



City of Los Angeles
Department of Water and Power

Power System Reliability Overview
September 24, 2009

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OUTLINE

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- Evolution of the LADWP System
- Why is local area generation needed for reliability?
- Present and Future Requirements
- Transmission Upgrades?

LADWP Overview

- Vertically integrated utility – LADWP owns and operates most of its generation and transmission resources
- Generation assets include Los Angeles area gas fired and hydro electric generation and external coal, nuclear, and hydro generation
- Future large scale renewable energy will generally come from resources located outside of the Los Angeles area and will have to be imported

LADWP Overview

- Transmission system is comprised of an internal network of 138-kV and 230-kV lines and cables and an external transmission network composed of 287-kV, 500-kV and HVDC transmission.
- The internal transmission network moves power around the system between a series of high voltage receiving and switching stations
- The external transmission system is used to import bulk electric power to the city

Reliability Criteria

- LADWP must meet Reliability Standards set forth by the North American Electric Reliability Corporation (NERC) and enforced under the authority of the Federal Energy Regulatory Commission (FERC)
- Transmission reliability criteria requires that sufficient generation be on line or immediately available as follows:

Reliability Criteria

- Sufficient appropriately located generation must be on line and producing energy such that:
 - For pre-contingency conditions, all circuits must be loaded below their continuous rating and voltages shall be normal.
 - Following the worst contingency (loss of generation or transmission) no circuit shall load beyond its emergency rating and voltage shall be greater than or equal to 95% of normal

Reliability Criteria

- Sufficient appropriately located generating capacity must be either on line or available in a prescribed amount of time such that:
 - All circuit loadings can be reduced below the continuous rating and voltages are returned to normal.

Evolution of LADWP System

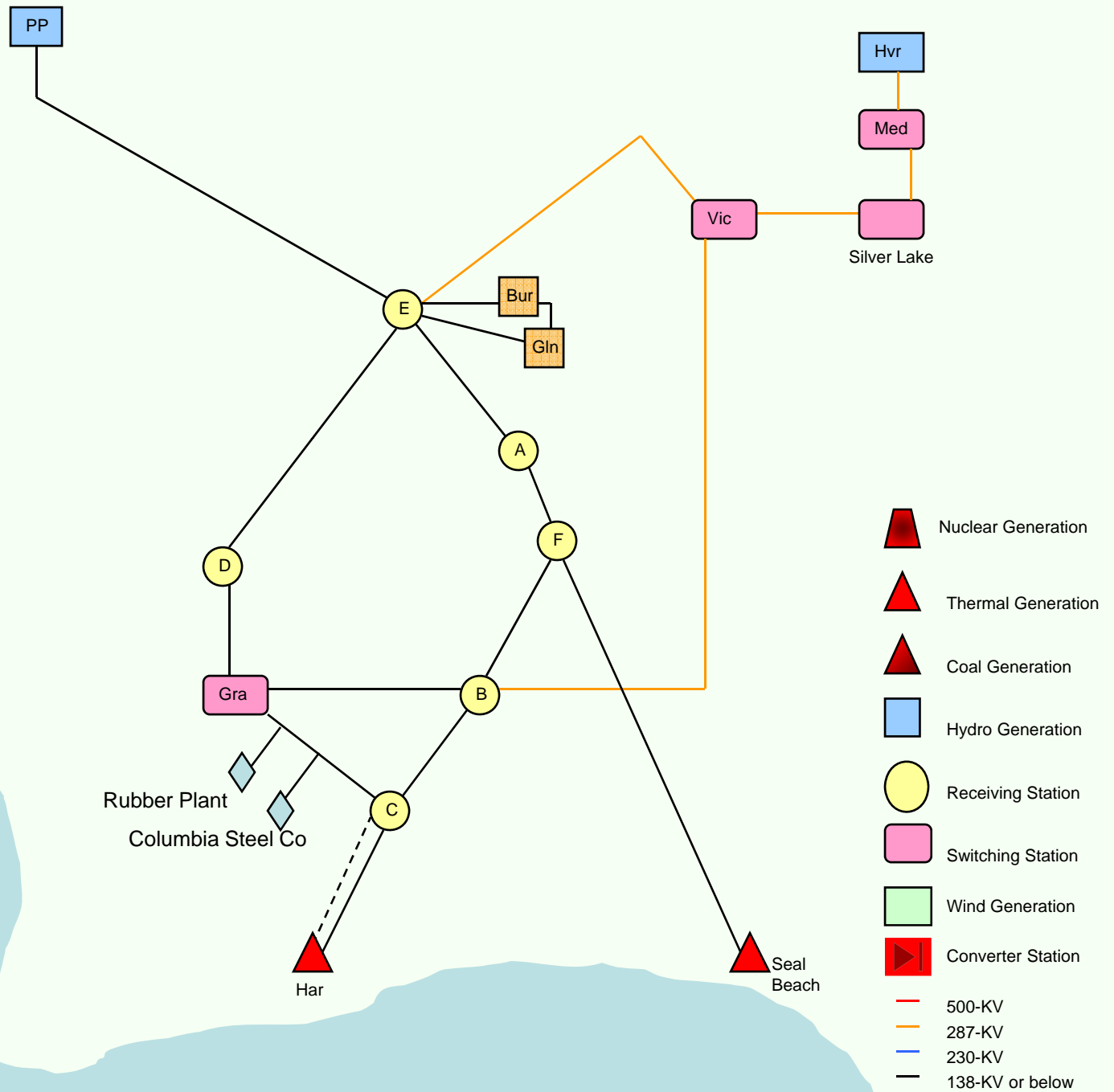
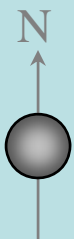
- In the 1940s through 1960s, as Los Angeles experienced large load growth, gas fired generation was constructed along the coast.
- The LADWP local area transmission system was constructed to transmit this coastal generation to the growing load centers within Los Angeles.
- Starting in the late 1960s, Los Angeles began participating jointly with other utilities in coal and nuclear facilities located remotely and also began accessing low cost hydroelectric power in the Pacific Northwest.

