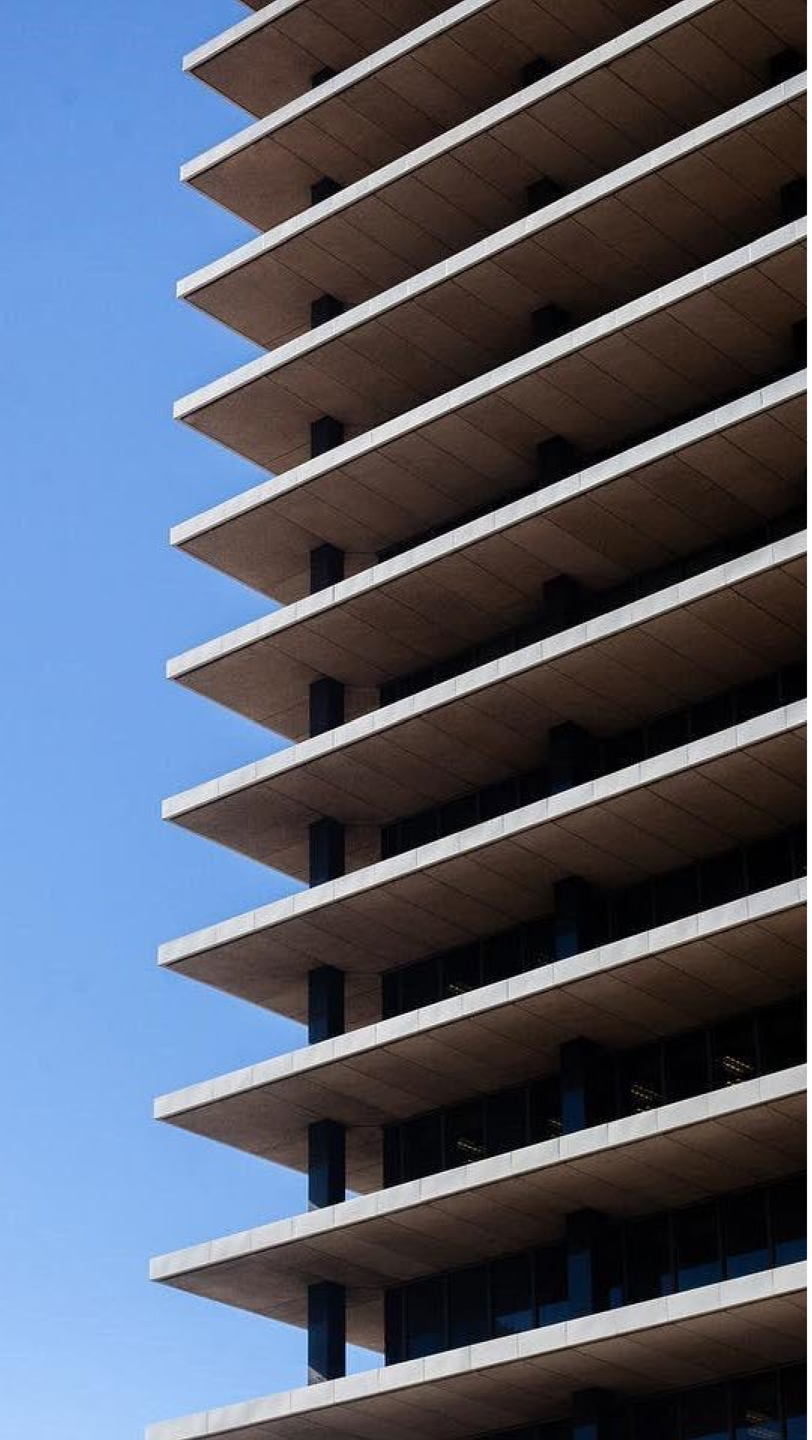
2024 SLTRP Kickoff Meeting

March 21, 2024

Power **S**ystem **P**lanning **D**ivision



Agenda

1

LADWP Overview

- 2024 SLTRP Purpose and Guidelines
- 2022 Cycle SLTRP Review
- Strategic Long-Term Resource Plan (SLTRP) Overview
- Clean Energy Technology Overview
- Q&A

2

2024 SLTRP

- Reliable in-basin capacity Needs
- 2024 SLTRP Planning Challenges
- Q&A
- Questionnaire

