Los Angeles Department of Water & Power

STATE WATER RESOURCES CONTROL BOARD
July 19, 2011

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

Why 2020 Doesn't Work

System Reliability

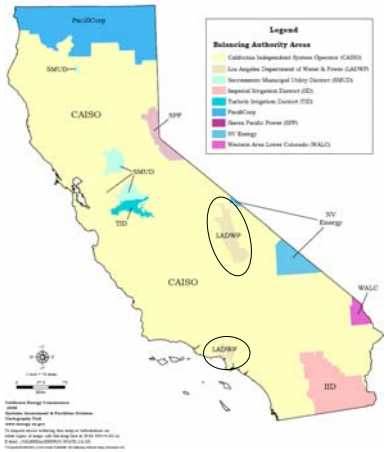
- Coastal units are critical to system reliability
- Cannot take any plants off-line until replaced
- Physical space at sites requires sequential rebuild
- 2015 to 2020 is intense power supply change for LADWP without adding complexity of replacing coastal power plants concurrently

Financial

- 2015-2020 is most capital intensive period in LADWP history – worst possible time to add more debt
- Debt Capitalization targets will be exceeded with 2035 Schedule, increased further with 2020 Schedule if it was physically possible
- 2020 Schedule would add 6% rate increase between 2015 and 2019 compared to 2035 Schedule

- How the Power System Works
- Power System Basics
- Why Repower?
- Alternate Technologies for Power Plant Cooling
- Implementation Plan
  - Technology
  - Schedule
  - Cost
- Why 2020 Doesn't Work

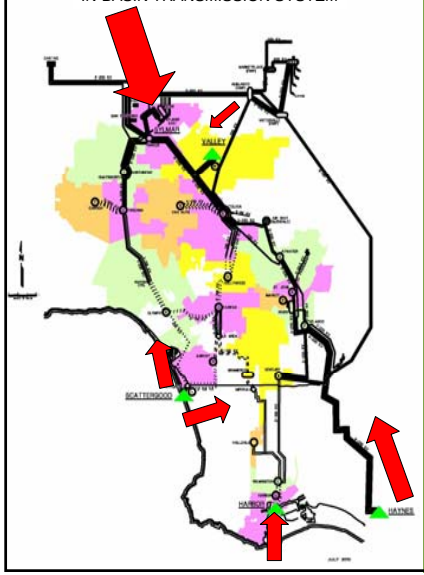
How the Power System Works



CA Balancing Authority Area

LADWP's External Transmission

IN-BASIN TRANSMISSION SYSTEM



How the Power System Works

LADWP's transmission system was initially constructed to move power from the coastal plants to the Downtown and Valley areas in a south to north direction.

Hydroelectric resources, imported power, and large scale renewables enter the system from north and must travel southward to our customers.

LADWP's transmission system is not capable of supplying full system requirements from imported power.

Cannot move unlimited amounts of power around the City.

Power System Basics

- All units are needed at the coastal plants to allow for potential forced outages and to meet the minimum capacity requirements.
- LADWP does not have the flexibility to take a unit out of service until the new unit is on-line.
- Seasonal studies performed to determine peak day requirements.
- Daily studies performed based on what we expect that day.

Power System Basics

ELECTRIC POWER SYSTEM

- Systems are interconnected networks with 3 main elements - generation, transmission, and distribution.
- Power generation (supply) and power load (demand for power) must be balanced – very close to equal *continuously.*
- Systems must be kept within operational limits so that no single fault or failure can cause the system to fail (shut down).
- All electric utilities develop multiple scenarios: Consider various power demands, the loss of different amounts of generating power at different units and stations, the availability or lack of power via specific transmission lines, etc. or "reliability assessments".

Power System Basics

TRANSMISSION SYSTEMS

- Electricity "flows" or travels over transmission lines much like water through rivers.
- Where as a river flows into a lake, electricity flows into a load center.
- Water can only be withdrawn from the lake at a rate that the river can resupply it.
- Customer demand can only be supplied from transmission up to its capacity.
- Additional demand must be supplied from a local source.