Evolution of LADWP System

- A large high capacity transmission network was constructed composed of 500-kV AC and HVDC circuits to import this energy. This network primarily ties into the LADWP system at the north end
- These imports create high north to south loading on the in city transmission network. The coastal generation is required to off load these circuits and supply the local area load
- Reliability generation is required year round. The requirement increases as the load increases

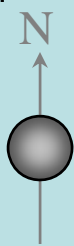
- Harbor and Fairfax RS-D were added
- Additional Hoover required a new line from Victorville to RS-E
- In order to import more external resources, more transmission was added.

1949

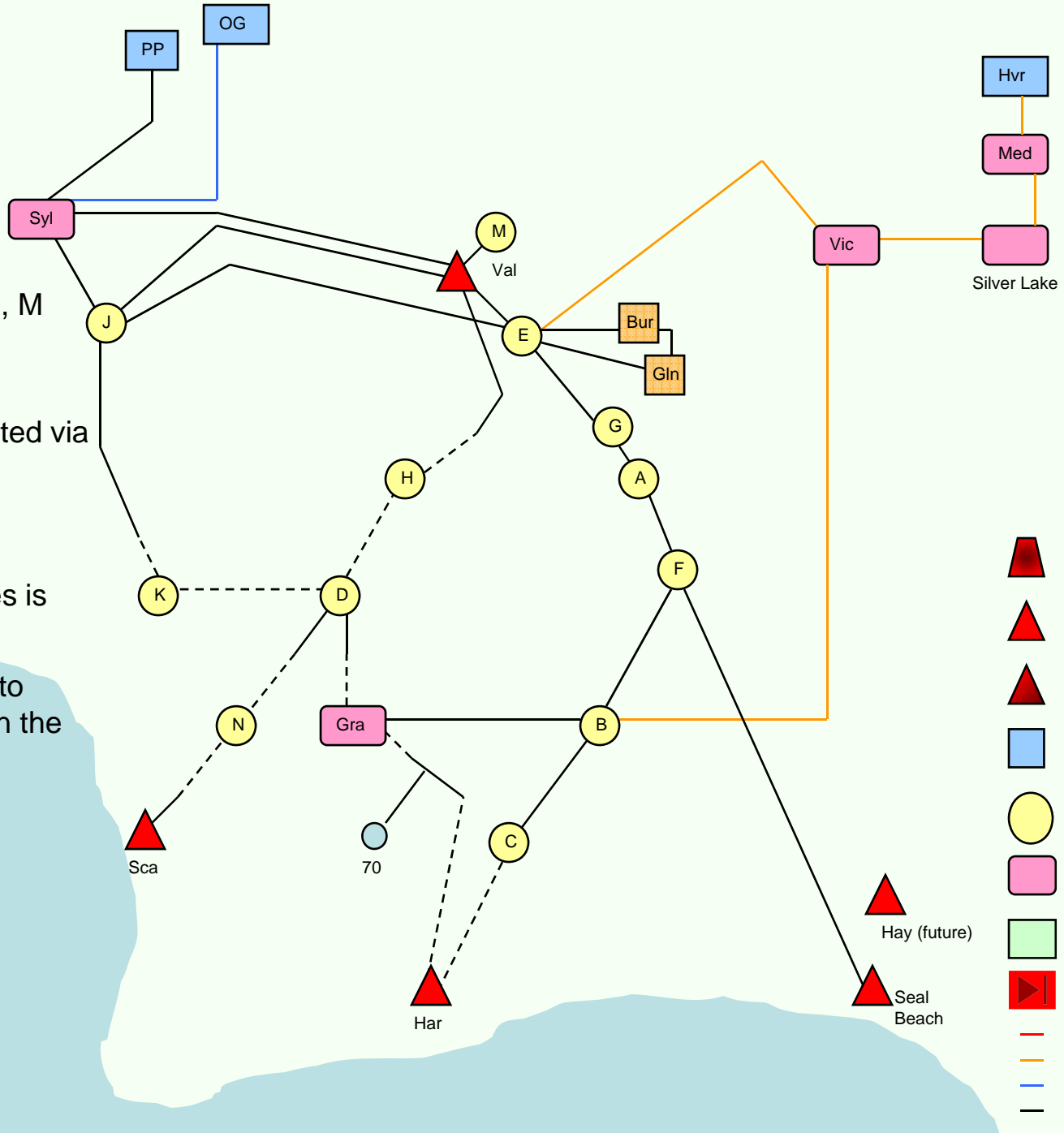


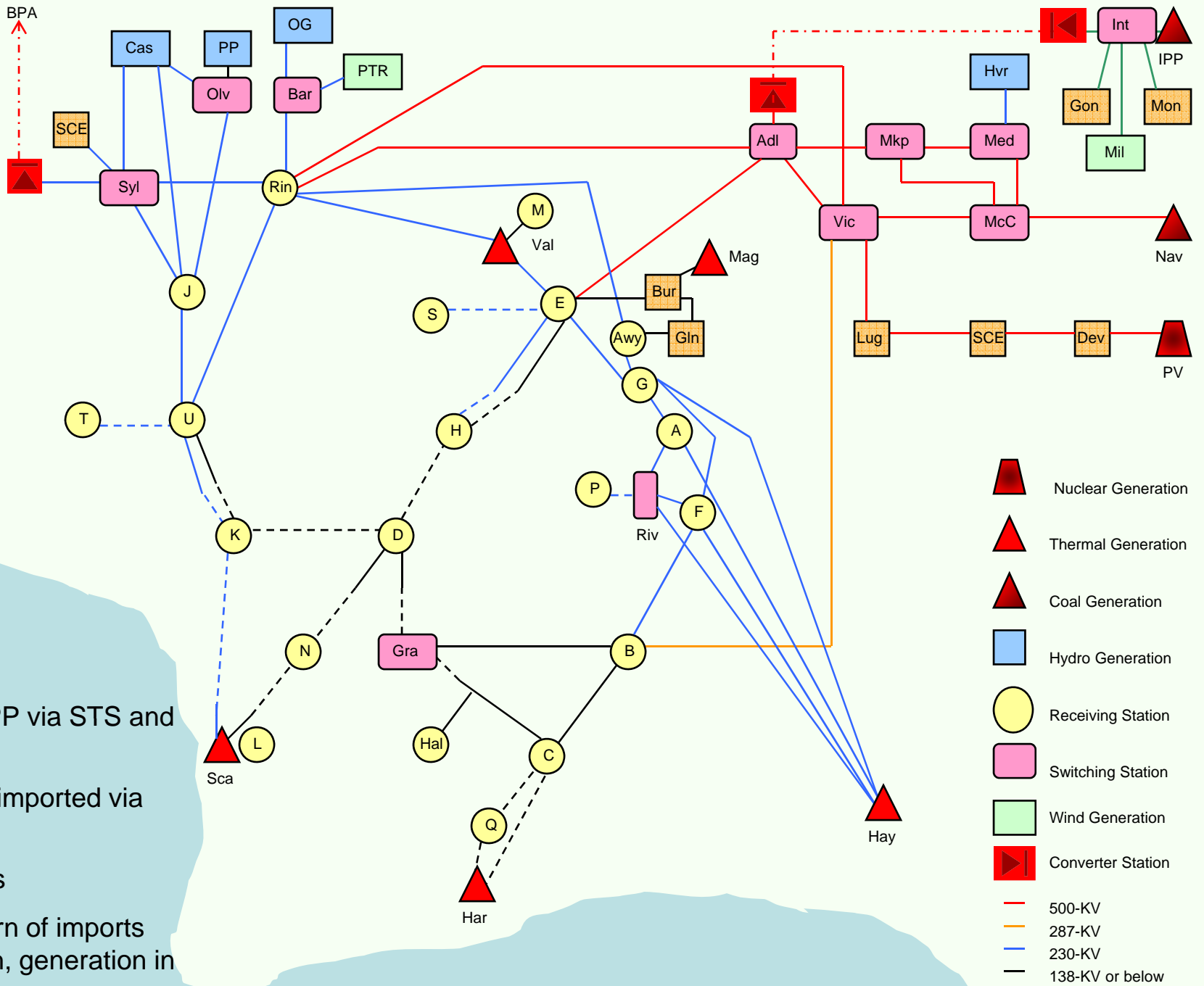
- RS-G, H, J, K, N, M have been added
- Owens Gorge generation connected via a 230-kV line
- Valley and Scattergood are in service and Haynes is being built

