# Appendix B:  LADWP's  Implementation Plan

Los Angeles Department of Water & Power

# IMPLEMENTATION PLAN

## for the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling




Submitted to:

**State Water Resources Control Board**

**Due April 1, 2011**

Revised per corrigenda dated April 4, 2011


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## Corrigenda – April 4, 2011

## Implementation Plan for the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling – dated April 1, 2011

<u>Corrections to Table of Contents:</u>

Page ii, Table of Contents – Section 2.7 IM&E studies add: "Annual Reports" to read: "*IM&E Studies,* ***Annual Reports****…"*

Page ii, Table of Contents – Section 2.7 – Add *"**IM&E Studies Appendix 2**"*

Page ii, Table of Contents change NPDES Annual Reports Appendix 2 to Appendix 3 to read: "***NPDES Annual Reports ……. Appendix 3***"

Page ii, Table of Contents, change Report of Waste Discharge for Harbor Generating Station Appendix 3 to Appendix 4 as follows: *"**Report of Waste of Waste Discharge for Harbor Generating Station Appendix 4**"*

Page iii, Table of Contents, add the following to the List of Attachments: "***Attachment 3 Aerial Photographs Current Transmission Line Right of Ways"***"

<u>Corrections to the body of the report:</u>

Page 11, 3rd paragraph, 4th sentence, change "LAWDP" to "***LADWP***"

Page 18, Move header "**Harbor Generating Station**" to next page 19

Page 20, Section 2.5, correct page numbers "…chart page 16 and following pages 18 – 31" to read: *"…**chart page 21 and following pages 22 – 30.***"

Page 22, move orphaned heading "**f) Available information on obtaining required air permits and required offsets**" to next page 23

Page 27, move orphaned heading "f) **Available information on obtaining required air permits and required offsets**" to next page 28

Pages 26, 27, 29, and 30 - paragraph d), change "… Conceptual Engineering to Commissioning Units. Refer to Chapter 1 Section 6 of this Plan" to read

> "…Conceptual Engineering to Commissioning Units.
> Refer to Chapter 1 **Section 5** of this Plan"

At end of Plan, include a separation sheet for Attachments 1 – 3.

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List of Attachments



List of Charts



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## Acronyms

| | |
|---|---|
| AEI | Adverse Environmental Impact |
| CAISO | California Independent System Operators |
| CARB | California Air Resources Board |
| cm | Centimeter |
| $CO_2$ | Carbon Dioxide |
| CWIS | Cooling Water Intake System |
| E | Entrainment |
| EL | Elevation |
| EPS | Emission Performance Standard |
| GAL | Gallons |
| GPM | Gallons per minute |
| HGS | Harbor Generating Station |
| HnGS | Haynes Generating Station |
| ILAH | Inner Los Angeles Harbor |
| IM | Impingement Mortality |
| In | Inches |
| IOU | Investor-Owned Utility |
| IRP | Integrated Resource Plan |
| kg | Kilograms |
| kV | Kilo Volt |
| LADWP | Los Angeles Department of Water and Power |
| LARWQCB | Los Angeles Regional Water Quality Control Board |
| m | Meter |
| mgd | Millions Gallons per Day |
| msl | Mean Sea Level |
| MWH | Mega Watt Hour |
| MLLW | Mean Lower Low Water Level |
| MW | Mega Watt |
| NERC | North American Reliability Corporation |
| NPDES | National Pollutant Discharge Elimination System |
| OTC | Once Through Cooling |
| PRP | Power Reliability Program |
| ROWD | Report of Waste Discharge |
| RMR | Reliability Must Run |
| RPS | Renewable Portfolio Standard |
| SACCWIS | Statewide Advisory Committee on Cooling Water Intake Structures |
| SCB | Southern California Bight |
| SCAQMD | South Coast Air Quality Management District |
| SGS | Scattergood Generating Station |
| SWRCB | State Water Resources Control Board |
| VERS | Variable Energy Resources |

## Executive Summary

The State Water Resources Control Board (SWRCB) adopted its Statewide Once-Through Cooling Policy (Policy) on May 4, 2010, which became effective on October 1, 2010. As required by the Policy, an Implementation Plan (Plan) is due April 1, 2011.

To achieve compliance with the draft Once-Through Cooling (OTC) Policy, which was released for review and comment on March 22, 2010, LADWP had proposed a facility-wide compliance approach targeting the 83.7 percent OTC reduction standard. On May 4, 2010, the Board adopted a Policy that eliminated the opportunity to use the facility-wide basis, and instead required unit-by-unit compliance, while maintaining the original compliance dates stipulated in the March 2010, draft Policy.

LADWP is following Track 1 to comply with the Statewide Policy. Under this Track, LADWP will be converting its three coastal power generating facilities from OTC to closed cycle cooling – completely eliminating the use of OTC. LADWP addresses the shift from facility- to unit-by-unit basis with an Implementation Plan schedule that enables LADWP to provide reliable service to its electric customers.

This document not only presents LADWP's Plan to implement the SWRCB's Policy, but also clearly explains why circumstances unique to LADWP's vertically-integrated electric system require a longer time than the Policy dictates to convert all nine generating units at the three coastal stations from OTC to closed cycle cooling. This Plan provides the necessary information that outlines the compliance path and schedule to reach full compliance with the Policy.

As described in more detail in this Plan, LADWP's electric system was designed and developed over its 106-year history separate from the balance of California's electric utility grid system.

As a vertically-integrated utility, LADWP is unique in that it owns and operates its own generation, transmission and distribution systems. For this reason, LADWP does not rely on the energy market or other transmission system operators as a primary means to meet its power needs.

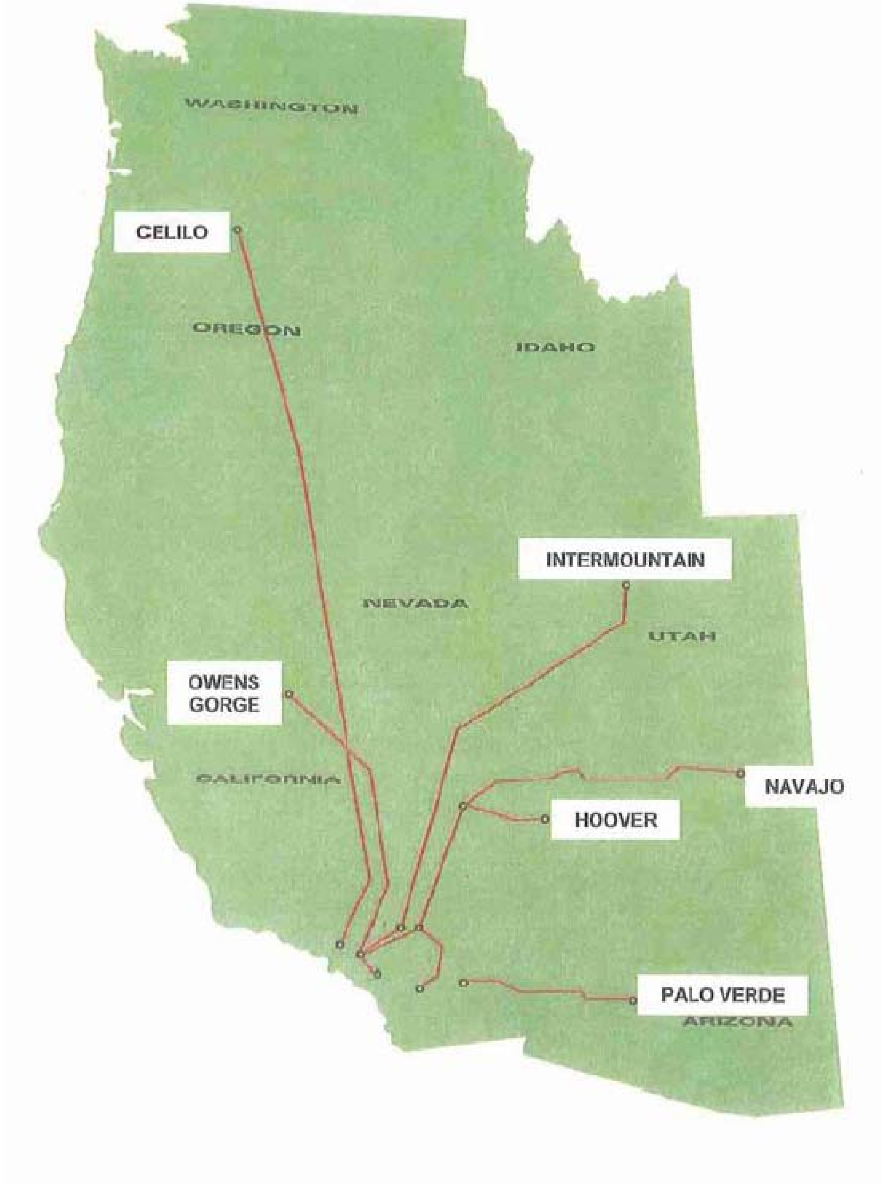



Figure ES-1 – Transmission Grid

LADWP's service territory covers 465 square miles. A transmission system network totaling more than 3,600 miles operates to transport power from the Pacific Northwest, Utah, Nevada, Arizona, and other areas in California to Los Angeles.

LADWP's coastal plants (Haynes, Harbor and Scattergood) support 2,839 MW of installed capacity, providing approximately 85 percent of the total generating capacity within the City of Los Angeles, and 39% of the total generating plant capacity owned by LADWP.

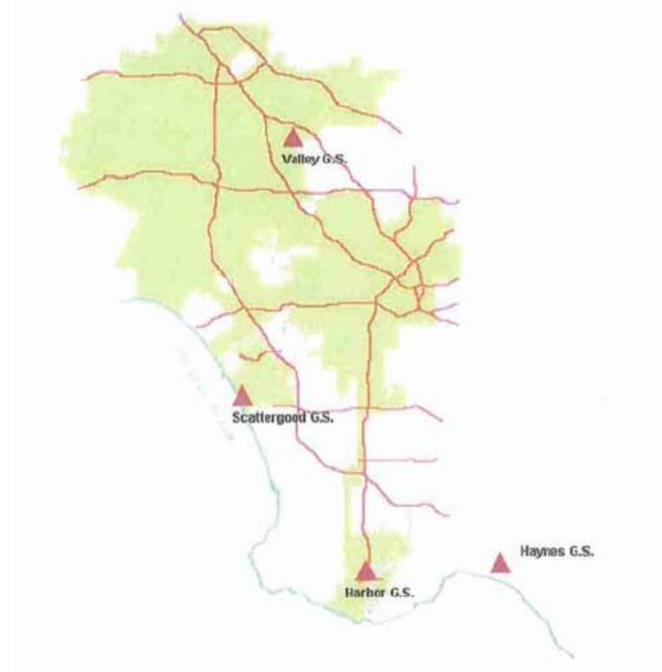


Figure ES-2 – LADWP in-basin power plant locations

The LADWP electric system was designed and evolved to rely upon its "in-basin" gas-fired generation to assure reliability of the system, and to enable the importation of power supplies from outside the Los Angeles basin.

LADWP is uniquely independent with its own grid system and is not part of the California Independent System Operators (CAISO) grid system which manages electricity flow for 80 percent of the state. Interconnections used by LADWP to import/export energy from other western utilities are all located external to the city or at its extreme northern edge. LADWP's generation reliability requirements do not change as a result of these interconnections. Due to the configuration of LADWP's system, developed over 75+ years ago, the capacity limitations of the intra-City transmission system precludes importing sufficient power to meet reliability requirements from these connections. The grid system was built out from the coastal plants. The southern and western portions of LADWP's service territory are located in transmission "cul-de-sacs" where the ability to import power from the north is limited. Local sources – namely, the coastal stations – must therefore deliver power to the local area load centers. This role of the OTC generating plants is critically important and relevant to the limitations facing LADWP in the timing and sequencing of actions to remove its in-basin generating units from service to accomplish the OTC elimination. The coastal plant units provide a local source of power (or local resource adequacy) that off loads the transmission circuits and also provide voltage support and stability to the entire system. Therefore, at no time can any of the existing units be taken off line (shut down) for the years necessary to build a replacement unit.

