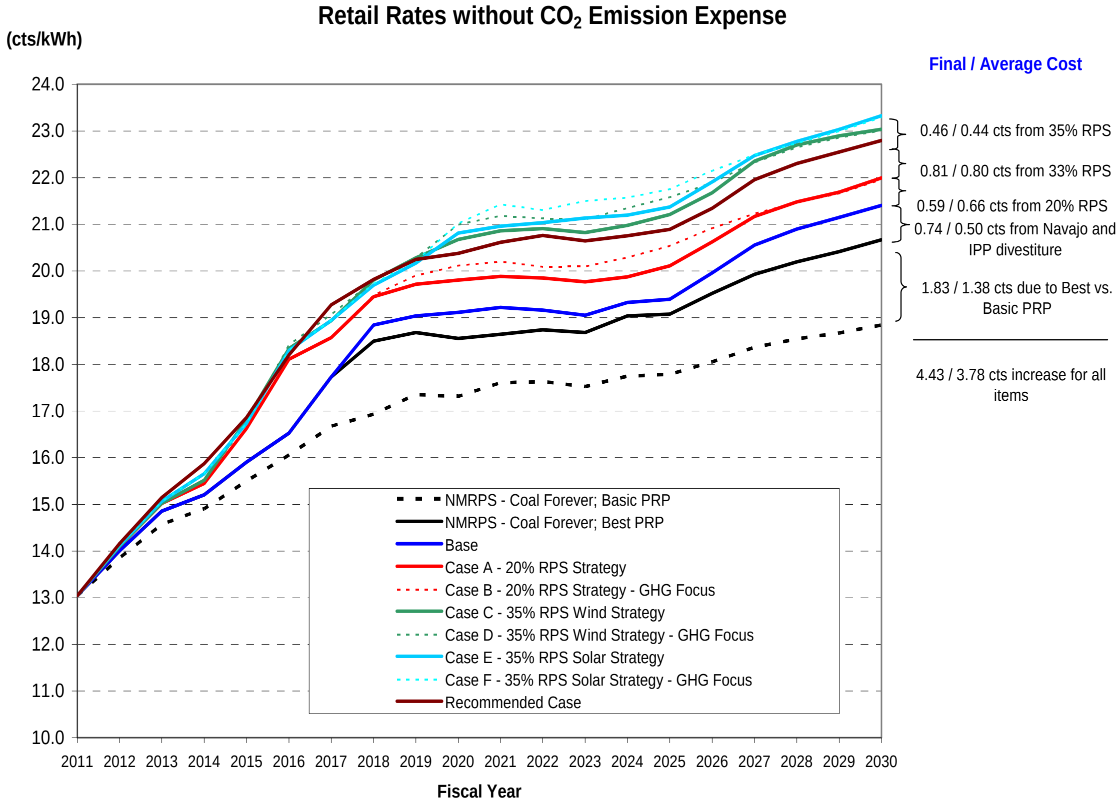


Figure 5-6 Electric rate impact without CO_2 emission expense

Sensitivity Analyses

Figure 5-7 summarizes the possible high and low range of CO_2 emissions in the study period for the Recommended Case. The high CO_2 emission scenario analysis assumes very conservative savings from DSM/EE and more dependency on IPP. Conversely, the low CO_2 scenario uses DSM/EE resources aggressively.