Power System Basics

TRANSMISSION SYSTEMS (cont.)

- Transmission systems are intended to operate at constant voltage (or "strength" – akin to water pressure in a hose).
- This constancy is required for customer's equipment (computers, motors, etc) to operate properly.
- The system must be designed and operated so that electrical equipment failures or other events will not result in excess current on a transmission line overloading it.
- Each piece of equipment within the system plays a critical and carefully calibrated role in maintaining system reliability.

Power System Basics

RELIABILITY REQUIREMENTS

- The reliability of a system is dependent upon resource adequacy and location

  Reliability = Resource Adequacy + Resource Location

- LADWP is mandated to have a certain reserve in the event of an emergency
- LADWP must meet the Western Electricity Coordinating Council (WECC) and North American Electric Reliability Corporation (NERC) standards at all times.

Who is NERC and WECC

- As of June 18, 2007, the U.S. Federal Energy Regulatory Commission (FERC) granted the North American Electric Reliability Corporation (NERC) the legal authority to enforce reliability standards with all users, owners, and operators of the bulk power system in the United States, and made compliance with those standards mandatory and enforceable.
- NERC has the legal authority to enforce compliance with NERC Reliability Standards, which it achieves through a rigorous program of monitoring, audits and investigations, and the imposition of financial penalties and other enforcement actions for non-compliance.
- The Western Electricity Coordinating Council (WECC) is the regional arm of NERC charged with monitoring compliance with the Reliability Standards in the Western United States.

Fire Risks to Reliability

Power System Basics

Reliability Issues with the OTC Policy:

- The three coastal plants' units represent 84% of the in-basin capacity and are critical to maintaining voltage support and balance the entire system.
- Therefore, in order to maintain energy supply and mandated reliability requirements, LADWP cannot relinquish any of the megawatts provided by the current coastal plants.
- There is insufficient space at the plants to continue operating existing generating units while simultaneously building new ones if had to do all upgrades at the same time.
- Therefore, multiple units at the generating stations would have to be shut down simultaneously to provide space in order to meet the 2020 deadline.

Limits on Coastal Plant Outages

Coastal Plant Capacity	Haynes	Scattergood	Harbor
Plant Capacity (MW)	1510	785	463
Plant Capacity with loss of largest element (MW)	960	340	235
Peak Day - All lines in service			
Capacity Required (MW)	1056	458	397
Peak Day - Loss of Line Scenario 1			
Capacity Required (MW)	1510	785	463
Maximum coastal generation may be insufficient under certain conditions			
Peak Day - Loss of Line Scenario 2			
Capacity Required (MW)	1510	615	463
Maximum coastal generation may be insufficient under certain conditions			
Peak Day - Loss of Line Scenario 3			
Capacity Required (MW)	1510	785	463
Maximum coastal generation may be insufficient under certain conditions			
Peak Day - Valley Combined Cycle N/A			
Capacity Required (MW)	1510	603	463
Maximum coastal generation may be insufficient under certain conditions			

Note 1: Harbor generation can cover Haynes or Scattergood shortfall to a limited extent
Note 2: All scenarios assume Valley Generating Station available except as noted.
Note 3: All scenarios assume Burbank Magnolia on line. Otherwise additional Haynes and/or Harbor required if available.

Limits on Coastal Plant Outages

- Sufficient capacity must be available to meet reliability requirements after accounting for forced generator outages.
- Transmission outages increase the coastal plant capacity requirement.
- Insufficient coastal generating capacity may lead to loss of customer supply.

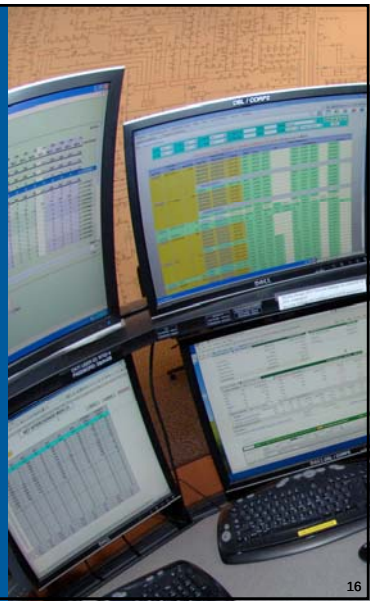
Why do we need to Repower?