As shown below on figures ES – 3 thru ES – 8, the coastal generating plants are in highly urbanized areas and on space restricted sites. There is insufficient space at these urban plants to install new closed-cycle cooling systems and the corresponding more efficient generating units, while continuing to operate the existing units. The replacement of generating plants and installation of massive dry cooling equipment to replace OTC requires carefully planned and executed serial project modification, to preclude any possibility of endangering the public health and safety of LADWP's 1.4 million retail electric customers from the risk of unreliable power supply during this unprecedented conversion.

Figure ES-3 – Aerial View of Harbor Generating Station

Figure ES-4 - Aerial view of Haynes Generating Station


Figure ES-5 - Aerial view of Scattergood Generating Station

Without the availability of the units at the three coastal stations that currently use OTC, the hydroelectric, nuclear, and coal power purchased from outside the region, comprising approximately 61% of LADWP's power supply, could not be reliably imported. This situation greatly constrains the manner and timing in which LADWP's OTC generating plants can be converted to closed cycle cooling. Specifically, as mentioned above, none of the generating plant units can be removed from service *while* repowering (replacement of the units with new, more efficient versions) with closed cycle cooling systems. The inability to take LADWP's existing generating plants off-line for any extended time, while they are repowered and/or changed from OTC to closed cycle cooling, requires LADWP to complete the OTC elimination sequentially at its different coastal plants. The most expeditious timeline to both repower and replace OTC with closed cycle cooling is to undertake the repowering and closed cycle cooling installation at the same time, plant-by-plant, unit-by-unit. To do otherwise would further extend the schedule for completing the elimination of OTC at these plants.

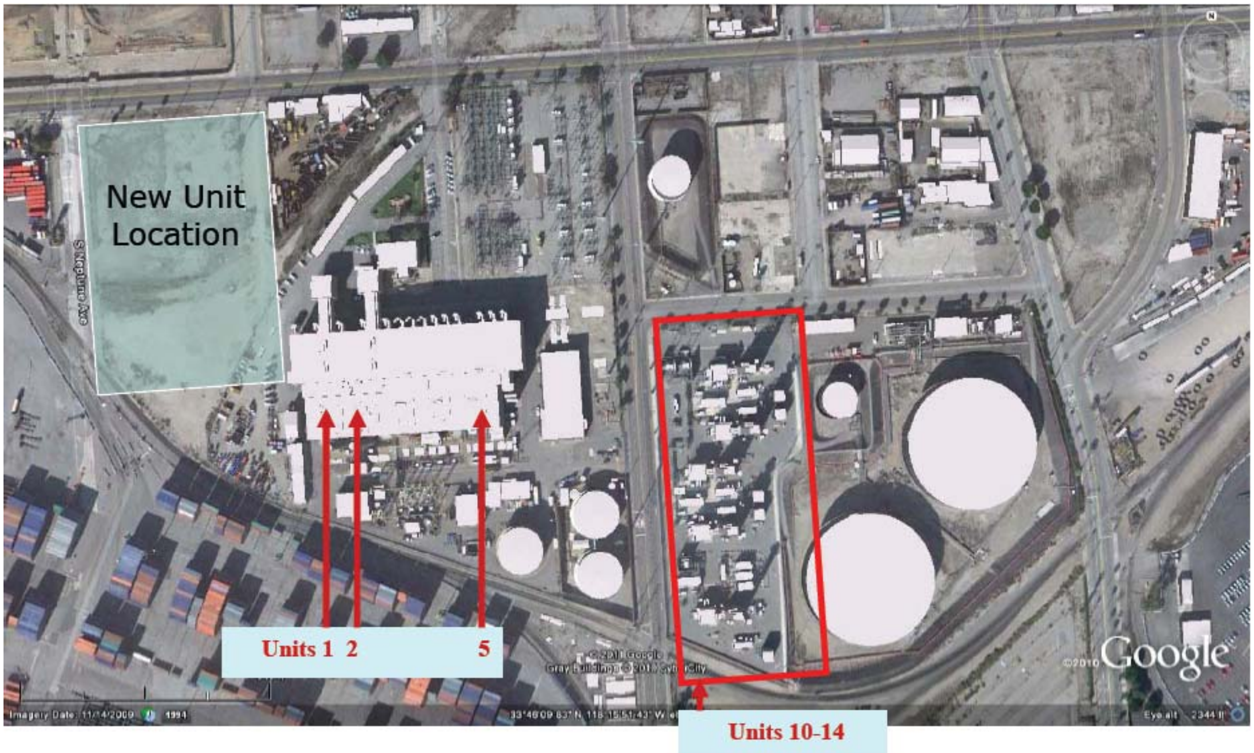



Figure ES-6 – Harbor Repowering Project - Proposed

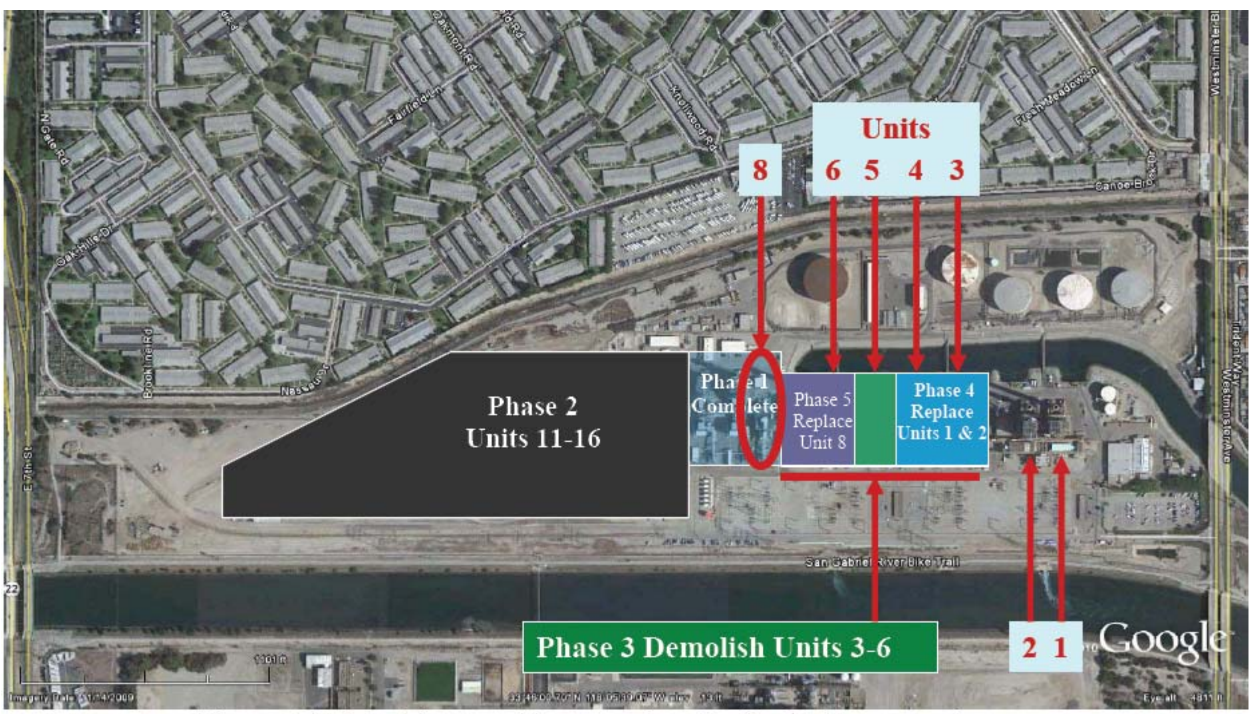



Figure ES-7 – Haynes Repowering Project - Proposed

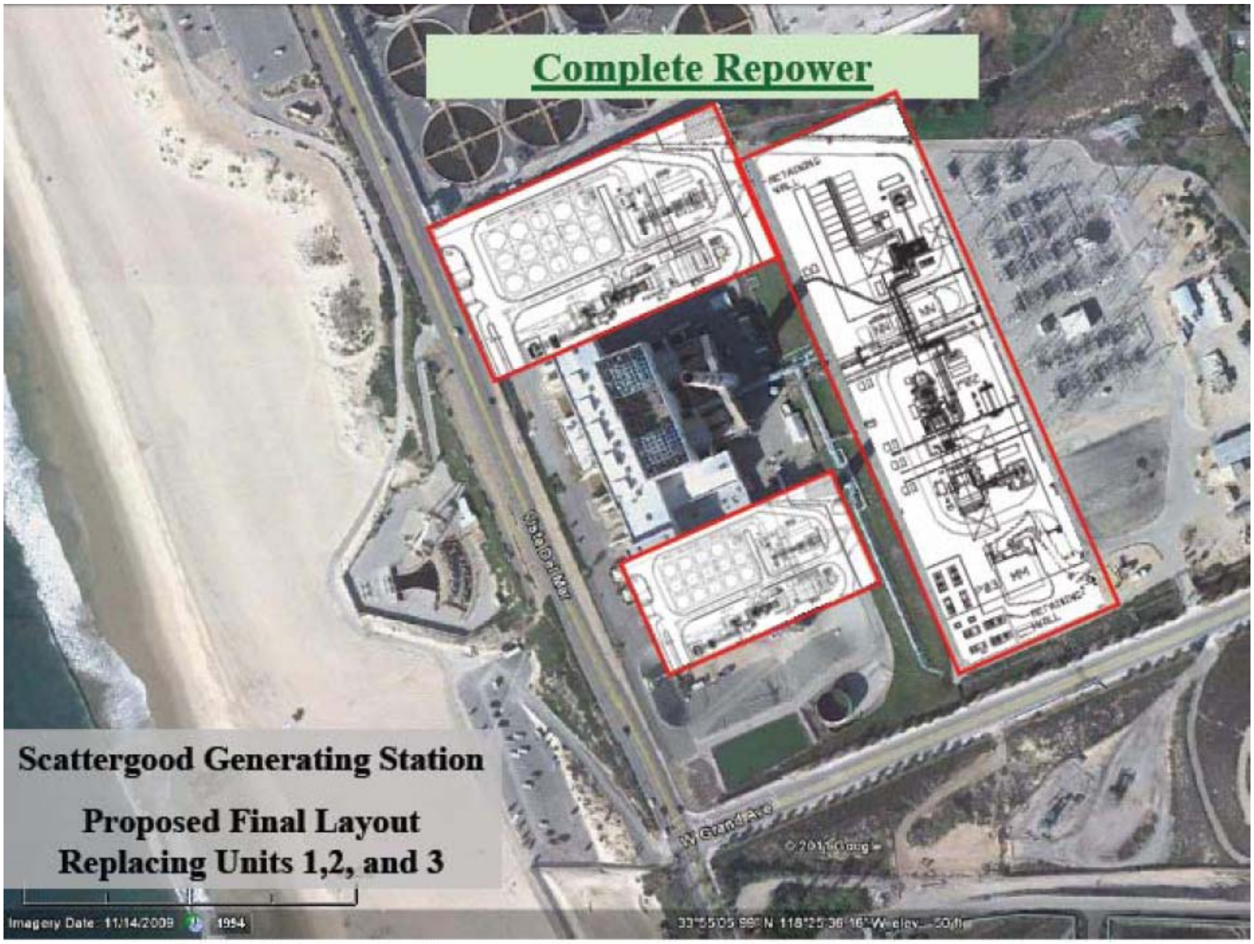


Figure ES-8 – Scattergood Repowering Project - Proposed

**An Aggressive New Plan and Schedule for OTC Elimination**

In 2010, LADWP had set forth a plan presented to the LADWP Board of Commissioners and various stakeholders that would achieve full OTC elimination by 2040. This plan for completion by 2040 has been explicitly included in our entire system power integrated resource plan (IRP), which was extensively reviewed and discussed in numerous public workshops in the Los Angeles area in 2010. Upon further study, and in recognition of the SWRCB's far more ambitious policy timeline, LADWP reworked its plan and associated timing of serial replacement of its generating plants to arrive at the Plan presented herein, which cuts an entire five years off of the schedule to achieve total elimination, plant by plant, unit-by-unit, by 2035. As a result, LADWP will be continuously undertaking power plant replacement and cooling technology installation every single year from now through 2035. This is the most aggressive possible schedule LADWP can undertake to achieve total OTC elimination. To move any faster would threaten reliable service to our customers.