2022 SLTRP

REVIEWING THE 2022 CYCLE

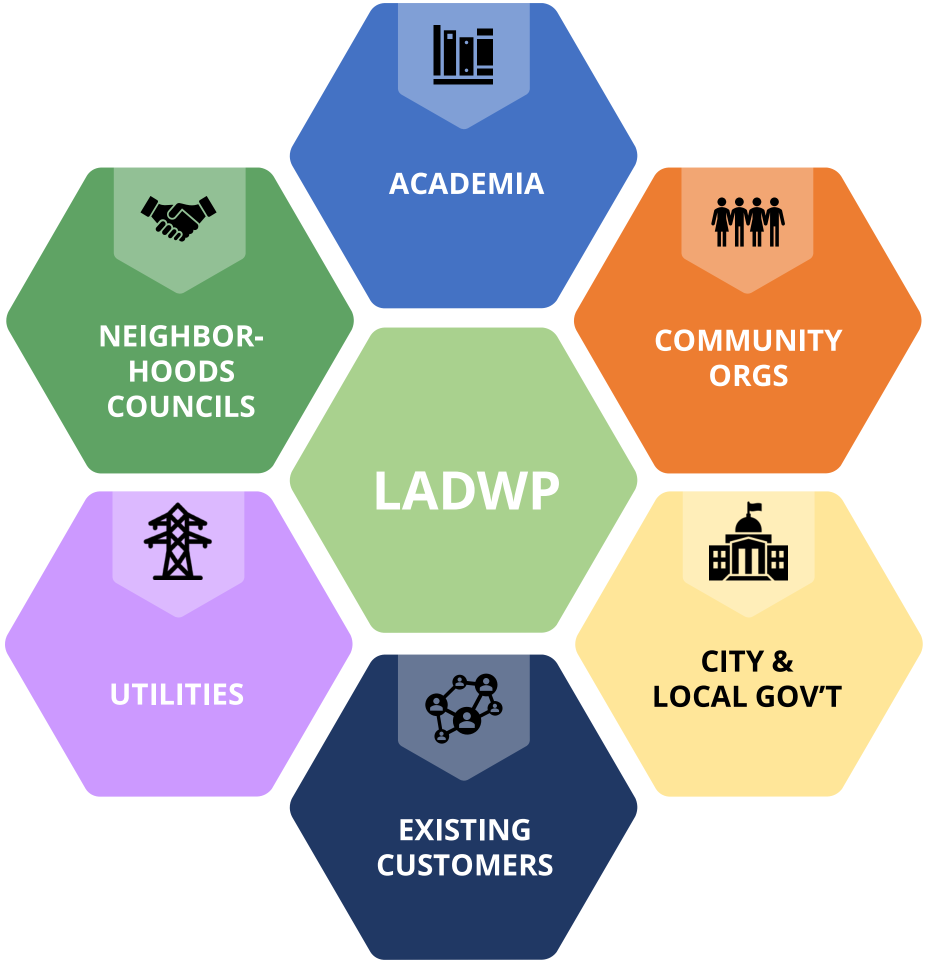
SLTRP ADVISORY GROUP

Bringing City Stakeholders to the Planning Process

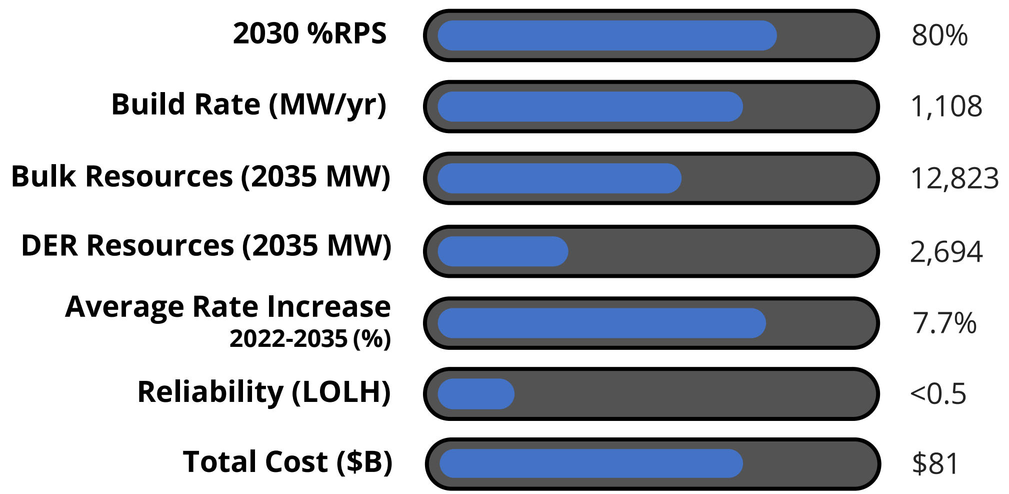
- **LAUNCHED IN SEPTEMBER 2021**
  - 11 Total Meetings
  - 45+ Stakeholders