To comply with OTC Regulations

Need plants' capacity and location where they are to meet System Load and site-specific reliability requirements

There is no other current technologies which will meet the OTC Regulations

Retrofitting older units is not environmentally and economically beneficial



Alternate Technologies for Power Plant Cooling

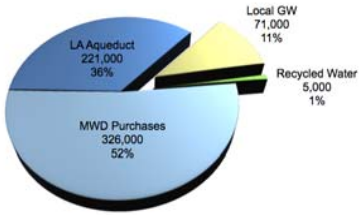
LADWP is committed to 100% elimination of OTC

Use of reclaimed water (RCW) for OTC

- Insufficient volume – Not enough
  - Scattergood requires 495 MGD at peak
  - Hyperion's daily flow was 180 – 410 MGD in 2004-2006
  - In 2004-2006, the total flow from Hyperion did not meet Scattergood's cooling water requirements over 57% of the time
  - Due to LADWP's successful water conservation efforts, the wastewater flow to Hyperion has declined
    - July 2006: Daily Wastewater Flow of 190 – 450 MGD
    - July 2009: Daily Wastewater Flow of 140 – 390 MGD

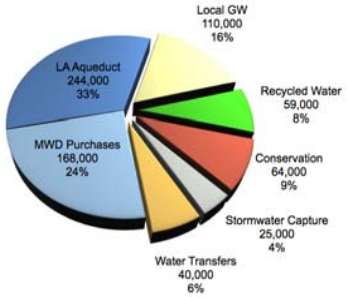
Water Supply Sources

FY 2006 – 2010
Average Total: 622,000 AFY*



*** Excludes 100,000 AFY of water conservation**

FY 2034 – 2035
Projected Total: 647,000 AFY*
(plus 64,000 AFY new conservation = 711,000)



Any reclaimed water should be used to displace potable water use.

Retrofitting Existing Plants with Closed-Cycle Cooling

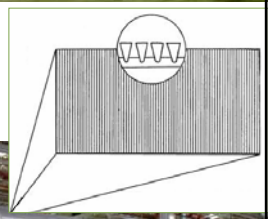
- Reliability Issue - Cannot take a unit out of service without new capacity in place.
- Technical and Engineering Issues
  - Complex conversion (condenser size)
  - Limited cooling options (wet cooling towers)
  - Poor use of potable or reclaimed water
- High retrofit cost of a unit with limited remaining life.

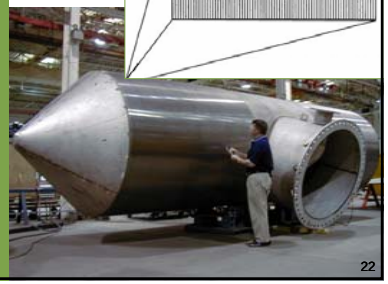
Alternate Technologies for Power Plant Cooling – Wet Cooling Towers