The Policy compliance dates stipulated for LADWP's three (3) coastal generating stations (Harbor, Haynes and Scattergood) are, in a word, infeasible: (Harbor – 2015, Haynes – 2019, Scattergood – 2020). The schedule stipulated in the policy would imperil reliability across LADWP's entire service area for the following reasons:

1) All three coastal generating stations are located in densely populated, highly industrialized urban areas. There is insufficient space on the foot print of the plants and surrounding areas, therefore there would need to be simultaneous shut-down of existing units to meet the compliance dates. This is because units would need to be shut down and demolished in order to make space for the new units.
2) The coastal plants provide balance and stability to the grid. If units were forced to shut down for long periods, the grid could not function; transmission lines would overload and "burn out", and power could not be delivered.
3) Imported power, entering the system from the North cannot be transmitted to the Southern and Western areas of Los Angeles to fulfill locational reliability requirements because the internal City transmission system lacks capacity to carry enough power. The internal transmission lines are "locked in" due to the increased urbanization. There is no real estate for adding new, or making substantial upgrades to the existing local transmission lines within the City.
4) LADWP is in the process of integrating variable (renewable) energy resources (VERS) into its system; the coastal generating station units are critical to meeting system demand when the VERS are not generating power or their power output decreases and/or fluctuates rapidly.

LADWP proposes the following compliance schedule:
Scattergood – 2024; Harbor – 2031; Haynes – 2035.
The detailed unit by unit schedule (see chart – Attachment 1) is:

Haynes 5&6 – 2013;
Scattergood Unit 3 – 2015;
Scattergood Units 1&2 – 2024;
Haynes Units 1&2 – 2027;
Harbor Unit 5 – 2031,
Haynes Unit 8 – 2035.

Chart 1 - By Facility

| **Facility** | **Statewide OTC Policy Schedule** | **LADWP Best Possible Schedule** |
|---|---|---|
| Harbor | 2015 | 2031 |
| Haynes | 2019 | 2035 |
| Scattergood | 2020 | 2024 |

Chart 2 - By Unit

| | LADWP Best Possible Schedule | | Statewide OTC Policy Schedule |
|---|---|---|---|
| **Facility** | **Unit** | **Schedule** | **Schedule** |
| Haynes | Units 5 & 6 | 2013 | 2019 |
| | Units 1 & 2 | 2027 | 2019 |
| | Unit 8 | 2035 | 2019 |
| Harbor | Unit 5 | 2031 | 2015 |
| Scattergood | Unit 3 | 2015 | 2020 |
| | Units 1 & 2 | 2024 | 2020 |

Figure ES-9 - Charts showing dates proposed versus OTC Policy

**Reordering Plant Replacement to Maximize Early OTC Volume Reduction**

This Plan is viable, but aggressive, and has been accelerated or "front-loaded" to the maximum extent possible. It is predicated upon a sequential or serial repowering to eliminate the use of OTC. LADWP has already begun eliminating OTC with the repower of Haynes Units 5&6 with dry cooling to be completed by 2013. In addition, to further maximize the reduction of OTC as soon as possible, LADWP has revised the repowering sequence at the Scattergood Generating Station so the largest OTC unit will be replaced first. This means an extra 10% overall OTC reduction. In addition, the Haynes Units 1 & 2 were "swapped" with the Scattergood Unit 1&2 project: Scattergood, with an inlet structure situated on Dockweiller Beach in Playa Del Rey, will be the first LADWP power plant to eliminate its use of OTC.

**Schedule Requires Seamless Execution**

This proposed schedule allocates the minimum amount of time for each of the very complex tasks which includes: conceptual engineering; air emissions modeling; demolition; obtaining permits from the South Coast Quality Air Management District; and the construction, commissioning and trial operations of new units that must be undertaken to convert the OTC coastal stations to closed-cycle cooling systems. At each stage of this multi-stage process, LADWP is reliant upon its Board of Water and Power Commissioners, the 15 member Los Angeles City Council, outside vendors, manufacturers, and/or regulatory agencies. For example, if there were no delays to obtain an air permit to construct new units, this task would take approximately 12 months. However, the air permitting for LADWP's Haynes Unit 5&6 repower project took a solid two years due to new regulations that were promulgated by EPA during the permit preparation process and required additional analysis and negotiations with the regulatory agencies. In addition, LADWP must obtain City Council approval before a Request for Proposal or a Contract for design, equipment procurement, engineering and/or construction services can be awarded. This process also has the potential to delay the schedule for months but is outside LADWP's control. If there are no delays in the schedule, each repowering project will require approximately 6 – 8 years. We have assumed no delays in every step of the process reflected in this Plan.

An extended schedule should not be construed as an attempt to shirk obligations. Quite the opposite is true: concurrent with OTC, LADWP must also radically revamp its fuel mix to meet mandates to reduce greenhouse gas emissions, divest from coal to meet emission performance standards, and integrate intermittent or variable renewable energy sources. This transformation of our power supply system is required to meet not only LADWP's goals, but also to meet soon-to-be-mandated State of California renewable portfolio standard (RPS) implementation requirements reflected in State legislation which sits on the desk of the Governor of California for his signature as of the date of this Plan. This confluence represents an unprecedented reconfiguration for the largest municipal utility in the country. Against that background, LADWP still plans to go *beyond* the requirements of the OTC policy and *totally* *eliminate* rather than just r*educe* OTC.

The extended schedule also represents a significant investment on the part of LADWP's customers who pay 100% of our costs. LADWP has no shareholders, no separate source of funds. Every dollar of cost incurred by LADWP gets fully placed into our power rates to our residential, business and government customers who pay our power rates. In contrast to those areas served by investor-owned utilities with merchant power plant/owner suppliers, LADWP's electric customers will directly bear the full costs of conversion to closed-cycle cooling. Despite this reality and burden, LADWP proposes an aggressive schedule which totally removes all ocean water for the cooling of its power plants. However, this must be accomplished over a schedule that maintains reliable service. This Plan accomplishes both by 2035. No earlier date is achievable.

# Chapter 1. LADWP and Compliance Schedule

## 1.1. Overview and Introduction

The State Water Resources Control Board (SWRCB) adopted its Statewide Once-Through-Cooling Policy (Policy) on May 4, 2010, which became effective on October 1, 2010. As required by the Policy, an Implementation Plan (Plan) is due April 1, 2011. This Plan provides the necessary information that outlines the compliance path and schedule to reach full compliance with the Policy.

The Los Angeles Department of Water and Power (LADWP) fully commits to converting its coastal power generating facilities from once-through ocean cooling (OTC) to closed cycle cooling, on a schedule that enables LADWP to provide reliable service to its customers.  Due to the uniqueness of LADWP, more time will be needed than what is stipulated in the Policy to ensure grid reliability that cannot be overcome as a consequence of its system design and development over the past 100 years. As a result, LADWP must repower and eliminate OTC in a methodical, sequential manner. The schedule as stipulated in the Policy would threaten LADWP's grid reliability by requiring critical units to be shut down that would cause an imbalance to the voltage support of the system. This would result in a total shut down of the transmission system. This would also cause violations with the Northern American Electric Reliability Corporation (NERC) requirements since LADWP would not be able to fulfill its local reliability must run requirements (RMR). For these and other reasons to be explained in detail in the Plan, LADWP is requesting the schedule be extended until 2035. This is the most aggressive and shortest time frame possible without jeopardizing grid reliability. The replacement of generating plants and installation of massive dry cooling equipment to replace OTC requires carefully planned and executed serial project modification to preclude any possibility of endangering the public health and safety of LADWP's 1.4 million retail electric customers while meeting the SWRCB's OTC policy from the risk of unreliable power supply during this unprecedented conversion.

The LADWP electric system was designed and developed over its 106-year history as largely separate from the balance of California's electric utility system. It is uniquely independent with its own grid system and is not part of the California Independent System Operators (CAISO) grid system which manages electricity flow for 80 percent of the state. Interconnections used by LADWP to export/import energy from other western utilities are all located external to the City or at its extreme northern edge. LADWP's reliability requirements do not change because of these interconnections. The Southern and Western portions of LADWP's service territory are located in transmission "cul-de-sacs" where the ability to import power from the north or from the external connections is limited, due to the capacity limitations of the intra-City transmission system. As a result of the increased urbanization, the internal transmission lines are "locked in". There is no real estate for adding new, or making substantial upgrades to the existing local transmission lines within the City.

LADWP is unique in that it is a vertically-integrated utility, that is to say, it owns and operates its generation, transmission and distribution systems. LADWP's service territory covers 465 square miles. A transmission network totaling more than 3,600 miles operates to transport power from the Pacific Northwest, Utah, Nevada, Arizona, and other areas of California to Los Angeles. LADWP's coastal plants (Haynes, Harbor and Scattergood) are the three major power plant sites for the Southern and Western areas of the system that support 2,839 MW of installed capacity, providing approximately 85 percent of the total generating capacity within the City of Los Angeles and 39% of the total generating plant capacity owned by LADWP. There are nine OTC units among these three plants.

The LADWP electric system was designed and evolved to rely upon its "in-basin" gas-fired generation to assure reliability of the system, and to enable power supplies from outside the system to be imported. The grid system was "built out" from the coastal plants. Without the availability of all in-basin generating plant units, including the units at the three coastal stations that currently use OTC to balance the system, hydroelectric, nuclear, coal and purchased power from outside the region, comprising approximately 61% of LADWP's power supply, could not be reliably imported. Local sources – namely, the coastal stations – deliver power to the local area load centers of the Southern and Western portion of the grid. The coastal plant units provide a local source of power (or local resource adequacy) that off loads the transmission circuits and also provide voltage support and stability to the entire system. Therefore, at no time can any of the existing units be taken off line (shut down) for years at a time to repower and change from OTC to closed cycle cooling. All three coastal plants are located in densely populated, highly industrialized urban areas. There is insufficient space on the foot print of the plant and surrounding areas to build new units without making space by demolishing old units. This situation greatly constrains the manner and timing in which LADWP's OTC generating plants can be converted to closed cycle cooling. Specifically, none of the generating plants' units can be removed from service while replacement cooling systems are installed in order to maintain reliability and balance the power on the transmission grid.

Figures 1 – 3 – Harbor, Haynes and Scattergood Generating Stations – Aerial photos

The inability to take LADWP's existing generating units off-line for years at a time, while they are repowered and changed from OTC to closed cycle cooling, requires LADWP to complete the OTC elimination sequentially at its different plants

The following Plan description presents LADWP's planned sequence of conversion from OTC to dry cooling for each of its three coastal plants, and the detailed explanation as to why this schedule cannot be accelerated.

**OTC Elimination - The Transformation of LADWP**

The replacement of 85% of LADWP's in-basin generation to eliminate OTC would be an unprecedented undertaking for the utility - even if that were the only significant change required of LADWP in the next decade. However, this major program will go forward as LADWP also:

- makes a major change in its entire power supply structure,
- upgrades its electric transmission system, and
- makes historic investments in its electric distribution system to improve and maintain reliability.

To date, LADWP has already reduced its fleet of OTC units from 14 to 9. Currently, LADWP is furthering its elimination of OTC; the Haynes Unit 5&6 repower began in 2007 and is targeted to be complete by 2013. This will reduce LADWP's overall use of OTC by 42% compared to 1990 usage. The Scattergood Unit 3 project has also commenced; its target completion date is 2015. Upon the completion of this second project, LADWP's overall OTC usage will be reduced by 56% compared to 1990 usage. LADWP made changes to its repowering plans in order to achieve larger reductions of OTC sooner. The Scattergood Unit 3 project was "swapped" with the Scattergood Unit 1&2 project, resulting in a larger reduction in OTC at the Scattergood site by 10%. In addition, the Haynes Unit 1&2 project was "swapped" with the Scattergood Unit 1&2 project in order to complete the elimination of OTC at the Scattergood Generating Station first, due to the location of its intake structure on Dockweiller Beach. Finally, for efficiency, older existing generating units at the coastal plants will be re-powered (converted to more efficient versions) before or concurrent with the installation of closed-cycle cooling systems.