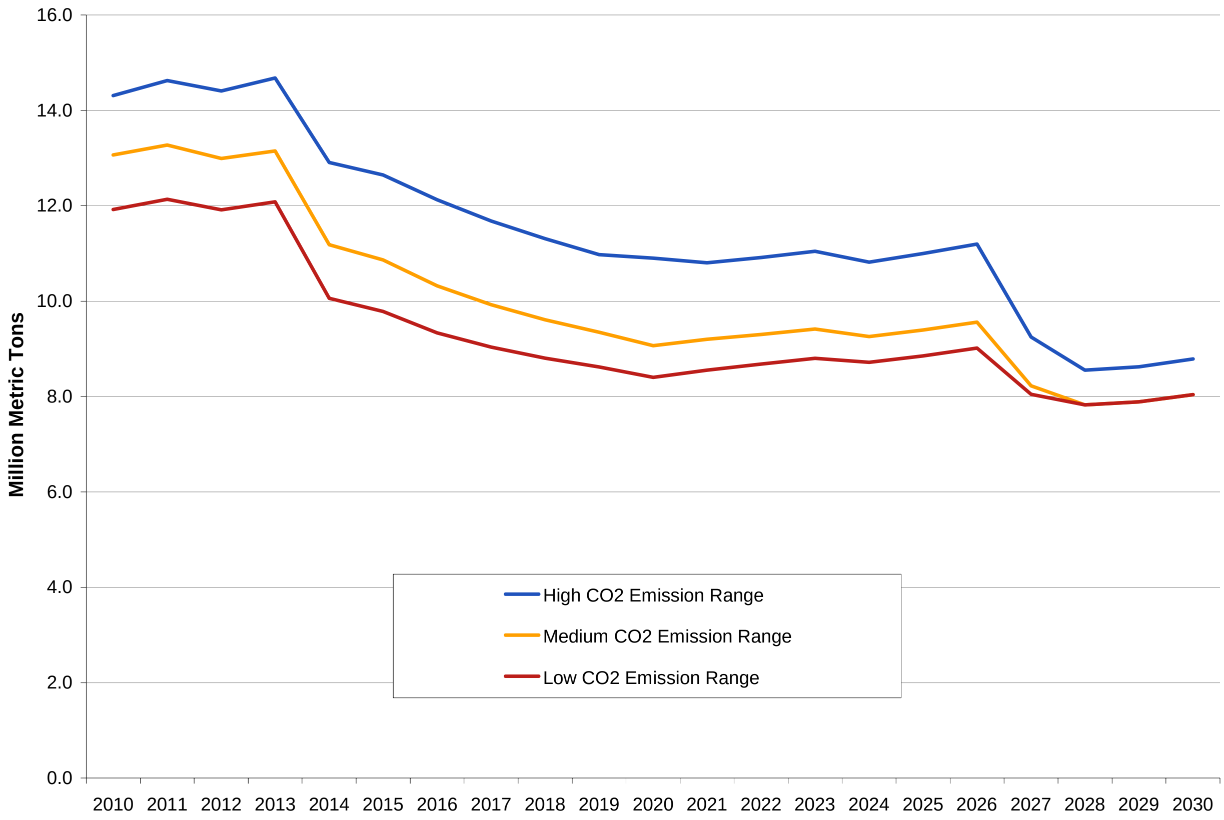


Figure 5-7: Recommended Case: CO_2 Emission Scenarios

The scenario analysis indicates that the CO_2 emission amount will vary significantly with changes made to analysis assumptions (see Section 5.3). For example, LADWP could emit 11 million metric tons of CO_2 at 2020 with high range assumptions or 8.4 million metric tons of CO_2 at 2020 with low range assumptions.

Assumptions used to model rate impacts can change. In order to reflect the variability in model assumptions, a sensitivity analysis was performed to determine a realistic range of rate impact trajectories. Figure 5-8 shows the retail price impact of the Recommended Case bounded by a high and low range. The high range assumes higher natural gas and CO_2 costs. The low range assumes minimal CO_2 costs; minimal EE costs; minimal natural gas costs; RPS costs are reduced to minimum CARB RES requirements, DR costs are reduced, the rate of PRP implementation is adjusted to minimize rate impacts and policy changes regarding financial metrics are enacted by the Board of Water and Power Commissioners.