Alternate Technologies for Power Plant Cooling - Dry Cooling Towers

Implementation Plan – Technology

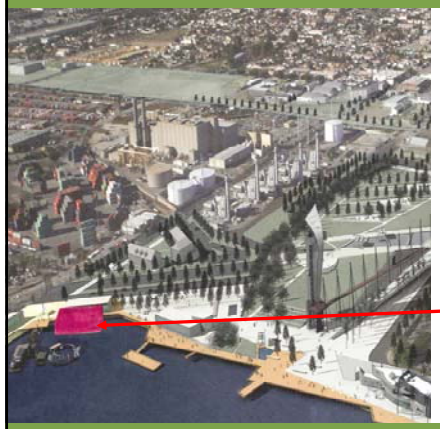
Cylindrical Wedgewire Screens

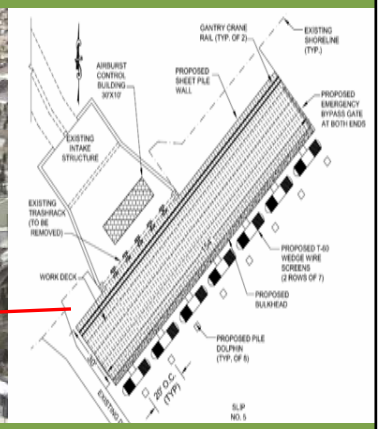




Implementation Plan – Technology

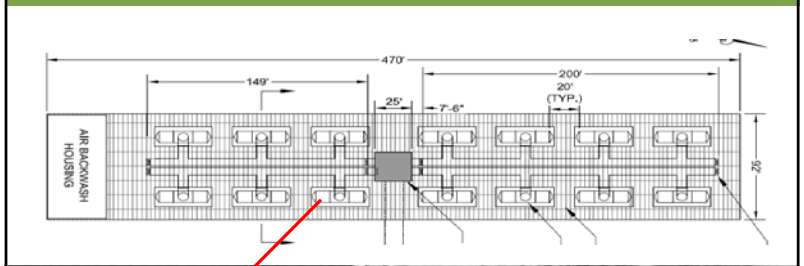
Cylindrical Wedgewire Screens - Harbor Generating Station



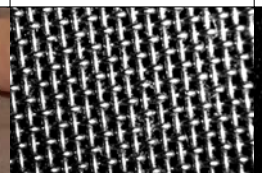
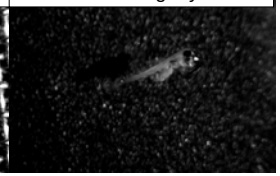
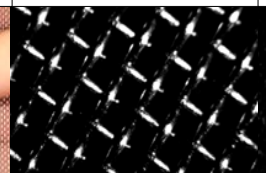
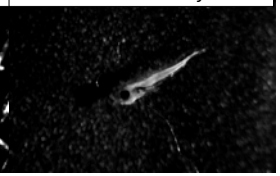


Implementation Plan – Technology

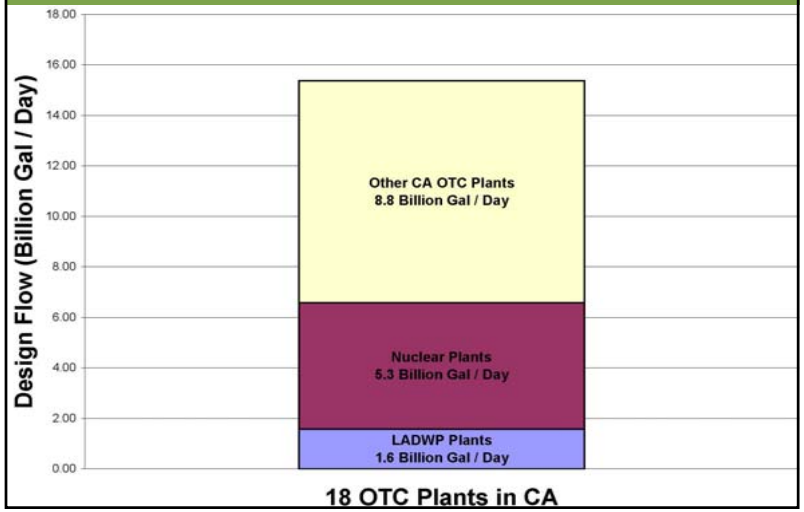
Cylindrical Wedgewire Screens - Scattergood Generating Station