In 2010, LADWP had set forth a plan presented to the LADWP Board of Commissioners and various stakeholders that would achieve full OTC elimination by 2040. This plan for completion by 2040 has been explicitly included in our entire system power integrated resource plan (IRP), which was extensively reviewed and discussed in numerous public workshops in the Los Angeles area in 2010. Upon further study, and in recognition of the SWRCB's far more ambitious policy timeline, LADWP reworked its plan and associated timing of serial replacement of its generating plants to arrive at the Plan presented herein which cuts an entire five years off of the schedule to achieve total elimination, plant by plant, unit-by-unit, by 2035. As a result, LADWP will be continuously undertaking power plant replacement and cooling technology every single year from now through 2035. This is the most aggressive possible schedule LADWP can undertake to achieve total OTC elimination. To move any faster would threaten reliable service to our customers.

Energy Sources

In addition to eliminating all use of OTC, LADWP is undergoing an energy supply transformation consisting of multiple power supply modification goals, primary of which is achieving a municipal renewable portfolio standard (RPS) of thirty-three percent that was set forth in 2007. Under the auspices of Senate Bill SBX 1 2, this goal was recently passed by the California State Legislature in extraordinary session and awaits approval by the Governor. If signed by the Governor, this mandate will require LADWP to provide 1/3 of its power supply from renewable energy by 2020.

LADWP must meet equally important regulatory mandates contemporaneous with the elimination of OTC:

- Required transition from coal-based to sustainable energy sources to comply with emissions performance standards in SB 1368 and meet greenhouse gas (GHG) emissions limit reductions required by Assembly Bill 32 (AB 32). This has resulted in the planned divestiture of LADWP's 477 MW share of the Navajo coal generating plant, which will be replaced this with non-coal-fired energy source.
- Increasing LADWP's reliance on energy efficiency from the present 3% of total power supply to 10% by 2020 to help meet GHG limits and State RPS mandates, and
- Supporting the Million Solar Roofs Initiative (SB 1) with LADWP's Solar Incentive Program, which has installed 25 MW at over 3,100 customer locations as of February 2011.

The result of these combined mandates is that in the next 25 years, LADWP will have replaced 90% of the energy sources that it has relied upon for the last 70 years. The new LADWP now being built is confronted with a steep learning curve encompassing the integration of variable power output from the variable renewable energy sources while balancing the power load with new quick start technology.

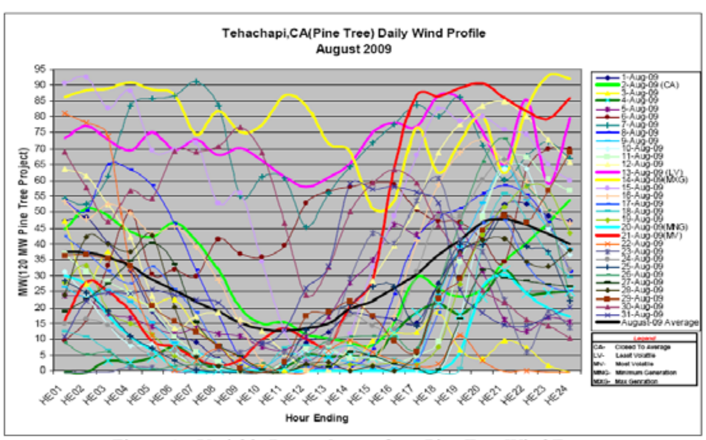



Figure 4 – Variable Power Output from Pine Tree Wind Farm

Transmission System
Concurrent with the energy resource portfolio transformation is the need for a significant system-wide upgrade to LADWP's aging transmission infrastructure; much of which was installed in the 1960's and 1970's but some as early as the 1940's. LADWP cannot maintain its current level of system reliability or integrate additional renewables (or variable energy resources -VERs), without these upgrades. Upgrades are required within the core LADWP system to maintain reliability. The importation of a significant portion of the renewable energy portfolio also necessitates major transmission upgrades.

In March 2011, LADWP transmission planners finished a reactive power management study with KEMA Consulting. This study identified reactive power needs at the transmission level which are necessary in order to support the integration of variable renewable resources. An implementation plan based on the study is being developed.

System Configuration
LADWP's system configuration of in-basin and imported energy resources, as well as its network of transmission and distribution systems, reflects its evolution from a newly formed municipal utility founded in 1917 through major city growth periods (both in residential and industrial development) post World War II. The oil embargo of the 1970's as well as, the annexation of communities such as the Los Angeles Harbor area, have shaped LADWP's resource portfolio, transmission system, and customer base over the decades.

As a result, the intra-City transmission system has become "locked in" due to increased urbanization and the lack of real estate to add, or make substantial upgrades to the existing local transmission within the City. In order to bring in new resources, additional transmission capacity is needed and therefore, whenever an external power resource is added to the mix, additional generation capacity is also required.

## 1.2. LADWP: A Brief Profile

Governance & Mandates
LADWP is the nation's largest municipally-owned, not-for-profit utility and serves a population of over 4 million people. LADWP's service territory covers 465 square miles. A transmission system network totaling more than 3,600 miles is operated to transport power from the Pacific Northwest, Utah, Arizona, Nevada, and California to Los Angeles. Governed by the Los Angeles City Charter, LADWP has an obligation to serve and is mandated to provide *reliable and affordable electricity* to its customers in an environmentally-responsible manner. These tenets constitute the objectives of all of LADWP's resource planning. LADWP is overseen by a five-member Board of Water and Power Commissioners whose actions are subject to review by the 15 members of the Los Angeles City Council and the Mayor of Los Angeles.

Organization & Service Territory

LADWP is a vertically-integrated utility, that is to say, LADWP owns and operates its generation, transmission and distribution systems. For this reason it does not rely on the energy market as a primary means to meet its power needs. The three investor-owned utilities (IOUs) – SCE, PGE, and SDG&E, are the only other utilities that have OTC generation stations within their service territories. The IOUs divested their aged, non-nuclear OTC stations in 1998, and are no longer obligated to utilize power generated by those stations. They are not responsible for converting those stations to dry cooling (or other technologies) to reduce or eliminate OTC. Nor are the IOUs directly responsible for any costs associated with that conversion. LADWP holds the distinction of being the only municipal utility that owns existing OTC non-nuclear generation and that requires its *customers* to be responsible for the conversion costs.

Grid (Transmission System)

Among California utilities, LADWP is uniquely independent with its own grid system; LADWP's grid is not a part of the California Independent System Operators (CAISO) grid system which manages the electricity flow for 80 percent of the state. LADWP's grid has very limited ties to adjoining utilities, principally SCE, as a result of how the grid was developed over the past 75+ years. Interconnections used by LADWP to export/import energy from other western utilities are all located external to the City or at its extreme northern edge. LADWP's reliability requirements do not change due to this.

Balancing Authority

LADWP operates an independent balancing authority meaning, it is responsible for continuously balancing customer demand and generation, while providing sufficient additional generation to handle load variations and to provide for loss of resources.

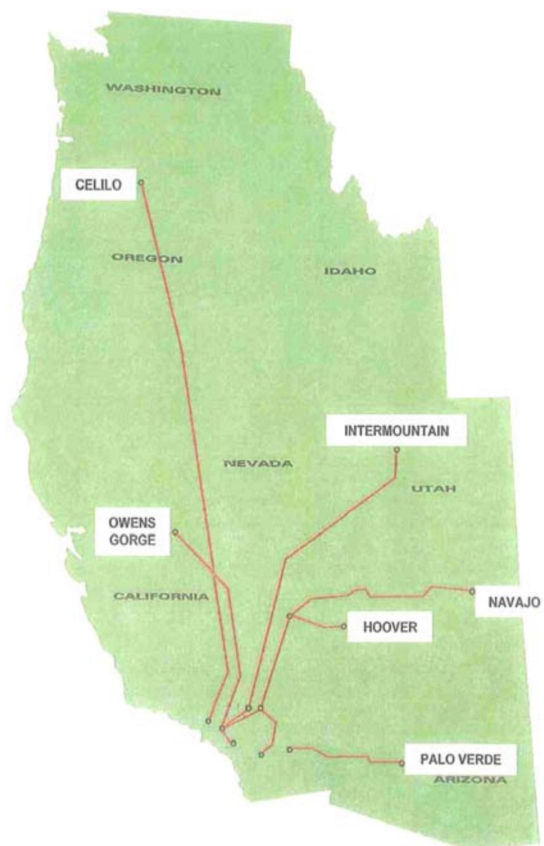



Figure 5 – Transmission System

In its role as a Balancing Authority, LADWP integrates resource plans ahead of time, maintains load-interchange-generation balance within its Balancing Authority Area (LADWP, Glendale, and Burbank), and supports interconnection frequency in real time.

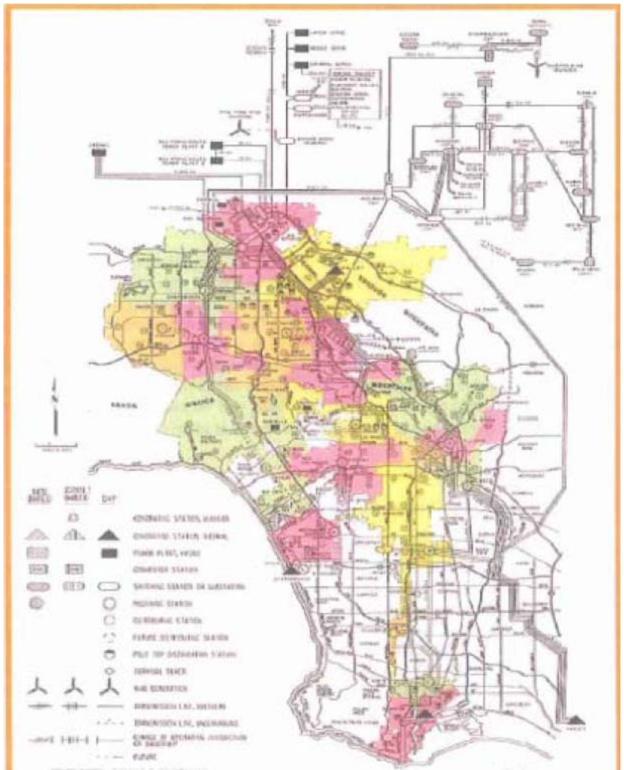


Figure 6 – In basin Transmission System

<u>Predicted Power Demand</u>
Electricity consumption 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. An increase of 1.6 percent is predicted in 2013-14, while the growth in annual peak demand over the next twenty years is predicted to be about 1.3 percent – approximately 100 MW per year. (Ref: LADWP IRP Section 2)

LADWP must have sufficient capacity to provide its customers with reliable supply of electric power.

<u>Overview of LADWP's Coastal Generation</u>
There is not adequate capacity on the internal (in-basin) transmission system to deliver sufficient "northern" or imported power to the Southern and Western areas of LADWP's service territory to meet demand. The coastal plants must make up the difference. Therefore, in the 1940s and 50s, the coastal plants were built, and local transmission lines constructed, to provide power to the Southern and Western load centers.

The Southern and Western portions of LADWP's service territory are located in transmission "cul-de-sacs" where the ability to import power from the north or from the external connections is limited due to the capacity limitations of the inter-City transmission system. As a result of the increased urbanization, the internal transmission lines are "locked in". There is no real estate for adding new, or making substantial upgrades to the existing, local transmission lines within the City.