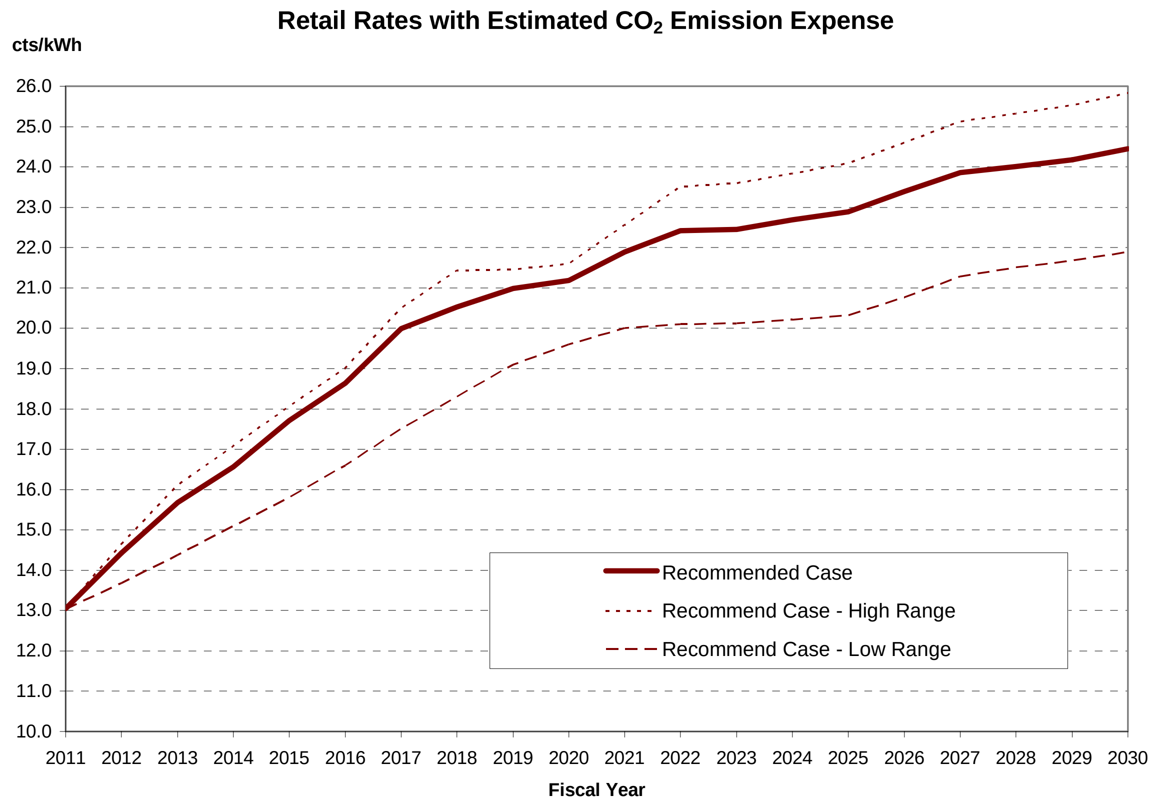


Figure 5-8 Retail price impact of the Recommended Case bounded by high and low range

The cost contribution from various environmental and reliability programs towards the retail rates are summarized in Table 5-3.

Table 5-3: Cost contributions from various environmental and reliability programs

Program	Retail Rate Impact at FY2030 (cents/kWh)	Average Retail Rate Impact from FY2011 through FY2030 (cents/kWh)
Power Reliability Program	1.83	1.38
Navajo and IPP Divestiture	0.74	0.50
20% RPS from No More RPS	0.59	0.66
33% RPS from 20% RPS	0.81	0.80
CO_2 Cap-and-Trade	1.63	1.21
Total - Recommended Case	**5.60**	**4.55**
35% RPS from 33% RPS	0.46	0.44
CO_2 Cap-and-Trade	(0.14)	(0.11)
Total at 35% RPS	**5.92**	**4.88**

Aside from the environmental and reliability improvement programs, increased fossil fuel expenses also drive the rate increase, for example: (1) coal that feeds IPP is projected to climb from 2010's $39/ton to 2027's $90/ton, and (2) natural gas at SoCal border is projected to climb from 2010's $4.32/MMBtu to 2030's $7.83/MMBtu. If these fuel increases do not materialize, then the retail rates curve in Figure 5-5, Figure 5-6 and Figure 5-7 will shift downward; however, the cost of environmental programs will remain substantially unchanged.

Because the analysis and conclusion are heavily dependent on a number of assumptions, LADWP will watch to see if these unfold as assumed. If expectations change (e.g., because of unanticipated technology changes, commodity price fluctuations, and policy changes), then the long-term plan will need to be revisited. Under all cases, it is assumed that the following items will occur, and that each will be central to LADWP regardless of the resource portfolio selected:

- Ensure that the power generation, transmission and distribution infrastructure operates in a reliable and efficient manner. Continue the Power Reliability Program initiated in 2007 which improves maintenance practices, addresses aging power system infrastructure, increases capital construction programs necessary to support load growth, and maintains staffing levels to support reliability related work.
- Support and advocate incremental requirements in Title 24 and other Green Building and appliance standards to reduce energy usage.
- Re-power Scattergood, Haynes, and Harbor end of life in-basin generation consistent with power system needs and environmental requirements.
- Continue to be self-sufficient, by maintaining system generation resources equal to or greater than customer's electrical needs.
- Provide sufficient generation to cover operating and replacement reserves in accordance to applicable federal and regional reliability requirements.
- Maintain full control of transmission assets and continue to augment those assets commensurate with load growth and renewable energy opportunities.
- Work with the Water System to develop programs that reduce the usage of electricity and

conserve water, as well as optimizing hydroelectric energy production.