Pattern: Imports into north, generation in the south



1959

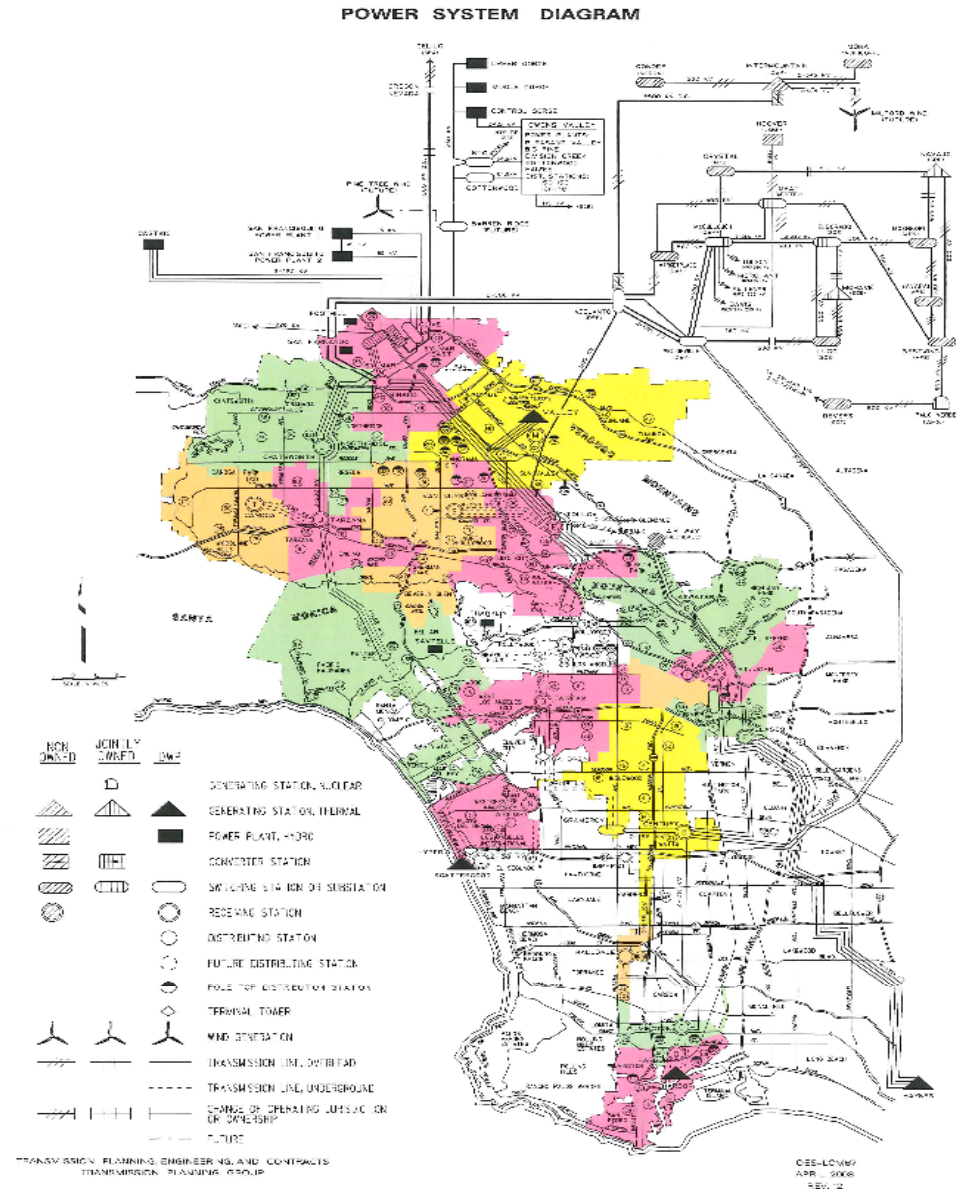




2009

- Importing IPP via STS and 500-kV AC
- Palo Verde imported via SCE system
- Renewables
- Same pattern of imports into the north, generation in the south

- The in-basin network consists of 115kV-to-230kV lines and cables.
- Power from external resources enters the system primarily at the northern borders of the city with some limited import capability on the east side.
- The internal transmission system cannot transmit all needed power to the central, western and southern portions of the city.



Why is local area generation needed for reliability?

- Provides necessary dynamic voltage support
- Provides energy needed to maintain transmission within limits for both pre- and post-contingency conditions
- Provides system inertia required to maintain stable imports on the transmission system. Examples of this are:
 - HVDC systems require sufficient inertia in order to properly operate
 - Import capability into Southern California is impacted by system inertia. The lower the inertia, the lower the import capability

Present and Future Requirements

- LADWP must have sufficient local area generation strategically located for reliability
- The resource portfolio must take into account historical and anticipated forced outages and reductions