**1.3 The Role of the Coastal Plants and LADWP System Reliability**

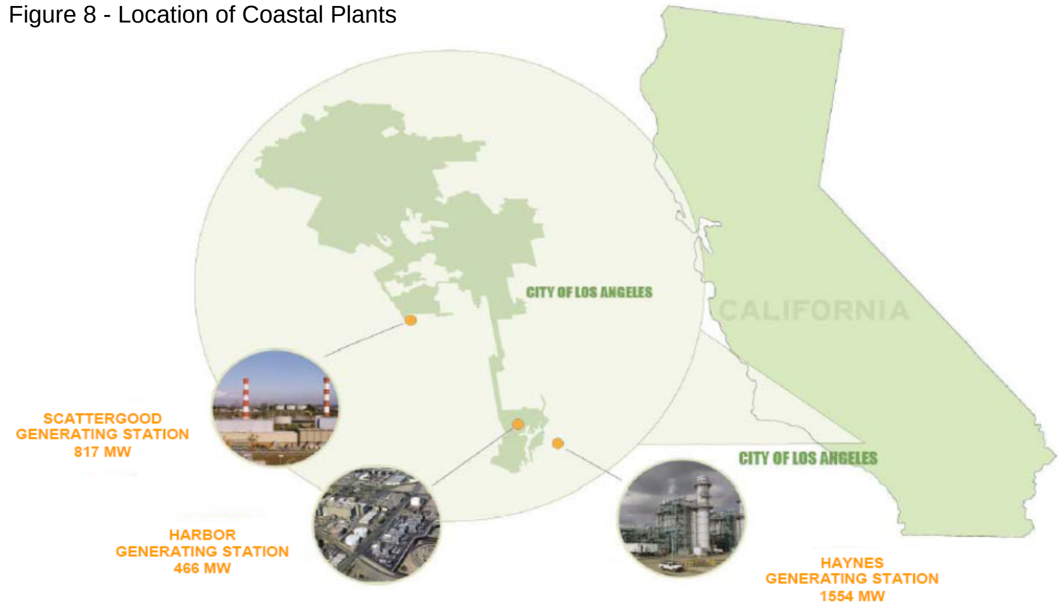
<u>The Role of the Coastal Plants</u>
The need to retain in-basin generation via the coastal plant units is paramount in order to meet reliability criteria, demand and reserve power, resource adequacy, contingency reserves, replacement reserves, and system stability. The different geographic regions of LADWP's in-basin system cannot be fed by all the in-basin plants. The fact that LADWP cannot import sufficient "northern" or imported power to the Southern and Western areas requires that all of the coastal plant generation units be available to produce power at all times to make up the difference. These units are critical in providing power to the Western and Southern load centers, in addition to maintaining stability and voltage control for the entire system.

Since the 1970s, population growth and increased urbanization has essentially "locked in" LADWP's transmission system. There is no real estate available for adding new, or making substantial upgrades to the existing, local transmission lines within the City (see photos below and in Attachment 3). In addition, upgrading existing lines would require taking multiple lines out of service continuously. The system could not withstand the long outage durations necessary to accomplish this work.


Figure 7 - Examples of how transmission growth is limited by residential and industrial growth along current right of ways

The coastal plants provide a local source of power that off loads the transmission circuits and also provide voltage support and stability to the entire system. The plants cannot simply be shut down; if they were, the transmission system would be overloaded, lines would burn out, and power could not be delivered.

Figure 8 - Location of Coastal Plants




LADWP's generation and transmission system must be able to meet the requirements noted below. The coastal in-basin plants play a critical role in meeting these requirements.

<u>Reliability Criteria</u>

It is essential that there is enough power in the system in the event of disruptions, equipment failures or power outages.  LADWP is required to have a plan for grid reliability. Its plan is predicated upon several criteria, which are discussed at length in the "Reliability Study: Final Report and Study Results" of December 31, 2010. (See Appendix 1, Grid Reliability Study).

<u>Demand & Reserve Power</u>

To ensure power system reliability and stability throughout the system, it is essential that all of LADWP's generating units be available to meet peak system demands. The reliability generation offloads transmission in various parts of the system. The effectiveness of each plant has differing impact on the different transmission paths. This requirement to have resources in specific areas of the system is known as the "reliability must run" - (RMR) requirement. In addition, all utilities must have reserve power available.

Multiple elements contribute to the reliability of the system; the North American Electric Reliability Corporation (NERC) reliability standards require that sufficient reserve generation capacity be maintained equal to the balancing authority's most severe single contingency (the largest loss of generation or transmission attributable to a single event) plus have a means to restore this reserve once it is placed into use.  The standards also set specific performance limits in regards to line loading and system voltage that must be met following credible transmission and generation events.

Resource Adequacy & Location

*Resource adequacy* is the availability of sufficient generation and transmission resources to meet customers' projected needs, plus reserves for contingencies. *Resource location* refers to the placement of generating sources within the transmission system, which is critical to maintaining system reliability after sudden disturbances, outages or equipment failures are experienced.

"Contingency" refers to the loss of any system component. Under the current NERC standards, at least 50 percent of *Contingency Reserves*[1] must be Spinning Reserve[2]. For LADWP, local and import transmission lines are vulnerable to failure and seasonal fires.

Replacement Reserve

Additional capacity must be available to restore contingency reserves following its deployment. This resource must be available within 60 minutes of a contingency event (such as an outage). Given LADWP's current generation portfolio, the system contingency plus replacement reserve requirement is approximately 1,100 MW.

System Stability

The rotating mass of large generating units provides stability (inertia) to the system which dampens fluctuations caused by changes in power demand and disturbances on the system. Reliable importation of power into Southern California requires sufficient inertia. Reducing generation in Southern California actually reduces the amount of power that can be imported.

"Regulation" of Renewable Resources

Most renewable resources produce electricity intermittently, and the amount of energy produced can fluctuate quickly from zero to full capacity and back, which presents operational challenges. Gas-fired, simple-cycle generator units capable of equally quick changes of generation in the opposite direction are able to compensate for energy swings and thus stabilize the system. This stabilization is known as "regulation".

Power Reliability Program (PRP)

LADWP established a Power Reliability Program, the goals of which include mitigating problem circuits and stations based on the types of outages specific to the facility, proactive maintenance and capital improvements based upon load growth, and establishing replacement cycles for facilities that are in alignment with the equipment's

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[1] Contingency Reserve

The capacity available to the Balancing Authority, that can be deployed in response to a generation or transmission resource loss. This capacity must at least equal the most severe single contingency.

[2] Spinning Reserve

Unloaded generation that is synchronized (connected) to the system and ready to serve additional demand.

life cycle. The PRP includes numerous replacement programs, including the transformers, pole replacement, and other necessary upgrades. The pole replacement capital program increases the number of poles replaced annually, with the goal of achieving an overall replacement cycle of 60 years (3,000 poles per year + 2,000 changed from normal business). Poles constitute a basic critical reliability element.

### 1.4 Current Policy Schedule Threatens Reliability

The OTC Policy compliance deadlines for LADWP are:
Harbor – 2015, Haynes – 2019, Scattergood – 2020.

This schedule presents a dilemma in that it will require that some of the existing units at the coastal plants be shut down simultaneously. This is not an option for LADWP, due to its responsibility to its customers under the City Charter and the requirement to comply with the NERC reliability standards.

The schedule does not allow existing units at the coastal plants to remain operational while new units are installed. The plants are located in densely-populated, and/or highly-industrialized urban areas where there is insufficient space to simultaneously construct replacement units that are compatible with closed-cycle cooling systems *and* keep the existing units in operation. Once a repowered unit has been put in service, only then can an existing unit be decommissioned and demolished to provide space for the next repowering phase.

As detailed above, existing units at the coastal plants provide local resource adequacy and are critical to meeting system demand, stability to the grid, and prevent overloading of transmission lines so that power can be delivered. In addition, imported power from the North cannot be transmitted to the southern and western areas of Los Angeles to fulfill the locational reliability requirements due to lack of transmission capacity to these areas. Therefore, the coastal plants' units must provide this power. Due to increased urbanization there is no real estate for adding new, or making substantial upgrades to existing local transmission lines within the City. Furthermore, LADWP is in the process of integrating VERS into its system; the coastal generating station units are critical to meeting system demand when the VERS are not generating power or their power output decreases and/or fluctuates rapidly. For these reasons, it is necessary to have new generation commissioned <u>prior to</u> removing existing units from service in order to maintain system reliability.

As mentioned earlier, the three coastal stations have a combined in-basin generating capacity of 2,839 MW, about 39% of LADWP's total capacity. Should natural disasters or other emergencies reduce or prevent the importation of power from the north to other portions of the City, the role of the coastal plants become even more critical.

The schedule stipulated in the Policy must be extended to prevent reliability impacts to LADWP's system. The solution is the extended compliance schedule LADWP has proposed, which represents an aggressive phased approach unit-by-unit.

**1.5. Proposed Necessary Schedule**

The schedule must allow for a methodical sequencing. The most inefficient units and those located right on the ocean (at Scattergood) are being replaced first followed by generating units that are most efficient.

The aggressive schedule provided below is predicated on a pace of two repowers per decade, and reflects replacement based on a unit-by-unit rather than a facility basis.

| | **Start Date** | **End Date** |
|---|---|---|
| Haynes 5&6 | 2007 | 2013 (See Figure HnGS7 in Appendix 6) |
| Scattergood 3 | 2010 | 2015 (See Figure SGS5 in Appendix 6) |
| Scattergood 1&2 | 2016 | 2024 (See Figure SGS7 in Appendix 6) |
| Haynes 1&2 | 2020 | 2027 (See Figure HnGS7 in Appendix 6) |
| Harbor 5 | 2025 | 2031 (See Figure HGS4 in Appendix 6) |
| Haynes 8 | 2028 | 2035 (See Figure HnGS7 in Appendix 6) |

See Attachment 1 – 2035 Schedule Outlay – Assumed no delays in every step of the process.

The following schedule was developed by identifying all the elements or tasks entailed in repowering and converting each coastal station from OTC to closed-cycle cooling. These include conceptual engineering, issuance of Requests for Proposal, demolition, construction and commissioning.

The time that is allocated for each element was determined by reviewing actual past and current repowering projects schedules and records.

The time that has been allocated should be considered aggressive rather than generous.  While it is LADWP’s intent that the repower projects will be undertaken in an expeditious manner, it must be noted that other entities – governing bodies and regulatory agencies - are necessarily an integral part of this process, and the final schedule is dependent upon their actions.

While there is some opportunity for overlap, many of these tasks must be completed in a sequential fashion, and some are contingent upon approvals by regulatory agencies.

Repowers with closed cycle cooling projects require complex “design/build” contracts. Development of specifications for the Request for Proposal (RFP) process often requires 9 or more months, but has been truncated to 7 months for this purpose.

As has been discussed earlier in this document, the limited space available at the coastal plants, combined with the need to keep existing units in operation while new units are installed, means a lengthier demolition process. The elements that comprise a generating station are interconnected; old units cannot simply be “unplugged.” Gas pipeline connections will have to be re-routed, for example. Vibrations from construction activities - including the destruction of earthen berms, removal of equipment, dismantling of other structures, demolition of concrete pads, grading and compaction - will impact the entire generating station and all of the equipment contained therein. Extraordinary care must be exercised to ensure that daily operations are not affected, delayed or halted due to demolition activities.

All power plants must observe multiple safety and national security procedures. In addition, LADWP must be a good neighbor and minimize construction impacts, primarily noise and vibration, to neighbors. These requirements and considerations, in concert with physical space constraints, will necessarily impact all phases of construction, from equipment delivery procedures and equipment laydown areas, to daily verification of construction crew identities. Against this background, schedules that are projected at 7.8 years per generating station are impressive. The HGS project will take less time – 6.8 years – because no demolition is required.