- **SUMMARY TOPICS**
  - LA100 Review
  - Policy Deep Dive
  - Customer Programs
  - Power System Reliability Program (PSRP)
  - No In-Basin Combustion and Energy Storage
  - Modeling and Assumptions
  - Case Sensitivities
  - Preliminary Results

- **PUBLIC COMMUNITY OUTREACH**
  - 3 virtual meetings in August and September 2022



2022 SLTRP RECOMMENDED CASE



Transmission	Mid
DERs	High
Natural Gas	2035
Hydrogen	Backup (after 2035)

Cost
(based on net present value)

- Fixed Cost
  Debt service, Capital, Fixed O&M, Power Purchase Agreements, etc.
- Variable Cost
  Fuel, GHG allowances, NOx credits, Variable O&M, etc.

Firm Generation

- LA100 determined that in all scenarios firm, **dispatchable generation** was required by 2035.
- LADWP expects to minimize use of in-basin green hydrogen turbines to provide only **backup power** in case of transmission loss (e.g. wildfire) or low renewable energy output.
- Firm generation provides **resiliency during outages** and supports development of new transmission pathways.

Build Rates

- Average build rate from 2018 to 2021 has been **200 MW per year**
- Includes both **utility** and **customer-sided** clean energy resources

Bulk Power Resources include:

- Utility Scale RPS
  - Over 1,000 MW of firm renewables
- Utility Scale Energy Storage
- In-Basin Hydrogen

Distributed Energy Resources include:

- Distributed Solar
- Distributed Energy Storage
- Demand Response

Affordability

- 7.7% annual rate increase year over year through 2035
- Tripling of bill by 2035

CAVEATS & CHALLENGES

There is a critical need to review internal and external constraints & optimize future resource plans.

Availability of Technology

- Monitor emerging technologies for readiness and feasibility.
- Availability of certain resources (e.g. geothermal)

System Reliability

- Firm, dispatchable capacity in-basin needs to be retained even in a decarbonized future Power System for reliability and resiliency.
- Address climate change impacts to reliability

Implementation Feasibility

- Human Resources, outage constraints, buildout schedule, real estate, and supply chain must be vetted and ramped up to support the buildout of clean energy resources.

Affordability and Equity

- Additional flexibility in planning to optimize resources is needed to improve cost affordability and minimize energy burden.
- Incorporate LA100 Equity Strategies

2024 SLTRP

BUILDING THE FUTURE (BACKGROUND)

Power System Overview

- **Largest Municipal Utility.** LADWP is the nation's largest municipal electric utility.
- **Large Load and Diverse Customer Base.** In fiscal year 2020-21, we supplied 20,936 gigawatt-hours (GWh) to more than 1.55 million residential and business customers, as well as more than 5,100 customers in the Owens Valley.
- **Vertically Integrated.** We maintain a diverse and vertically integrated power generation, transmission and distribution system that spans five Western states, and delivers electricity to more than 4 million people.

4 million residents
in our service territoty

300,884 distribution utility poles
130,703 distribution transformers
7,266 miles of overhead distribution lines
3,801 miles of underground distribution cables

4,040 miles of overhead transmission circuits
135 miles of underground transmission circuits
Transmission circuits spanning **5 Western states**

8,101 MW Net dependable generation capacity
6,502 MW Record instantaneous peak demand

55% Clean Power
37% Renewables
*Preliminary and unaudited values; submitted to the California Energy Commission for calendar year 2021

Resource Diversity

Wide distribution of generation across LADWP projects to provide power services to multiple regions.