- Current generation cannot be retired until equivalent resources are constructed in the same or comparable geographic region

Local Capacity Requirements for Summer 2009

	All Units Avail	Hay 1or 2 NA	Hay CC NA	Sca 3 NA	Val CC NA
Haynes	1341	1119	990	1341	1565
Scattergood 1, 2	174	174	174	348	174
Scattergood 3	445	445	445	Off	445
Valley	307	326	310	310	43*
Harbor 1, 2	0	162*	162	162*	162
Harbor 5	0	0	66	0	66
Harbor 10 -14	206*	235*	235*	94*	235*

There is a difference between capacity requirement and energy requirement

The minimum basin generation required for 2-hour security is:

NOB	HAY	SCA 1&2	SCA 3	VAL	HAR 1&2	HAR 5, 10-14	TOTAL
0	727	174	161	0	Off	Off	1062
2990	1048	61	332	0	Off	Off	1441

The minimum basin generation required for continuous security is:

NOB	HAY	SCA 1&2	SCA 3	VAL	HAR 1&2	HAR 5, 10-14	TOTAL
0	1335	145	136	312	Off	Off	1928
2990	1341	174	445	307	Off	206	2473

Present and Future Requirements

- Transmission forced outages may increase the amount of reliability generation required
 - Local area and import transmission is vulnerable to seasonal fires and other failures
- Sufficient local area generation must be available to compensate for forced outage of other local and remote generation
- Sufficient dispatchable generation must be available to regulate and back-up intermittent generation resources (wind and solar)