The time (duration) allocated for each task does not necessarily represent the total time that will be expended, due to overlapping of tasks. See the chart below for tasks, description, and time allotted:

## Chart 1 – Description of Repowering with Closed Cycle Cooling Tasks

| Task | Description | Time (months) | Comments |
|---|---|---|---|
| 1 | Conceptual Engineering & Emissions Modeling | 10 | A total of ten (10) months is allocated for these tasks. Should the EPA or SCAQMD request additional information or emissions modeling, a longer period of time will be required. For example, during the planning phase for the repowering of HnGS Units 5 and 6, this task took a full two years, because new regulations were promulgated and the EPA requested changes to the emissions modeling. For SGS Unit 3, there have also been delays due to modeling that has already extended the duration of this task. |
| 2 | Engineering & Permitting | 12 | These inter-related tasks will take approximately 12 months; please note that the SCAQMD will not issue an air permit until the CEQA process is complete. |
| 3 | CEQA | 18 | CEQA and permitting task can begin at the same time. |
| 4 | Prepare Request for Proposal (RFP) | 7 | Preparation of the RFP can commence two months prior to completion of the emissions modeling. |
| 5 | Prepare City Council Ordinance | 1 | An ordinance is required for design/build contracts. One month is allocated to obtain necessary approvals from LADWP manager, General Manager, and the LADWP Board of Commissioners. Can begin this task at the same time as start of CEQA. |
| 6 | City Council Approval of Ordinance | 1 | The ordinance must be submitted for assignment to a specific City Council meeting agenda; upon City Council approval the RFP can be issued. Approval of the ordinance is dependent upon approval of CEQA. It cannot be approved until CEQA is approved. |
| 7 | Advertise RFP, Review Proposals, Select Vendor and Board of Water and Power approval | 9 | An RFP cannot be advertised until both CEQA and the ordinance have been approved. |
| 8 | Award of Contract – City Council Approval | 2 | The design/build contract (agreement) must next be approved by the City Council; upon City Council approval, equipment procurement, demolition and/or construction can begin. |
| 9 | Procure Equipment | 20 | Equipment orders are placed. Cannot start until after City Council approval. |
| 10 | Demolition | 18 | Demolition will occur simultaneously with equipment procurement. Cannot start until after City Council approval |
| 11 | Construction | 24 | Construction will commence after demolition and will overlap with final stage of equipment procurement. |
| 12 | Commission New Units | 13 | If more than one unit is being commissioned, it is not necessary to commission them serially; ther can be some overlap. |
| 13 | Total Time for Project Completion | 94 months | |

2014 – 2019 Time Frame - Coal Divesture, Renewable Integration, Transmission System Upgrades and Trouble-Shooting New Technology:

During the time frame 2014 - 2019, LADWP will be implementing and complying with the following:

SB 1368 – stipulates that by 2018, LADWP cannot execute long-term contracts (of 5 or more years) with baseload plants that do not meet the emissions performance standard (EPS) of 1,100 pounds of $CO_2$ per each mega-watt-hour (MWH). The out-of-state, coal-fired plants now under contract to LADWP cannot meet this EPS, so LADWP must secure cleaner replacement power. LADWP will be replacing some coal-generated power, or 21% of the total, by 2018.

The California Air Resources Control Board (CARB) regulation to require 33% renewables by 2020. Progress toward the CARB 33% goal is to be measured at specific interim dates: 20% in 2012; 24% in 2015; 28% in 2018; 33% in 2020. LADWP will be integrating up to 33% renewables by the same end date.

Much of LADWP's current renewable energy is purchased through short –term contracts, LADWP does not intend to replace these, as they would leave LADWP very vulnerable to increasing competition for such power, and increase the risk of the Renewable Portfolio Standard (RPS) falling well below 20%.

Long-term contracts and the development of LADWP-owned renewable generation are the surest strategies for maintaining the current 20% RPS and achieving 33% by 2020.

Power Reliability Program – As discussed earlier, in order to be able to integrate the mandated renewables and ensure power system reliability, LADWP plans to do the following:

- Pole Replacement – Increase the number poles replaced annually
- Cable Replacement – Increase underground cable replacements from 40 miles to 60 miles per year
- Distribution Transformers – Priority-based replacements taking into account loading, number of customers, age, and neighborhood conditions
- Load Growth – Construct new distribution stations to support load growth
- Deteriorated vaults and obsolete equipment – Repair over 900 substructures, identify obsolete equipment and replace
- Station Transformers – Changing out 846 main transformers in Distribution, Receiving, and Switching Stations
- Underground transmission line circuit upgrades

Commissioning New Units and Trial Operation – The concurrent integration of renewables and new equipment at the Haynes Generating Station (repowered Units 5 and 6) and Scattergood Generating Station (repowered Unit 3) represents a steep learning curve for LADWP. Real-world data and institutional experience that have informed power system decisions for decades must be re-evaluated and revised. The installation of new generating units by itself constitutes a delicate balancing act. These are not "plug and go" pieces of equipment: their output, operations, and maintenance will need to be assessed daily, on a unit-by-unit, facility, and system-wide basis, over a period of time of at least three years. LADWP's renewable power supply can and will fluctuate rapidly and dramatically, in conjunction with seasonal demand peaks and lows. LADWP has no first-hand knowledge regarding the units' performance – such as start and response times-pertaining to its *own* system. This variability mandates a longer period of time over which the equipment can be evaluated and fine-tuned. LADWP will need a "buffer" period that will provide the time needed for trouble-shooting the new, quick start technology and the gathering of operational and performance data to improve performance and efficiency. Upgrades to the transmission system are equally vital for maximum output and diminished loss of power; these should logically coincide with the installation and troubleshooting of new units at the Haynes and Scattergood generating stations.

### 1.6. Demographics and Rates

The average Angeleno family consists of 3.6 people. The poverty level for a family of 4 is $22,400. The City of Los Angeles has 164,080 families, or 15.8% of the total, who live in poverty. Nearly three quarters of a million individuals (725,196), or about 19.1% of Angelenos, live in poverty.

The 2009 average median household in the City of Los Angeles is $48,570, which is lower than the statewide median. In comparison to the rate payer household incomes in other service territories, the median household of counties in SDG&E is $60,354 and the median household of counties in SCE service territory is $57,033.

Due to the demographics of the City of Los Angeles, even moderate rate increases will have a severe impact on LADWP's rate payers. Rate increases that may result from OTC compliance will be in addition to baseline rate increases intended to cover fuel, operation and maintenance costs.

### 1.7. Conclusion

Compliance with City Charter mandates to provide reliable, affordable power in an environmentally-sustainable manner can be achieved only with the extended schedule. LADWP is completely revamping its fuel mix in an aggressively short time frame that is unprecedented in the public or private sector. But there are realities that must be considered, and reliability is paramount. Reliability should be considered synonymous with "security."

There is limited transmission within the City of Los Angeles for the reasons previously noted, and imported power from the North cannot be brought to the Southern portions of LADWP's system due to the lack of the transmission capacity. There is no room to perform substantial upgrades to the intra-transmission lines. Due to associated balance and stability issues, reductions in local area generation reduces the amount of power that can be reliably imported via LADWP's transmission system. Imports into Southern California are impacted by all area generation. System load that is solely met by generation from a long distance is susceptible to voltage issues and can have stability problems under heavy transmission line flow.

The coastal power plant units provide voltage support and stability to the transmission system and therefore all units at these plants must be available for the reliability of the system. Time is also needed to upgrade the transmission system in order to be able to integrate the new variable resources and trouble-shoot new quick start technology.

The extended schedule sets an aggressively realistic, OTC compliance schedule that *relieves, to the extent possible, the hardship to LADWP's rate payers*, and provides reliability certainty and security for LADWP's grid system. In addition, OTC is completely eliminated. No earlier date is achievable.

The following items on pages 18 through 35 are specific data requests by the State Board for each implementation plan.

## Chapter 2. State Board Implementation Plan Requirements

2.1 Identify Compliance Alternative:

**Track 1 will be selected for all LADWP facilities**

2.2 Describe the general design, construction, or operational measures that will be undertaken to implement your selected alternative.

a. If Track 1 is selected, will the units be re-powered, or retrofitted, and will closed-cycle wet cycle cooling or dry cooling be employed:

**Units will be repowered and either closed –cycle wet cooling or dry cooling will be employed**.

b. If Track 2 is selected… –

**Not applicable, not using Track 2.**

c. If closed-cycle wet cooling is selected as a compliance alternative, the plan must address whether recycled water of suitable quality is available for use as make up water.

**At this time, it has not been determined whether or not wet cycle cooling will be utilized for any future re-power projects. However, modeling studies have commenced to determine the availability and suitability for the use of recycled water at Harbor, Haynes, and Scattergood generating stations as make up water should wet cycle cooling be chosen.**

2.3 Schedule

**See Attachment 2**.

2.4 Identify the time period, if any, when generating power is infeasible and describe the measures that will be taken to coordinate this activity through the appropriate electrical system balancing authority's maintenance scheduling process and/or infrastructure planning process.  For each period when power generation is infeasible, describe the reason for this constraint.

**Harbor Generating Station (HGS)**

There are no specific conditions or time periods when generation from the Harbor Generating Station (HGS) would be impacted by external conditions, except when a unit is off-line or there are transmission system limitations. HGS is only limited or impacted when units at the station are out for planned or unplanned outages or there are transmission limitations. Planned outages are coordinated on an on-going basis to ensure sufficient generation is available both system wide and at specific locations.

The Unit 5 is scheduled to have a planned outage once per year. The outage time varies and is driven by unit runtime, expected operation, type of maintenance required, and budget.

**Haynes Generating Station (HnGS)**

There are no specific conditions or time periods when generation from the Haynes Generating Station (HnGS) would be impacted by external conditions, except when a unit is off-line or there are transmission system limitations. HnGS is only limited or impacted when units at the station are out for planned or unplanned outages or there are transmission limitations. Planned outages are coordinated on an on-going basis to ensure sufficient generation is available both system wide and at specific locations.

Each unit is scheduled to have a planned outage once per year. The outage time varies and is driven by unit runtime, expected operation, type of maintenance required, and budget.

**Scattergood Generating Station (SGS)**

There are no specific conditions or time periods when generation from the Scattergood Generating Station (SGS) would be impacted by external conditions, except when a unit is off-line or there are transmission system limitations. SGS is only limited or impacted when units at the station are out for planned or unplanned outages or there are transmission limitations. Planned outages are coordinated on an on-going basis to ensure sufficient generation is available both system wide and at specific locations.

Each unit is scheduled to have a planned outage once per year. The outage time varies and is driven by unit runtime, expected operation, type of maintenance required, and budget.

**Operations**

Based on the last three years of operating data, LADWP will average approximately 20% outage time (planned and unplanned) for the units at the three generating locations per year. As units get older, equipment begins to fail and unplanned outages increase in frequency and duration. The need to keep generation capacity available to the system for grid reliability necessitates an extended compliance schedule. Taking too many units out of service at any one time could compromise the necessary reserve capacity of the system.

Another factor that will affect reliability is the increasing integration of renewable power sources in the coming years. The coastal plants will play a larger role in providing a balancing power source as the renewables phase in and out of availability due to wind and solar factors affecting their generation. The need for these plants to react quickly to changing power needs will be critical as these renewable sources are integrated into the system.

2.5 If implementation plans include re-powering of existing units, please provide as much detail as possible on the generating units:

**See Summary chart page 21 and following pages 22 - 30.**

a) The size (in Mega Watt) of the re-powered generating units;

b) Technology of the re-powered units (i.e., combined cycle, single gas turbines, etc.);

c) The amount of power that would still be generated during repowering process, and the ultimate generating output once the repowered process has been completed;

d) Timetable for the above repowering process;

e) Electrical characteristics of the new repowered generating units if available when implementation plans are submitted; and

f) Available information on obtaining required air permits and required offsets.