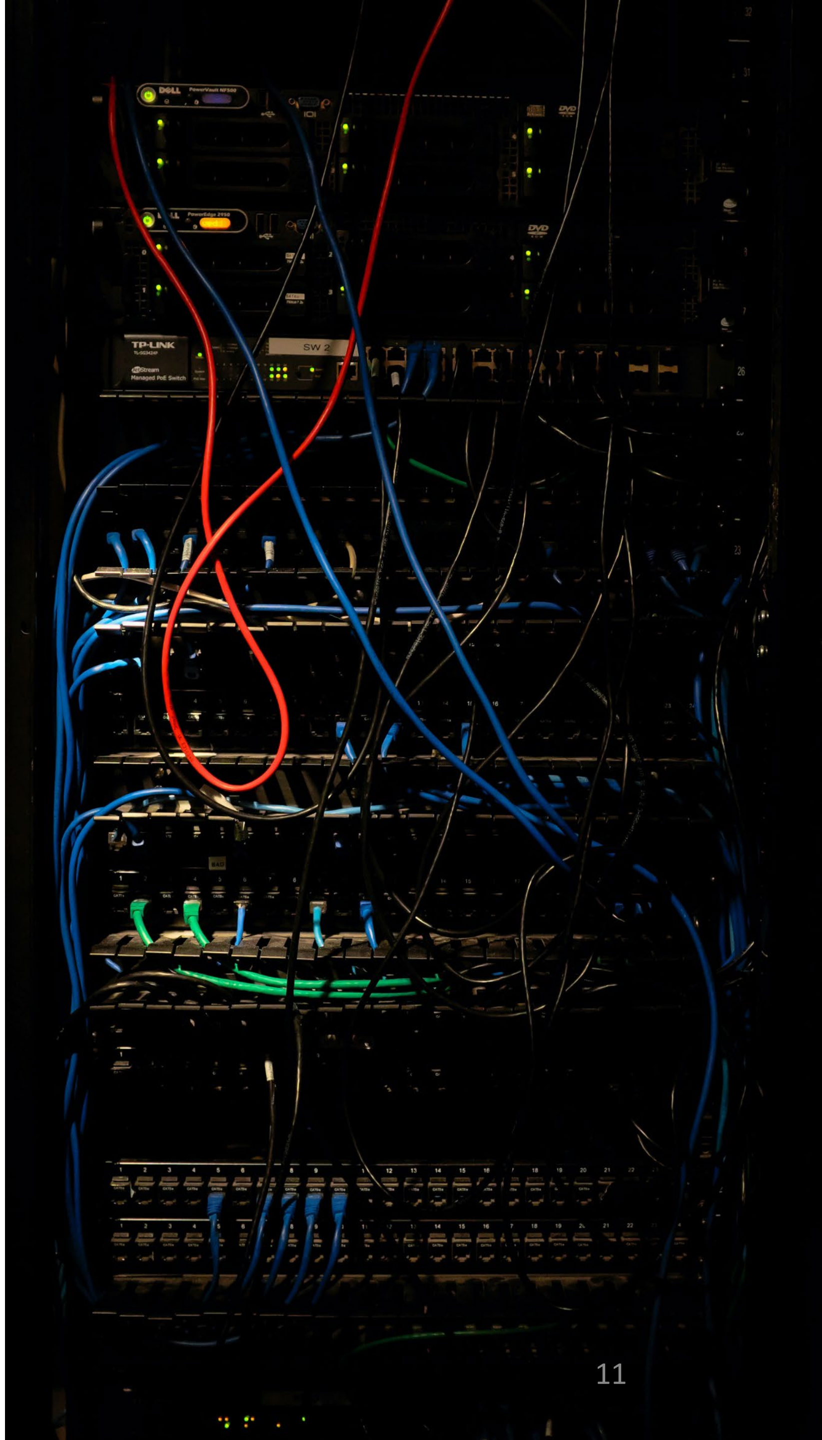
- **In-basin Generating Stations.** Gas-fired generation at LADWP's in-basin generating stations.
- **Pacific Northwest.** Wind and hydro generation from the Pacific Northwest.
- **Owens Valley**. Wind, solar, and hydro generation from the Owens Valley.
- **The Intermountain Power Project.** Wind and solar facilities located in Utah.
- **Hoover Dam.** Hydro generation from the Hoover Dam.
- **Arizona and New Mexico.** Wind generation from Arizona and New Mexico.
- **Palo Verde Nuclear Generating Station.** Nuclear generation located in Arizona.
- **Nevada**. Apex gas-fired generating station and solar facilities in Nevada.
- **Castaic Plant.** Castaic pumped-hydro facility located north of Los Angeles.