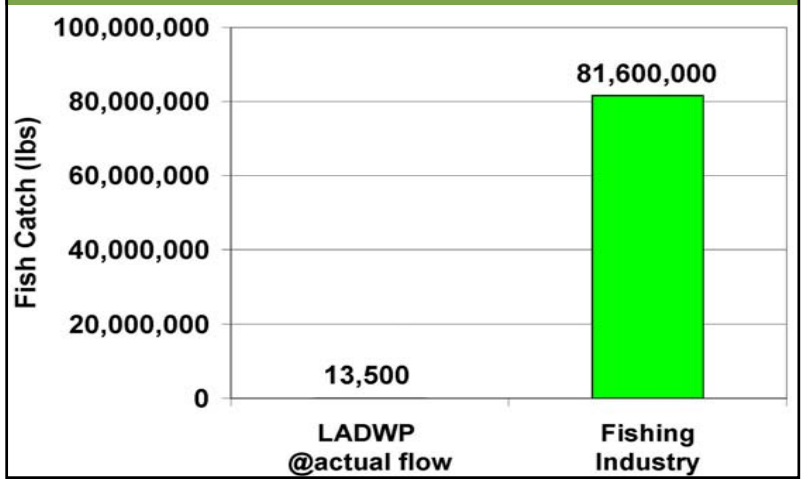
Implementation Plan – Technology

Actual	1.6x Magnification	1.6x Magnification
0.2 mm Stainless Mesh	0.2 mm Stainless Mesh	2.1 mm goby
		
0.5 mm Stainless Mesh	0.5 mm Stainless Mesh	2.3 mm blenny
		

Comparison of OTC Usage in CA



Fish Catch in Greater Los Angeles Area in 2006



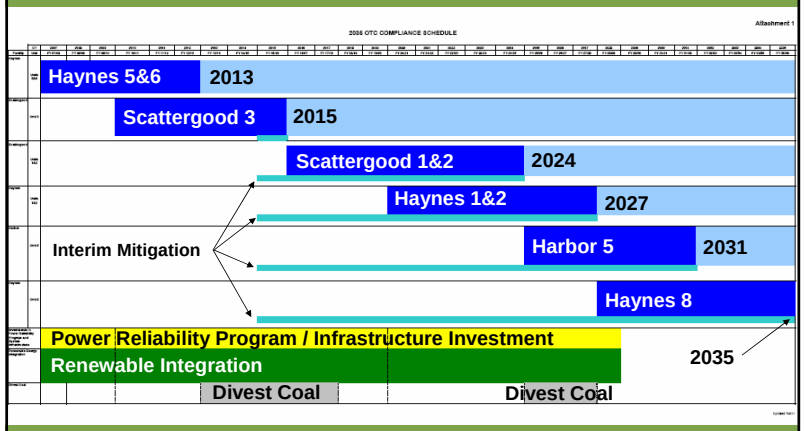
Repowering Schedule - 2035

LADWP'S 9 Units Utilizing OTC	In-Service Date
Haynes - Units 5 And 6	December 31, 2013
Scattergood - Unit 3	December 31, 2015
Scattergood - Units 1 And 2	December 31, 2024
Haynes - Units 1 And 2	December 31, 2027
Harbor - Unit 5	December 31, 2031
Haynes - Unit 8	December 31, 2035

Order of repowerings based on:

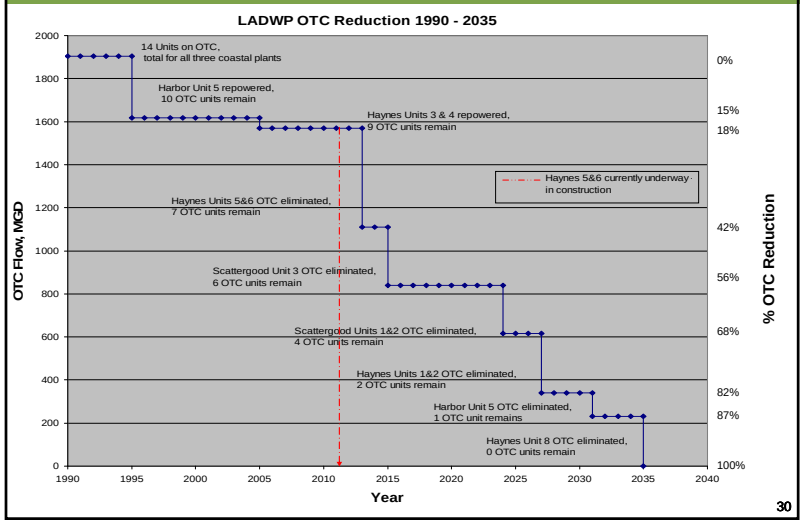
- Reliability
- Environmental Benefits
- Forecasted Capacity Factor of Units