Chart 2 - Los Angeles Department of Water and Power Repowering Information for Existing Units
316 (b) Implementation Plan

| Existing Unit Description | Size of New Repowered Unit (s) (MW) | Technology of Repowered Unit | MW Produced by Unit(s) during Repowering Process | Ultimate Generating Output of New Unit (s) | Timetable for Repowering | Electrical Characteristics of the Repowered Unit | Available Information on Obtaining Air Permits and Offsets |
|---|---|---|---|---|---|---|---|
| Harbor 5 | 65 | Technology to be determined. Wet/dry Cooling Towers | Existing MW to remain in service until new unit on line. | 65 MW | 2029 - 2035 | To be determined | Permit Application not yet started |
| Haynes 1&2 | 444 | Technology to be determined. Wet/dry Cooling Towers | Existing MW to remain in service until new units on line. | 444 MW | 2024 - 2031 | To be determined | Permit Application not yet started |
| Haynes 5&6 | 600 | 6 Simple Cycle Gas Turbines with Dry Cooling | Existing 600 MW to remain in service until new units on line. | 600 MW | First Unit in Service by Jan 2013<br>All Units by June 1, 2013 | Fast Start<br>Full Load in 10 minutes<br>Automatic Control<br>Remotely Operated | Permit to Construct Issued 12/29/10<br>Offsets surrendered for PM10 |
| Haynes 8 | 250 | Technology to be determined. Wet/dry Cooling Towers | Existing 235 MW to remain in service until new unit on line. | 250 MW | 2034 -2040 | To be determined | Permit Application not yet started |
| Scattergood 1&2* | 367 | Technology to be determined. Wet/dry Cooling Towers | Existing MW to remain in service until new units on line. | 367 | 2019 - 2026 | To be determined | Permit Application not yet started |
| Scattergood 3* | 509 or 574 | One Combined Cycle and two Simple Cycle<br>or<br>Two Combined Cycles<br>with dry cooling | Existing 460 MW to remain in service until new unit on line. | 509 or 574 MW | In Service by Dec 31, 2015 | Generate at 13.8KV<br>Step up to 230KV and integrate into the grid | Permit Application has been initiated. Offsets will be surrendered prior to permit issuance. |

* Scattergood Generating Station currently generates 818 MW, 818 MW will be replaced with 818 MW; since Unit 3 will be replaced with 509 or 574 MW, Units 1 and 2 will be de-rated.

# Haynes Units 5&6

Haynes Units 5&6 is scheduled to undergo a repowering project that will bring the units into compliance with the Statewide Policy on the Use of Ocean Water for Once-Through Cooling (OTC). The following information is provided as requested in the Implementation Plan requirements.

Specific Information requested includes the following:

a) The size (in Mega Watts) of the new repowered generating units;

    **The project will replace both units with six, 100 MW Simple Cycle Gas Turbines. Net capacity of the repowered Units 5&6 will be 600 MW**.

b) The technology of the repowered units (i.e. combined-cycle, single gas turbines, etc.)

    **The new units scheduled to replace Units 5&6 will be six 100 MW Simple Cycle Gas Turbines with dry cooling for inter-stage cooling.**

c) The amount of power that would still be generated during the repowering process, and the ultimate generating output once the repowered process has been completed.

    **During the repowering process, both Units 5&6 (535 MW) will remain in service and available for generation. The units will not be retired until the new units are in place and functional. Once the new units are installed the output from these new units will be 600 MW and the existing units will be retired.**

d) The timetable for the repowering process

    **The construction, equipment procurement, and commission portions of the repowering with dry cooling project is scheduled to begin in April 2011 and will be completed by June 1, 2013.**

e) Electrical characteristics of the new repowered generating units if available

    **The new Simple Cycle Gas Turbines will be a fast start technology capable of reaching full load in 10 minutes. The units will have automatic generation control and will be capable of being remotely operated.**

f) Available information on obtaining required air permits and required offsets.

**The Permit to Construct for Units 11-16 (application Numbers 495664 through 495669) was issued by the South Coast Air Quality Management District on December 29, 2010. Most of the project was exempt from the offset requirement, per the provisions of SCAQMD Rule 1304(a)(2) which provides an exemption from the modeling and offset requirements on a MW-for-MW basis for replacements of steam boilers with advanced gas turbines. Offsets were surrendered by the LADWP for PM10 to cover the emissions associated with the small increase in capacity of the new units.**

# Scattergood Unit 3

Scattergood Unit 3 is scheduled to undergo a repowering project that will bring the unit into compliance with the Statewide Policy on the Use of Ocean Water for Once-Through Cooling (OTC). The following information is provided as requested in the Implementation Plan requirements.

Specific Information requested includes the following:

a) The size (in Mega Watts) of the new repowered generating units;

**This generating unit is scheduled to be replaced at the Scattergood Generating Station. The project will replace the unit with either One Combined Cycle Unit and Two Simple Cycle Units (509 MW) or with two Combined Cycle Units (574 MW).**

b) The technology of the repowered units (i.e. combined-cycle, single gas turbines, etc.)

**The new units scheduled to replace Unit 3 will be either:**
**One Combined Cycle Unit and Two Simple Cycle Units with dry cooling**
**OR**
**Two Combined Cycle Units with dry cooling**

c) The amount of power that would still be generated during the repowering process, and the ultimate generating output once the repowered process has been completed.

**During the repowering process, Unit 3 (460 MW) will remain in service and available for generation. The unit will not be retired until the new units are in place and functional. Once the new units are installed the output from these new units will be 509 MW or 574 MW as per the final design decision.**

d) The timetable for the repowering process

**The Unit 3 repowering project is scheduled to be in service by December 31, 2015.**

e) Electrical characteristics of the new repowered generating units if available

**The equipment will generate electricity at 13.8 KV and will then be stepped up to 230 KV and interconnected to the Scattergood Switch Yard**.

f) Available information on obtaining required air permits and required offsets.

**The Permit Application for the Scattergood Unit 3 project has been initiated by LADWP, but the Permit has not yet been issued. Most of the emissions will be exempt from the offset requirement per the provisions of SCAQMD Rule 1304(a) (2) which provides an exemption from the modeling and offset requirements on a MW-for-MW basis for replacements of steam boilers with advanced gas turbines. Offsets are anticipated to be surrendered for the planned increase in capacity prior to the issuance of the Permit to Construct.**

# Scattergood Units 1&2

Plans associated with Scattergood Units 1&2 that will bring the units into compliance with the Statewide Policy on the Use of Ocean Water for Once- Through Cooling (OTC) are still being determined at this time. Available information is provided as requested in the Implementation Plan requirements.

Specific Information requested includes the following:

a) The size (in Mega Watts) of the new repowered generating units;

   **367 MW**

b) The technology of the repowered units (i.e. combined-cycle, single gas turbines, etc.)

   **To Be Determined. The cooling system will utilize either wet or dry cooling towers and will not utilize OTC**.

   **At this time, it has not been determined whether dry or wet closed cycle cooling will be utilized. However, modeling studies have commenced to determine the availability and suitability of recycled water as make up water for Scattergood Units 1&2 .**

c) The amount of power that would still be generated during the repowering process, and the ultimate generating output once the repowered process has been completed.

   **The amount of power that would still be generated is to be determined, however during any repowering process, Units 1&2 (367 MW) will remain in service and available for generation. The unit will not be retired until the new unit(s) are in place and functional**.

d) The timetable for the repowering process

   **2016 – 2024 – Conceptual Engineering to Commissioning Units. Refer to Chapter 1 Section 5 of this Plan.**

e) Electrical characteristics of the new repowered generating units if available

   **To Be Determined**

f) Available information on obtaining required air permits and required offsets.

   **The Permit Application for the Scattergood Units 1&2 project has not yet been initiated**.

# Haynes Units 1&2

Plans associated with Haynes Units 1&2 that will bring the units into compliance with the Statewide Policy on the Use of Ocean Water for Once-Through Cooling (OTC) are still being determined at this time. Available information is provided as requested in the Implementation Plan requirements.

Specific Information requested includes the following:

a) The size (in Mega Watts) of the new repowered generating units;

   **444 MW**

b) The technology of the repowered units (i.e. combined-cycle, single gas turbines, etc.)

   **To Be Determined. The cooling system will utilize either wet or dry cooling towers and will not utilize OTC**.

   **At this time, it has not been determined whether dry or wet closed cycle cooling will be utilized. However, modeling studies have commenced to determine the availability and suitability of recycled water as make up water for Haynes Units 1&2 .**

c) The amount of power that would still be generated during the repowering process, and the ultimate generating output once the repowered process has been completed.

   **The amount of power that would still be generated is to be determined, however during any repowering process, Units 1&2 (444 MW) will remain in service and available for generation. The unit will not be retired until the new unit(s) are in place and functional.**

d) The timetable for the repowering process

   **2020 - 2027 – Conceptual Engineering to Commissioning Units. Refer to Chapter 1 Section 5 of this Plan.**

e) Electrical characteristics of the new repowered generating units if available

   **To Be Determined**

f) Available information on obtaining required air permits and required offsets.

**The Permit Application for the Haynes Units 1&2 project has not yet been initiated.**

# Harbor Unit 5

Plans associated with Harbor Unit 5 that will bring the unit into compliance with the Statewide Policy on the Use of Ocean Water for Once-Through Cooling (OTC) are still being determined at this time. Available information is provided as requested in the Implementation Plan requirements.

Specific Information requested includes the following:

a) The size (in Mega Watts) of the new repowered generating units;

**65 MW**

b) The technology of the repowered units (i.e. combined-cycle, single gas turbines, etc.)

**To Be Determined. The cooling system will utilize either wet or dry cooling towers and will not utilize OTC.**

**At this time, it has not been determined whether dry or wet closed cycle cooling will be utilized. However, modeling studies have commenced to determine the availability and suitability of recycled water as make up water for Harbor Unit 5.**

c) The amount of power that would still be generated during the repowering process, and the ultimate generating output once the repowered process has been completed.

**To Be Determined, however during any repowering process, Unit 5 (65 MW) will remain in service and available for generation. The unit will not be retired until the new unit(s) are in place and functional**.

d) The timetable for the repowering process

**2025 - 2031– Conceptual Engineering to Commissioning Units. Refer to Chapter 1 Section 5 of this Plan.**

e) Electrical characteristics of the new repowered generating units if available

**To Be Determined**

f) Available information on obtaining required air permits and required offsets.

**The Permit Application for the Harbor Unit 5 project has not yet been initiated.**

# Haynes Unit 8

Plans associated with Haynes Unit 8 that will bring the unit into compliance with the Statewide Policy on the Use of Ocean Water for Once-Through Cooling (OTC) are still being determined at this time.  Available information is provided as requested in the Implementation Plan requirements.

Specific Information requested includes the following:

a) The size (in Mega Watts) of the new repowered generating units;

   **250 MW**

b) The technology of the repowered units (i.e. combined-cycle, single gas turbines, etc.)

   **To Be Determined.  The cooling system will be either wet or dry and will not utilize OTC.**

   **At this time, it has not been determined whether dry or wet closed cycle cooling will be utilized. However, modeling studies have commenced to determine the availability and suitability of recycled water as make up water for Harbor Unit 5**.

c) The amount of power that would still be generated during the repowering process, and the ultimate generating output once the repowered process has been completed.

   **To Be Determined, however during any repowering process, Unit 8 (250 MW) will remain in service and available for generation.  The unit will not be retired until the new unit(s) are in place and functional.**

d) The timetable for the repowering process

   **2028 – 2035 – Conceptual Engineering to Commissioning Units. Refer to Chapter 1 Section 5 of this Plan.**

e) Electrical characteristics of the new repowered generating units if available

   **To Be Determined**

f) Available information on obtaining required air permits and required offsets.

   **The Permit Application for the Haynes Unit 8 project has not yet been initiated.**

2.6. Identify the transmission configuration around the units, and specify planned upgrades and known contingencies related to these transmission facilities, so as to document awareness of transmission improvements as part of the generation planning process.