Red Cloud Wind Project

LADWP Plant Summary	
Plant Name	Red Cloud
COD	2021
Location	Navajo, New Mexico
Net Plant Capacity (kW)	331,000
LADWP Share	100%

Recent Accomplishments

1. **LA100 Equity Strategies Report.** Completion of report document.
2. **Signing of Eland Solar.** Signing of the Eland Solar and Storage Power Purchase Agreement.
3. **CAISO WEIM Participation.** Participation in California Independent System Operator’s (CAISO) Western Energy Imbalance Market (WEIM).
4. **Red Cloud Wind Project.** Commissioning of the Red Cloud Wind Project.
5. **Vehicle Charging Installations.** Supporting the installation of 20,000 electric vehicle charging stations.
6. **IPP Renewed.** Leading the commissioning of IPP Renewed.
7. **Green Hydrogen Transition.** Supporting the transition to green hydrogen.



Available Technologies – Pros & Cons

Technology	Pros	Cons
Wind	• Zero emissions • Counts towards RPS goals and mandates	• Generation is intermittent • Must be sited in locations with sufficient wind • Not dispatchable
Solar PV	• Zero emissions • Counts towards RPS goals and mandates • Inexpensive	• Generation is intermittent • Must be sited in locations with sufficient solar • Not dispatchable
Gas turbines	• Proven technology • Quick start-up times • Quick ramp rates • Dispatchable • Can potentially use hydrogen in the future	• Not as efficient as combined cycle units • Typically, lower capacity than combined cycle units, requiring a larger footprint • Emissions output
Combined cycle gas units	• Dispatchable • Proven technology • Highly efficient • Can potentially use hydrogen in the future	• Longer start-up times than turbines • Higher capital costs than turbines • Emissions output
Existing Steam boilers	• Proven technology • Dispatchable	• Long start-up times • Inefficient compared to combined cycle units

Available Technologies – Pros & Cons

Technology	Pros	Cons
Geothermal	• Zero emissions • Counts towards RPS goals and mandates	• Expensive • Must be sited in locations with sufficient geothermal resources
Fuel cells	• Dispatchable • Can provide zero emissions if using renewable hydrogen • Quiet	• Very expensive • Not tested at scales required by LADWP
Existing Nuclear	• Zero emissions • Provides firm, baseload generation	• Generation output cannot be ramped up and down • High capital costs • Radioactive waste • Safety concerns
Hydroelectric (e.g. Pumped Hydro)	• Zero emissions • Dispatchable	• Site specific – most sites have already been developed • Environmental impact of flooding large areas for the reservoir
Lithium-Ion Batteries	• Can ramp up and down quickly • Good round-trip efficiency • Cheaper than flow batteries	• Relatively high leakage rate • Not good for long-term storage • Disposal of electrolyzer chemicals

Los Angeles Department of Water & Power

Break for Q&A

2024 SLTRP

RELIABLE IN-BASIN CAPACITY NEEDS

Diverse and Reliable Decarbonized Grid

- **Achievable** from a technical standpoint
- The procurement and construction of clean electricity generation and energy storage resources must be sustained at **unprecedented; record-setting build rates**.
- **Geographic** and **technological diversity** of zero-carbon energy resources lowers overall costs and enhances system reliability.
- Firm and **dispatchable generation** is necessary to provide reliability during the transition and beyond.

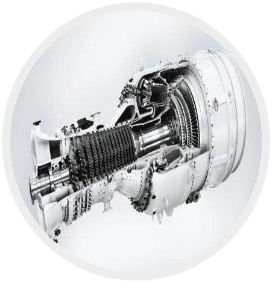
Electrification Efficiency Flexible Load