Implementation Plan - Schedule



Please refer to 11 x 17 Schedule

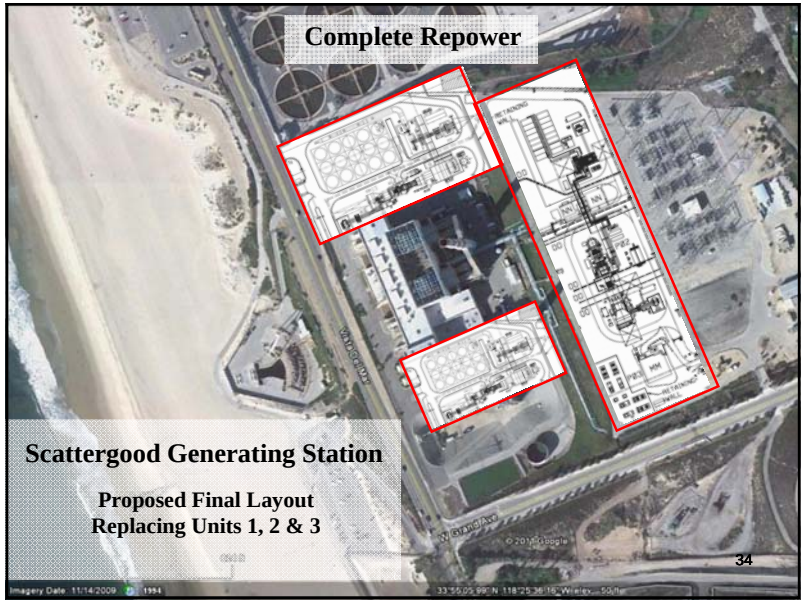
LADWP OTC Reduction 1990 - 2035



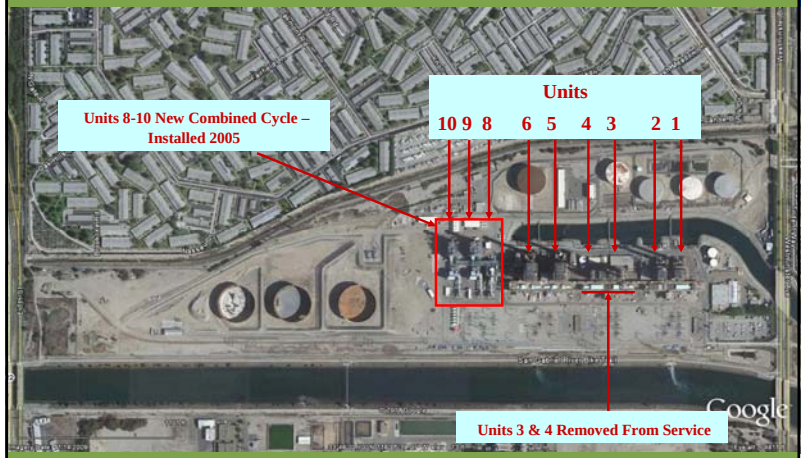
New Unit Layout
Phase 1
Phase 1
Unit 2
Unit 1
Unit 3
Scattergood Generating Station
Phase 1
Replace (Decommission) Unit 3
31

Phase 1
Phase 1
Unit 2
Unit 1
Unit 3
Scattergood Generating Station
Phase 2
Demolish Unit 3
32

Phase 1
Phase 1
Unit 2
Unit 1
Scattergood Generating Station
Phase 3
Replace/(Repower) Units 1&2
33