**Reliable electric power has been a cornerstone objective of LADWP since it began offering municipal electricity in 1917. Historically, LADWP's Power System reliability has consistently placed in the top quartile of the electric utility industry, and it is LADWP's goal to continue this into the foreseeable future. However, as a result of aging electrical distribution infrastructure, there are significant challenges for LADWP to continue to maintain these reliability goals. Most of the transmission system in the City is between 40-70 years old and requires significant resources to maintain and plan for replacement.**

**The present Los Angeles basin transmission system is capable of handling the expected system peak load for the next four years. To support long-term growth, LADWP is exploring increased utilization of the basin transmission system, or "beltlines" by dynamically rating these transmission lines to take advantage of their higher current-carrying capacity during cooler weather. This technique to upgrade capacity is currently being studied on the Valley-Toluca and Rinaldi-Air Way transmission lines. In addition, it is anticipated that one underground 138-kV circuit will be replaced each year in order to maintain transmission reliability.**

**<u>Harbor Generating Station</u>**

Harbor Units 1 & 2 are currently connected to the electric grid system by a 138-kV circuit dedicated to each unit. The remaining Harbor units, Unit 5 and five simple cycle turbines, feed into Receiving Station (RS) Q which is connected to the remainder of the system by two 138-kV circuits. The generation is not limited by transmission although a scheme is in place to trip units upon loss of a circuit during periods of high generation. However, a project to reconfigure the transmission from the Harbor Generating Station in order to increase flexibility and eliminate constraints is under construction. The multi-faceted RS-C by pass project will allow for new terminations for Harbor Units 1 & 2 and the creation of new circuits; that will increase transmission reliability in the Southern portion of the City.

**Haynes Generating Station**

Haynes is connected by four 230-kV lines to the electric grid system. The transmission capacity with all lines in service is sufficient to transmit the full output of the plant. Generation limitations can occur with all units on line and a transmission line out of service. Transmission system work is scheduled in order to avoid creating a generation limitation.

**Scattergood Generating System**

Scattergood Generating System is connected to the electric grid system by two 138-kV and one 230-kV circuits. The transmission is marginally sufficient to transmit the full output of the units. A scheme is in place to trip units upon loss of a circuit during periods of high generation. Transmission work is scheduled in order to avoid creating a generation limitation. A new 230-kV circuit is in the planning stages to correct this issue. This new cable circuit is 15 miles long and will operate at 230-kV. This cable project will allow for increased transmission of power from Scattergood Generating Station to Receiving Station K. The new cable system will utilize cross-linked polyethylene insulation instead of paper impregnated with oil. The new cable system will eliminate the environmental hazards of oil and require less maintenance. This new circuit is planned for commercial operation by 2014.

2.7 Please provide any prior studies that accurately reflect current impingement or entrainment impacts. Prior impingement studies must accurately characterize the species currently impinged and their seasonal abundance.

For the Harbor Generating Station, submit a new or updated Report of Waste Discharge (ROWD) Application. For all generating stations, submit the last five years of monitoring information prescribed by the NPDES permits.

**Please refer to Appendix 2 for LADWP Impingement Mortality and Entrainment (IM&E) Reports for the Scattergood, Haynes, and Harbor Generating Stations.**

**Please refer to Appendix 3 for LADWP Annual Reports for Scattergood, Haynes, and Harbor Generating Stations.**

**Please refer to Appendix 4 for LADWP Report of Waste Discharge Application for Harbor Generating Station.**

In addition, you must also comply with Immediate and Interim Requirements:

1. By October 1, 2011: for existing power plants with offshore intakes, shall install large organism exclusion devices having a distance between exclusion bars of

no greater than nine inches, or other exclusion devices, deemed equivalent by the State Water Board.

**LADWP's only generating station with an offshore intake is the Scattergood Generating Station (SGS). Fifteen (15) exclusionary bars (panels) were installed at the intake riser velocity cap at SGS on February 20, 2008, to prevent medium/large marine animals from getting into the cooling water intake structure. Each panel is approximately 6'-6" by 5'-11" and consists of 8 bars equally spaced at 9" from each other.**

2. No later than October 1, 2011, an existing power plant that includes a unit that is not directly engaged in power-generating activities or critical system maintenance must cease intake flows, unless you demonstrate to the State Water Board that a reduced minimum flow is necessary for operations. Therefore, by April 1, 2011, you must provide information regarding when it is likely that each unit in your facility may not be generating power, or when you are performing critical system maintenance that would result in the cessation of intake flows. This information may be provided in terms of likely months when there will be no intake flow, with the understanding that if a need for power arises, that intake flows will re-start, as long as appropriate documentation is later provided regarding that unexpected power demand. If a reduced minimum flow is necessary for operations during the period when power is not typically generated, then you must define specifically why that is the case and provide an estimate of minimum flows as compared to historic flow during corresponding months 2000-2005 when power is not typically generated.

**As a vertically integrated utility, LADWP must maintain sufficient reserve power to ensure grid reliability while also meeting the current demand for electricity. All units are, at all times, involved in power generating activities, that includes standby status in order to bring units online as necessary due to spikes in the demand, unplanned outages that may occur at a generating unit's location or other facilities, or due to variability of the variable energy resources (VERs), meaning wind and solar.**

**The circulating water pumps at the three coastal generating stations need to be maintained in an operational ready condition, meaning that water needs to flow through the system at all times. If the cooling water flow through the condensers is stopped, the system will be compromised by biofouling and affect the readiness of the units to be brought back online when needed.**

**As LADWP integrates VERs into its generation portfolio, it is essential that all of the generating units be available to meet peak system demands and to balance the electric needs of the grid**

**system due to the variability of the VERs. All units are generating or in standby status in order to meet reliability must run (RMR) requirements and NERC standards.**

**Typically, generating units in LADWP's system are brought down once per year for planned maintenance. This planned maintenance typically occurs between October and May during the period of time when peak demand for power is lowest. These maintenance activities can last from weeks to months depending upon the nature of the maintenance activity and would constitute the periods of time when power would not be generated from the units. These outages are variable and subject to change so no set time frames are established for each unit being down at a given time each year.**

3. Interim Mitigation Measures
   The State Policy requires existing power plants to "*implement measures to mitigate the interim impingement and entrainment impacts resulting from the cooling water intake structure(s), commencing October 1, 2015 and continuing up to and until the owner or operator achieves final compliance. The owner or operator must include in the implementation plan, described in Section 3.A below, the specific measures that will be undertaken to comply with this requirement.*"

### 3.1 Description of Interim Mitigation for Harbor, Haynes, and Scattergood GS

**As an environmental leader, LADWP intends to eliminate rather than just reduce its use of OTC. And until that goal is achieved, interim IM and E mitigation measures will be implemented.**

**A velocity cap was installed at LADWP's SGS in 1958; a new model replaced the original in 1974. The cap redirects the flow of the cooling water from a vertical to a horizontal direction, and also minimizes the velocity at which the water is pulled into intake pipes, to help prevent impingement. At the request of LADWP, in 2006, MBC Applied Environmental Sciences, Tenera Inc., and URS Corporation performed an Effectiveness Study on the velocity cap IM reductions. It was found that the velocity cap effectiveness is 97.6% for reductions in abundance and 95.3% effective in reduction of biomass. Since 2008, SGS has had exclusionary bars to exclude medium to large marine mammals.**

**To build upon these accomplishments, LADWP has convened industry, scientific and other stakeholders to explore additional mitigation opportunities. LADWP plans to help foster the development of new technologies, and improvements to existing technologies, through jointly-sponsored pilot studies. Such studies will greatly assist in the realization of commercially-available, cost-effective, and reliable IM and E mitigation**

**technologies. Potential partners include the Electric Power Research Institute, Inc. (EPRI) and the West Basin Municipal Water District. EPRI is an independent, nonprofit organization that conducts research and development relating to the generation, delivery and use of electricity, and provides technology, policy and economic analyses. The West Basin Municipal Water District is a public agency that owns a desalination demonstration facility, provides drinking and recycled water to its 185-square mile service area and delivers 30 million gallons of recycled water throughout the South Bay area of California.**

**In addition, the State Board has identified the preferred mitigation method as providing funding to the California Coastal Conservancy that will ultimately be used "*for mitigation projects directed toward increases in marine life associated with the State's Marine Protected Areas in the geographic region of the facility.*" The California Coastal Conservancy has identified several restoration projects in the South Coast region that, when implemented, would provide increases in habitat and production of marine life.**

**The LADWP proposes to provide funding to the Coastal Conservancy as interim mitigation from October 1, 2015 and continuing up to and until final compliance. The amount provided will be based on the actual cooling water intake flow of each unit during each year. Discharge data submitted to the State Water Resources Control Board and the Los Angeles Regional Water Quality Control Board will be used for the volume calculations. LADWP will provide three dollars ($3.00) for each one million gallons ($10^6$ gallons) withdrawn by each unit. This dollar amount was determined jointly by the SWRCB Chief Deputy Director and LADWP in August 2010 and is based on cost analyses of actual mitigation projects overseen by the SWRCB.**

**This approach will allow for consistent implementation of the policy among all the plants required to conduct interim mitigation. By providing funding on an annual basis it also addresses uncertainties on the volume of cooling water necessary to support operations at the facilities. This approach also avoids the uncertainties that are associated with the implementation of any restoration project and the difficulties in determining the appropriate level of funding for projects that might continue to require funding and provide benefits well beyond the date when final compliance is achieved.**

**Glossary**

| | |
|---|---|
| Closed-cycle cooling | There are two types of closed-cycle cooling: wet and dry |
| Combined cycle unit | A generation configuration where the waste heat from a combustion turbine generator is channeled through a heat recovery steam generator (HRSG); this produces steam, which is then processed through a steam turbine to generate power. Combined cycle plants are highly efficient and produce very low emissions. They are typically intended to operate as an intermediate resource. |
| Compatibility | Units or turbines must be compatible with cooling towers |
| Distribution system | Distribution systems “step down” or lower the high-voltage power so it is can be used in homes and businesses. |
| Distributing station | Distributing stations deliver power in specific geographic areas of LADWP’s service territory |
| Facility | The entire power plant or generating station |
| Generation | The creation of energy/power/electricity |
| Grid | Generally, the entire transmission (and distribution)system; also called the “system” |
| In-basin | Located within the Los Angeles metropolitan area |
| IOU | An IOU is a private sector company utility that is owned by its investors (shareholders): **I**nvestor-**O**wned **U**tility |
| Load Zone | A concentration of load; a center point of a load zone or area |
| Municipal/Muni/MOU | A municipal utility is one that is owned by a government agency or entity |
| OTC | Once-through-cooling: the use of coastal or estuarine water to cool power plant turbines or units |
| Reliability | The certainty that the utility can provide sufficient power to all of its customers at all times |
| Re-power | Installation of more energy-efficient generating units (turbines) to replace older, less-efficient units |

| | |
|---|---|
| | Note: A facility can be re-powered only with new turbines/units |
| Retrofit | Installation of new cooling tower<br>Note: A facility can be retrofitted only |
| Service territory | The entire area for which LADWP provides power and water. As a municipal utility and City of Los Angeles department, LADWP serves the entire Los Angeles community. |
| Simple cycle unit | An electric generator powered by a combustion turbine that has no provision for waste heat recovery. |
| Transmission | In general, the sending of power over transmission and/or distribution lines. Transmission lines typically carry high-voltage power from the source (the power plant or generating station) to substations that lower the voltage |
| Unit | The equipment that generates power; a turbine or generating unit |
| Vertically-integrated | A utility that owns generation, transmission and distribution systems –a complete system. Many utilities own only one or two elements. |
| Voltage | Is an energy pressure or potential that causes current to flow in a circuit. |

**References**

Annual Reports for HGS, HnGS, SGS (IX, page 27) – Appendix 3
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US Census 2005-2009, American Community Survey
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Impingement Mortality and Entrainment Studies

Harbor Generating Station
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June 28, 2007, Velocity Cap Effectiveness Study

Los Angeles City Charter (II. LADWP profile, page 4)

LADWP Integrated Resources Plan (IRP) (II. LADWP profile, page 6)

North American Electric Reliability Corporation (NERC) reliability standards
(III. System reliability, page 6)

Once-Through-Cooling Policy (I. Introduction, page 4)
  Track 1 (IX, page 14)
  Track 2 (IX, page 14)

Power Reliability Program (IV, LADWP system reliability, page 7)

Power System Reliability ranking (LADWP in top quartile of electric utility industry) – HnGS unit 8, page 26

Rates, LADWP (VII, page 12)

Reliability Study: Final Report and Study Results, December 31, 2010 (IV, page 7) - Appendix 1

Renewable Portfolio Standard (I, page 4)

Senate Bill (SB) 1368 (VI-page 11)

Waste Discharge Application, HGS (IX, page 27) – Appendix 4

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## Attachments 1 – 3