- Maintain a "AA" credit rating, a debt service of at least 2.25 times, operating cash of $300 million, capitalization ratio not greater than 60 percent, and electric rates lower than neighboring investor owned utilities. In addition, LADWP will maintain net income sufficient to ensure stable City Transfers.

Each of the targets listed above will be tested in the future to meet requirements for system reliability, fiscal responsibility and environmental stewardship. Modifications will be made as necessary to assure that these core principles are met.

Regulatory and Reliability Investments

Regulatory investments are investments needed to comply with various regulatory requirements, including eliminating once-through ocean cooling, reducing GHG emissions, and re-licensing certain power plants. Reliability investments are investments needed to maintain, refurbish, or replace aging infrastructure. These investments include pole, cable, and transformer replacements in addition to various initiatives established to ensure system reliability.

Strategic Investments

Strategic investments include procurement of additional renewable generation resources and associated transmission and early compliance with certain GHG emissions regulations. These investments would ensure LADWP is well positioned to implement various environmental policy objectives.

Table 5-4 illustrates budgeted and non-budgeted regulatory, reliability, and strategic investments.

Table 5-4: Budgeted and non-budgeted regulatory, reliability, and strategic investments

2011-2020 Investments ($ Billions)			
Investment	**Budgeted**	**Non-Budgeted**	**Total**
Regulatory/Reliability Investments			
Re-powering	**1.2**	**0.2**	**1.4**
SB 1368 Compliance	**0.0**	**0.3**	**0.3**
Castaic Re-licensing	**0.0**	**0.1**	**0.1**
Demand-Side Management	**1.0**	**0.2**	**1.2**
Power Reliability Program	**10.7**	**0.4**	**11.1**
Environmental Fees	**0.0**	**1.5**	**1.5**
Strategic Investments			
Early SB 1368 Compliance	**0.0**	**0.1**	**0.1**
New Renewables	**0.0**	**6.0**	**6.0**
Local Solar	**0.3**	**0.9**	**1.2**
New Transmission	**0.3**	**0.9**	**1.2**
Advanced Reliability Program	**0.0**	**1.0**	**1.0**
Basic Generation, Transmission, and Distribution	**20.0**	**0**	**20.0**
Total	**33.5**	**11.6**	**45.1**

Figure 5-9 shows the 10-year investment plan, which includes approximately $33 billion of budgeted expenditures, $3 billion of non-budgeted regulatory and reliability investments, and $9 billion of non-budgeted strategic investments.