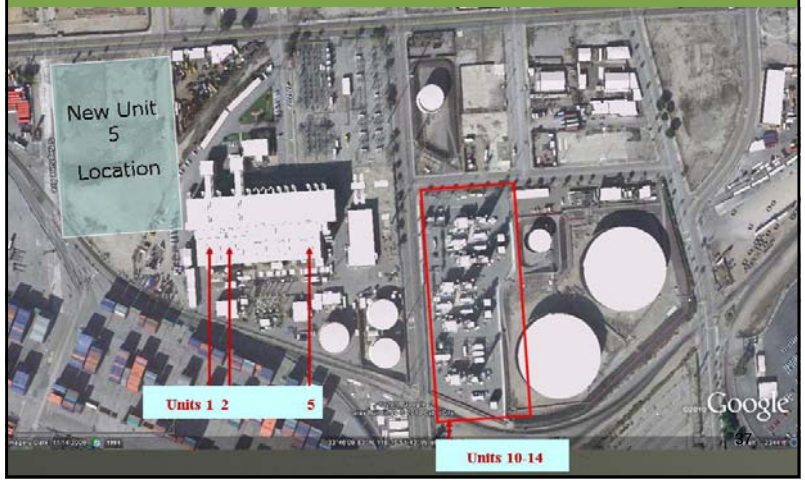

Complete Repower
Scattergood Generating Station
Proposed Final Layout
Replacing Units 1, 2 & 3
34

Haynes Generating Station
Current Site Layout



Haynes Repowering Project
Proposed Site Development

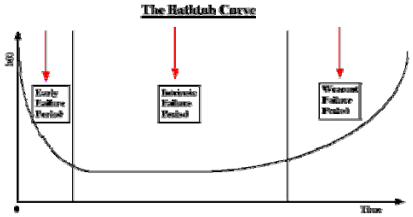
Harbor Repowering Project Proposed Site Development



Other Considerations

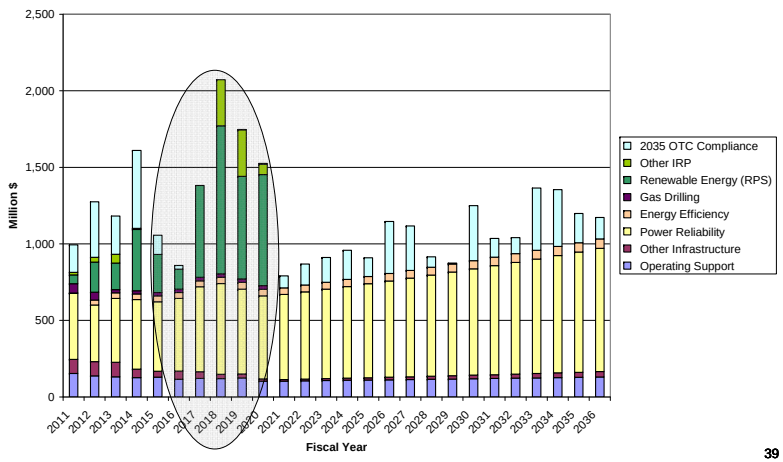
Timeframe 2014- 2020:

- SB 1368 – LADWP will be replacing some coal-generated power, or **30%** of coal capacity, by 2018
- SBx1-2 – LADWP will be integrating up to **33%** renewables by 2020
- SB 1 – LADWP plans to incorporate up to **225** MWs new solar roof top
- Power Reliability Program / Smart Grid
- Commissioning New Units and Trial Operation



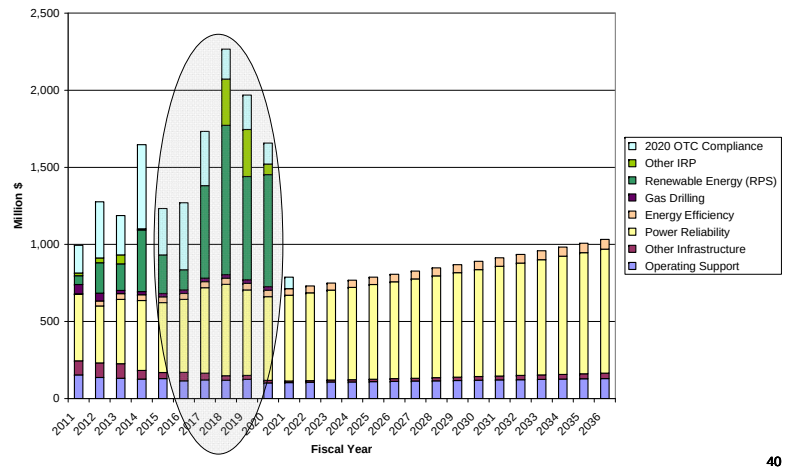
Power System Capital Cost Projections for 2035 Compliance