Customer Rooftop Solar

Renewable Energy

Storage

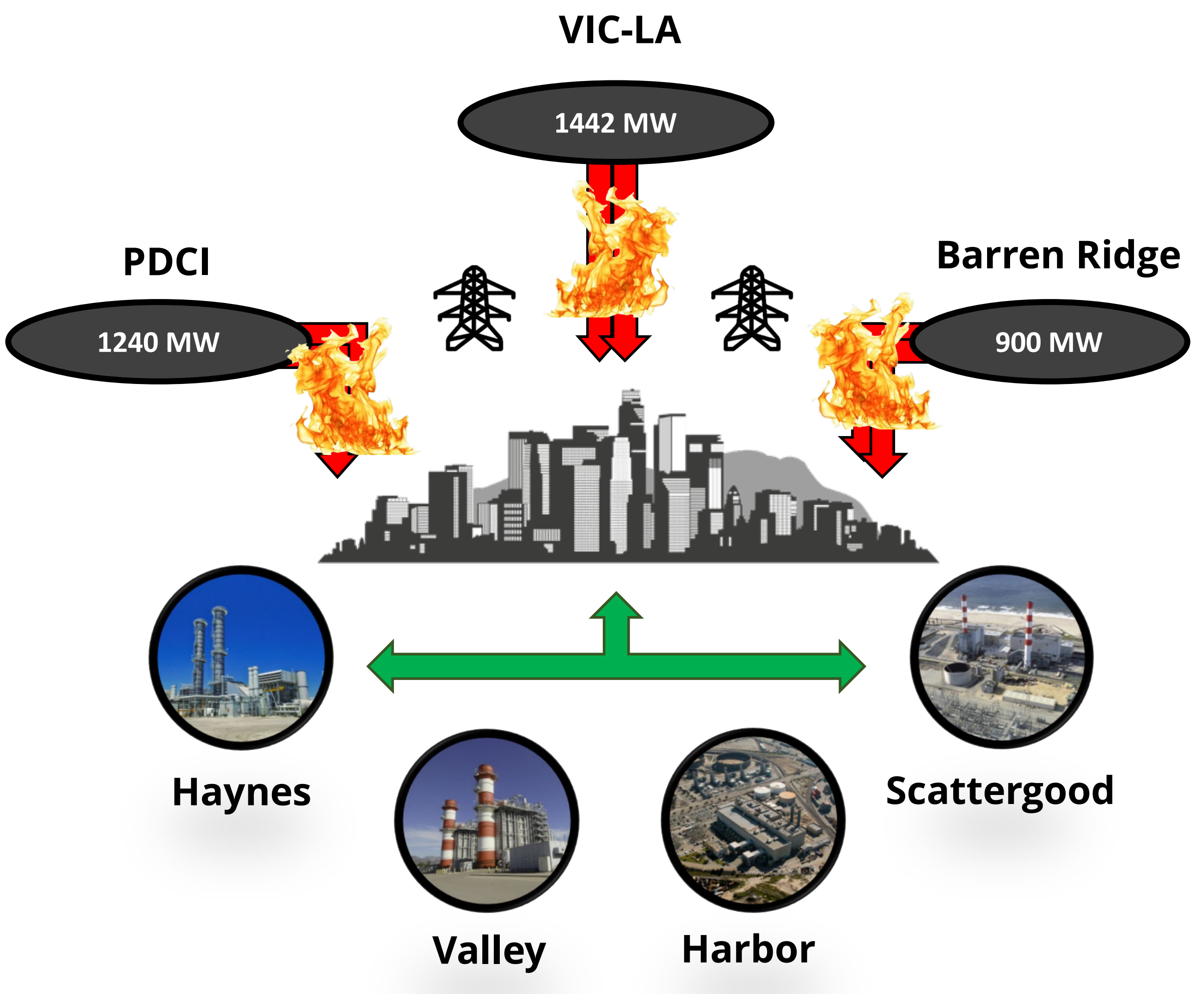
Transmission, Distribution



Dispatchable Renewable Generation

In Basin Resiliency

When There is a Transmission Outage, We Would Rely on Local Generation to Keep Critical Power Flowing