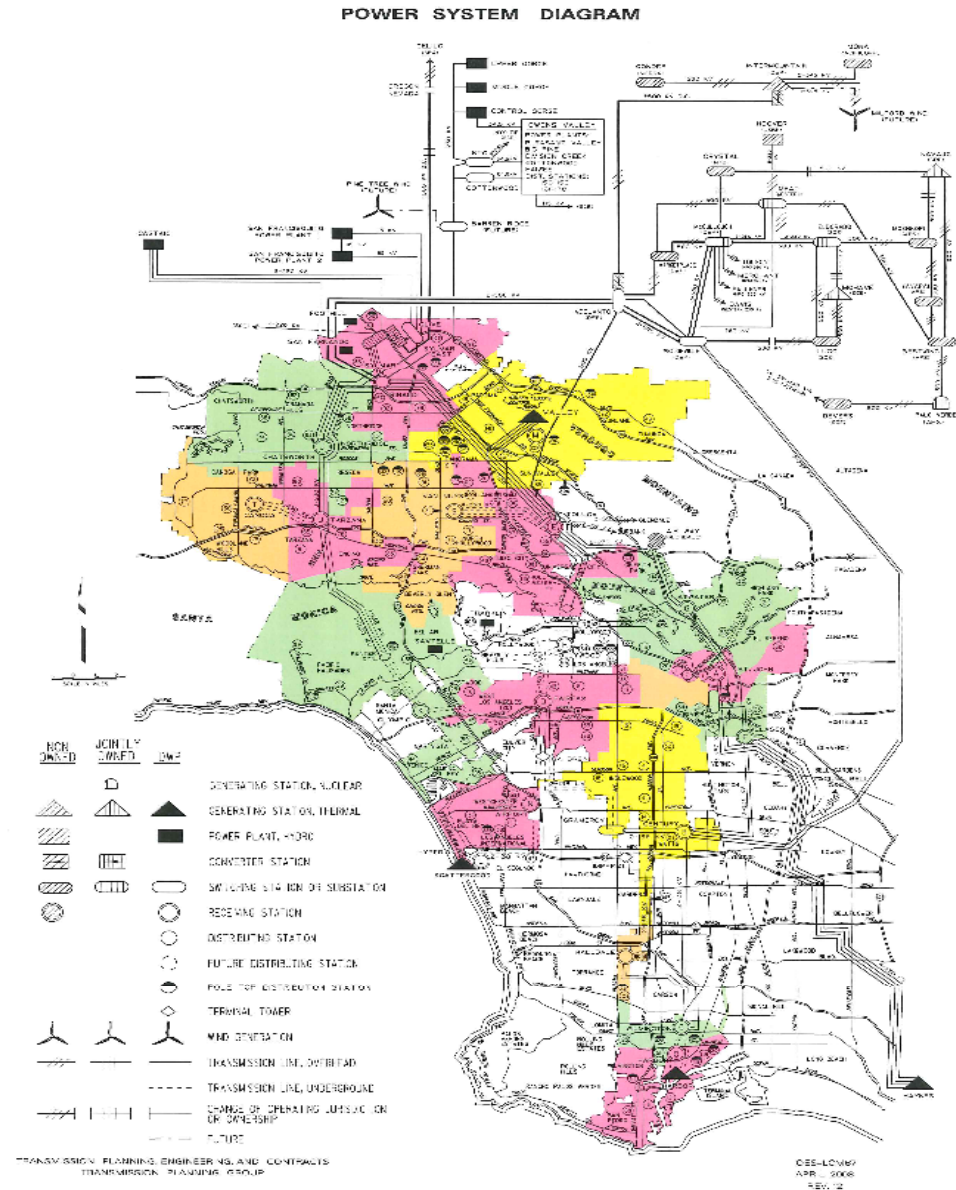
Present and Future Requirements

- Planned repowering projects may change the operation of coastal generation but will not have significant impact on capacity and energy requirements during the peak times of the day
- Renewables can meet general energy needs but do not reliably meet capacity requirements, regulation, and locational needs.

Transmission Upgrades?

- Local area transmission was initially constructed to move power from south to north at a time when Los Angeles was growing
- The early transmission was comprised of 138-kV lines and cables. Later additions were at higher capacity 230-kV

- There is limited ability to upgrade the internal transmission due to it being in a dense metropolitan area.
- 10-year transmission plan is primarily focused on load growth and renewable integration



Transmission Upgrades?

- Los Angeles is now a largely metropolitan area. Opportunities to add or upgrade local area transmission is limited
- Plans to upgrade the old 138-kV system was found to be impractical due to impact to infrastructure and high cost
- Right of way for overhead transmission is no longer available
- Underground circuits are difficult and costly to install, have generally lower transmission capability and require additional support equipment

Los Angeles Department of Water and Power Repowering Projects and Emission Reduction Credits (ERCs)

- **The Haynes Generating Station (HnGS) Repowering Project will replace two steam boiler units with six advanced simple-cycle gas turbines.**
- **The 616 MW of gas turbines will increase the capacity of the facility by 12 MW gross with no net increase in capacity**
- **The DWP has applied for the SCAQMD Rule 1304 exemption from the ERC requirement**
- **In the absence of Rule 1304, the DWP would need to acquire over 900 lb/day of PM ERCs**
- **The DWP is in the preliminary stages of designing the Scattergood Generating Station Repowering Project which will replace two steam boiler units with gas turbine technology**
- **The SCAQMD has held a number of workshops regarding streamlining its New Source Review regulations. One proposal is to calculate the ERC requirement in an annual rather than a monthly basis.**

QUESTIONS?