Costs Through Fiscal Year 2036



Power System Capital Cost Projections for 2020 Compliance

Costs Through Fiscal Year 2036



Comparison of Capital and Borrowing Required for OTC Compliance Plans

	FISCAL YEAR							
	2011 - 2014	2015	2016	2017	2018	2019	2020	2015 - 2020 Total
2020 Compliance Plan								
Total LADWP Capital Costs ($M)	$5,105	$1,232	$1,270	$1,733	$2,266	$1,969	$1,657	**$10,127**
OTC Compliance Capital Costs ($M)	***$1,345***	***$301***	***$435***	***$352***	***$194***	***$223***	***$136***	***$1,641***
Financial Plan Borrowing ($M)	$3,086	$773	$739	$1,131	$1,660	$1,207	$594	**$6,104**
Capitalization Factor	57.9%	62.3%	63.5%	65.2%	67.5%	68.0%	66.9%	
2035 Compliance Plan								
Total LADWP Capital Costs ($M)	$5,060	$1,057	$858	$1,381	$2,072	$1,747	$1,526	**$8,641**
OTC Compliance Capital Costs ($M)	***$1,300***	***$125***	***$23***	***$0***	***$0***	***$2***	***$5***	***$155***
Financial Plan Borrowing ($M)	$3,046	$616	$359	$766	$1,477	$1,171	$543	**$4,932**
Capitalization Factor	57.9%	61.8%	62.0%	62.9%	65.4%	66.7%	65.7%	
Additional OTC Compliance Costs to meet 2020 Compliance Plan ($M)	**$45**	**$176**	**$412**	**$352**	**$194**	**$221**	**$131**	**$1,486**
Additional Borrowing to meet 2020 Compliance Plan ($M)	**$40**	**$157**	**$380**	**$365**	**$183**	**$36**	**$51**	**$1,172**

Average Retail Rate Effects of OTC – 2020 v. 2035 Compliance Plans

(Excluding Accelerated Coal Replacement)

	FISCAL YEAR				
	2015	2016	2017	2018	2019
2020 Compliance Plan					
Retail Revenue Requirement ($M)	$3,722	$3,915	$4,089	$4,330	$4,837
Average System Rate (cents/kWh)	15.8	16.5	17.0	17.8	19.7
Average Rate Increase	5.6%	4.2%	3.2%	4.6%	10.3%
Capitalization Factor	62.3%	63.5%	65.2%	67.5%	68.0%
2035 Compliance Plan					
Retail Revenue Requirement ($M)	$3,717	$3,893	$4,043	$4,222	$4,551
Average System Rate (cents/kWh)	15.8	16.4	16.8	17.4	18.5
Average Rate Increase	5.5%	3.8%	2.7%	3.2%	6.4%
Capitalization Factor	61.8%	62.0%	62.9%	65.4%	66.7%

The annual average difference for 2020 compliance increases rates, 2016 – 2019 by 1.6% per year.

Why 2020 Doesn't Work

System Reliability

- Coastal units are critical to system reliability
- Cannot take any plants off-line until replaced
- Physical space at sites requires sequential rebuild
- 2015 to 2020 is intense power supply change for LADWP without adding complexity of replacing coastal power plants concurrently

Financial

- 2015-2020 is most capital intensive period in LADWP history – worst possible time to add more debt
- Debt Capitalization targets will be exceeded with 2035 Schedule, increased further with 2020 Schedule if it was physically possible
- 2020 Schedule would add 6% rate increase between 2015 and 2019 compared to 2035 Schedule