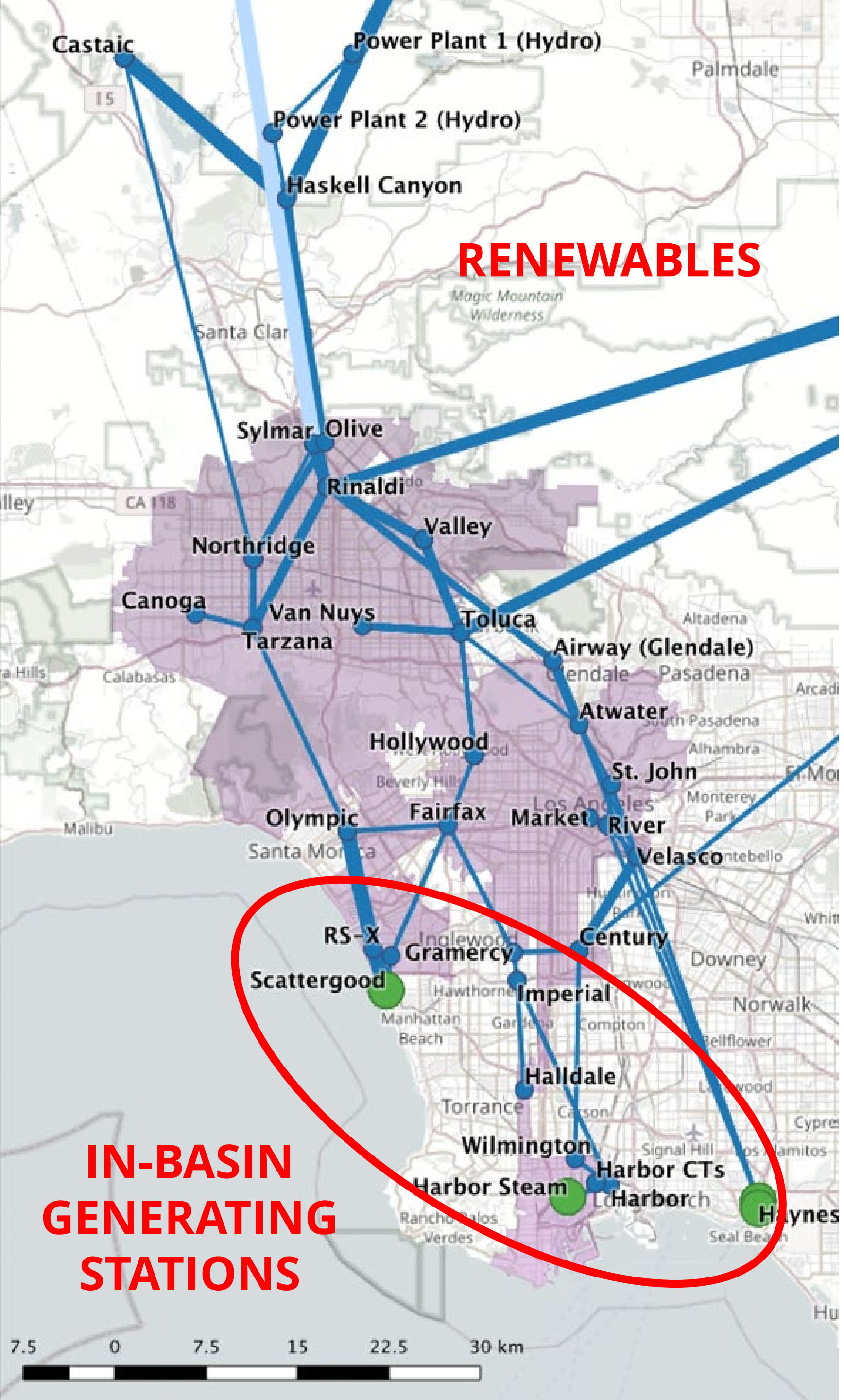
Example

The 2019 Saddle Ridge Fire impacted the Pacific DC Intertie for **22 hours**, Barren Ridge corridor for **10 hours**, and VIC-LA path for **5 hours**.

Limitations

Existing storage technologies are **incapable of supporting** long duration outages in a cost-effective manner.

Local dispatchable generation is critical for maintaining reliable system.



In-Basin Topology

In-basin Generation

LADWP transmission network was designed in part around in-basin generation, located mostly in the **south**.

Importing Renewables

Renewables are primarily imported from the **north**.