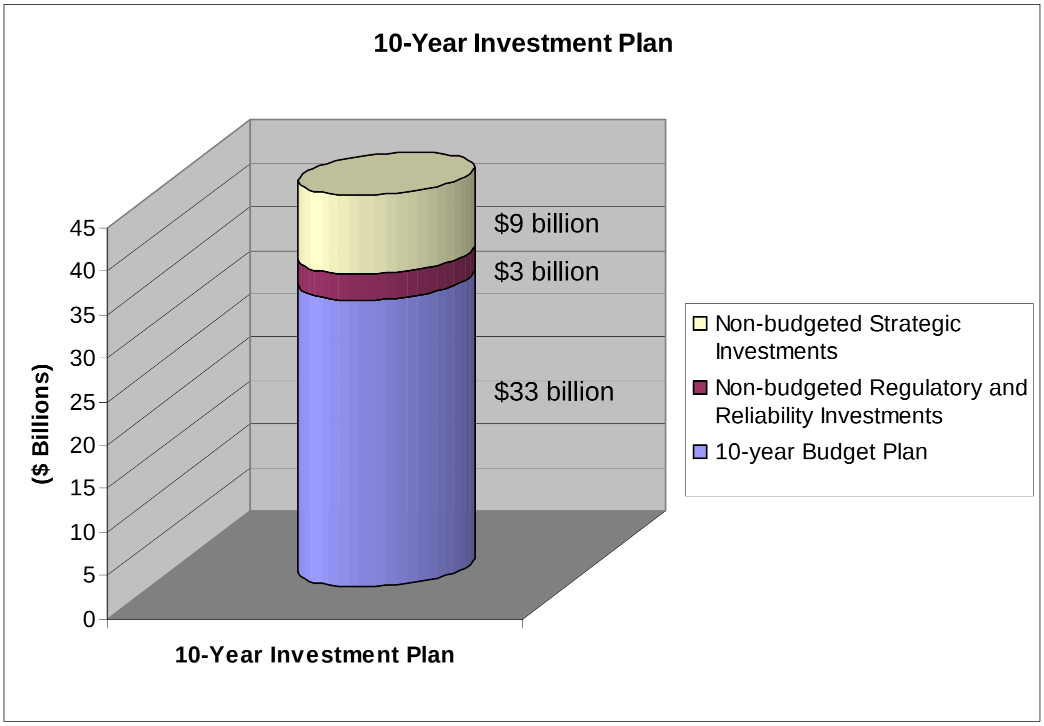


Figure 5-9: 10-year investment plan including budgeted and non-budgeted regulatory, reliability, and strategic investments

Investments associated with each strategic case were included as input parameters for the production cost model analysis. The impacts of those investments for the recommended case are reflected in the retail rates as shown in Figure 5-8.

5.5 Near-term Actions

The actions needed to be taken by LADWP in the next two to four years are very similar no matter what resource procurement strategy is chosen. From the development assumptions listed above and projected resource procurement needs, the following actions are recommended to be taken in the near-term:

1. Proceed with re-powering plans for generation units at the Haynes and Scattergood Generation Stations.
2. Continue to investigate the technical and contractual options for coal-fired generation to be compliant with SB 1368.
3. Replace the Navajo Coal Plant by 2014.
4. Perform a comprehensive EE/DSM potential study for use in updates to this IRP, as required by State regulations.
5. Develop a Demand Response Program to provide 200 MW of load reduction before 2015.
6. Develop renewable strategies for geothermal, biogas, solar, and wind resources.
7. Complete a comprehensive study of issues associated with integrating increasing amounts of variable energy resources such as wind and solar to reflect possible megawatt limits for the LADWP electric power system.
8. Procure and develop advanced technologies in the areas of: weather forecasting energy scheduling, customer kWh metering, high speed communications and information systems, and large scale energy storage systems.
9. Develop and incorporate strategies to:
   a. Fully utilize existing transmission assets;
   b. Locate renewables as close as practical to the load center to reduce transmission losses;
   c. Preserve existing brown field sites to be repurposed for renewable or natural gas generation;
   d. Incorporate the concept of O&M cluster zones to maximize operational efficiencies;
   e. Assess and develop necessary transmission facilities to deliver electricity generated from new facilities.
10. Develop a renewable energy feed-in tariff program to encourage 30 MW of renewable generation resources to be developed before 2015.
11. Sign Power Purchase Agreements for an additional 200 MW of wind or other cost effective renewable energy projects by 2014.
12. Encourage the development of an additional 50 MW of customer owned solar projects before 2015.
13. Develop up to 145 MW of Solar on Los Angeles properties under public/private partnership projects before 2015.
14. Investigate the potential use of term physical gas supply arrangements, either with contracts for physical supplies or futures contracts to limit LADWP's exposure to volatile gas prices. Include the flexibility for closing these contracts as well.

15. Increase the allowed capitalization ratio from 60 percent to 65 percent.
16. Increase the minimum cash-on-hand requirement from $300 million to 110 days of operating expenses.

5.6 Long-term Goals

The analysis and conclusions contained in this IRP are heavily dependent on a number of assumptions, such as the projected fuel and purchase power costs, RPS target goals, renewable generation costs, proposed state and federal mandates, and GHG emissions costs. If these assumptions were to change, LADWP's long-term strategies will need to change accordingly.

Integrated resource planning is an on-going process. LADWP will continue to adapt and refine the IRP as the uncertainties are better understood, and policy direction and requirements are solidified. A new IRP will be issued in 2012, and every two years thereafter.

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