Locally Sited Generators

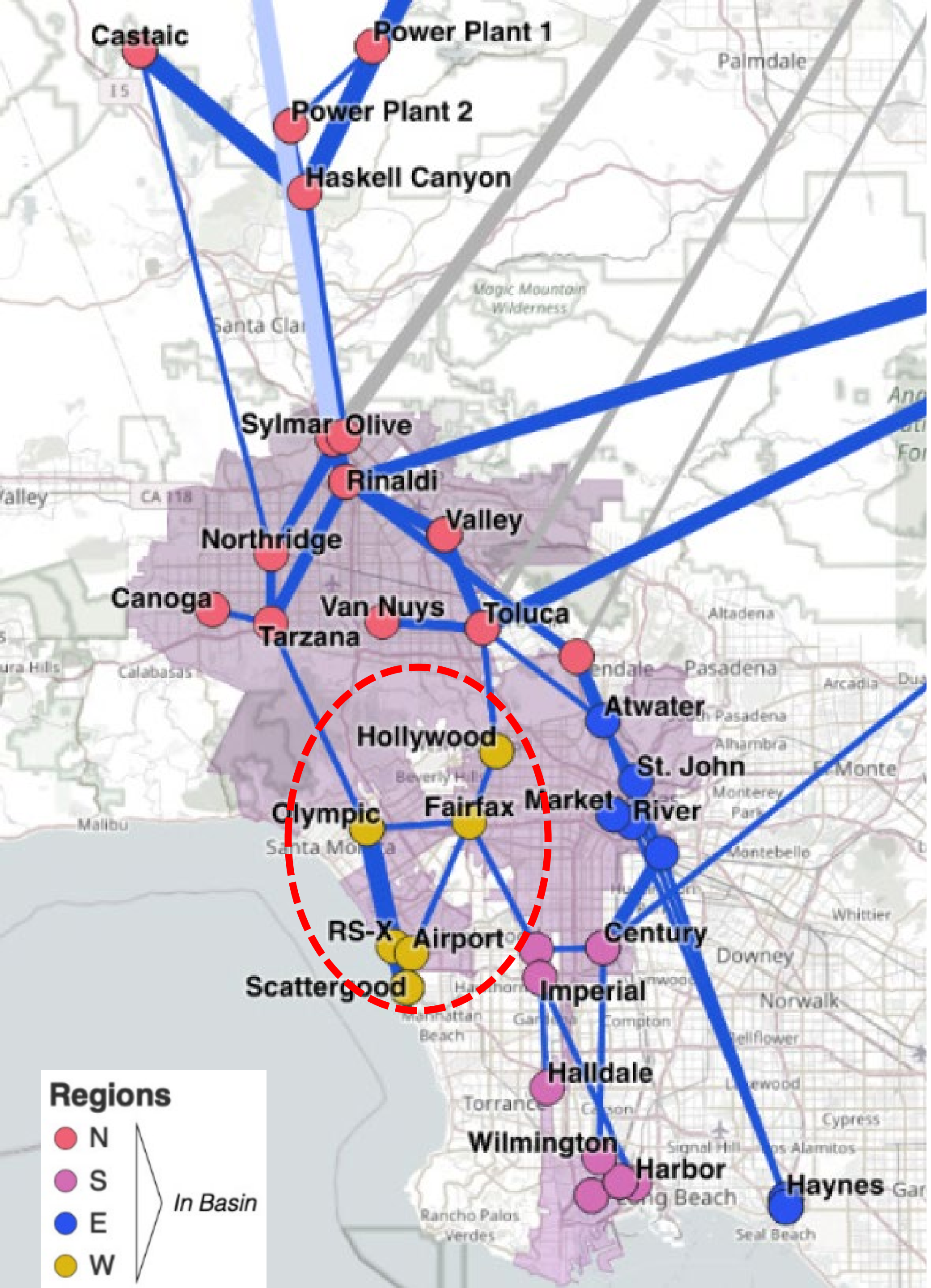
Transmission limitations and inadequate renewable supply are currently addressed by running locally sited generators.

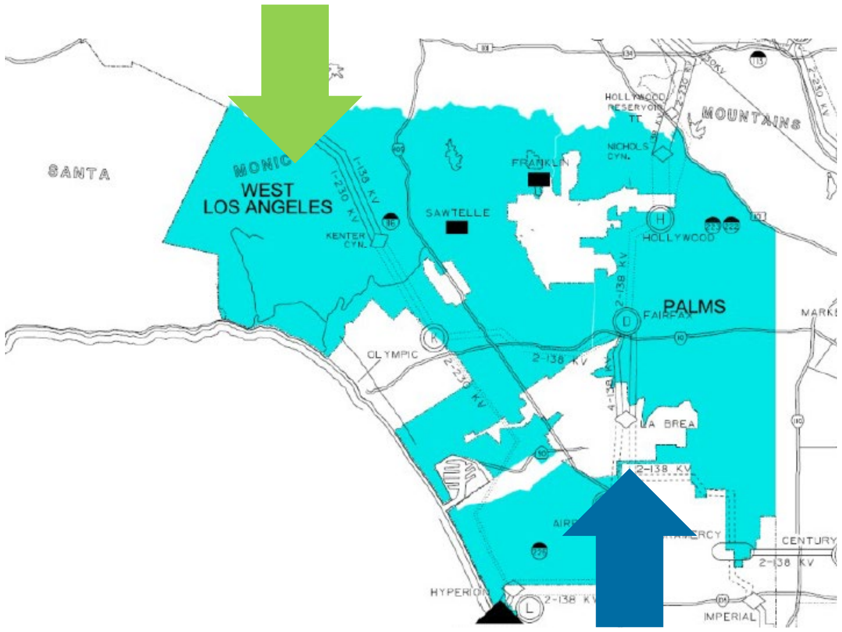
LA100 Study – Key Takeaway

In-basin capacity must be maintained for **reliability** and **resiliency**, even in a decarbonized future Power System.

All 2022 SLTRP cases have been developed to maintain reliability and resiliency. It is a regulatory mandate.

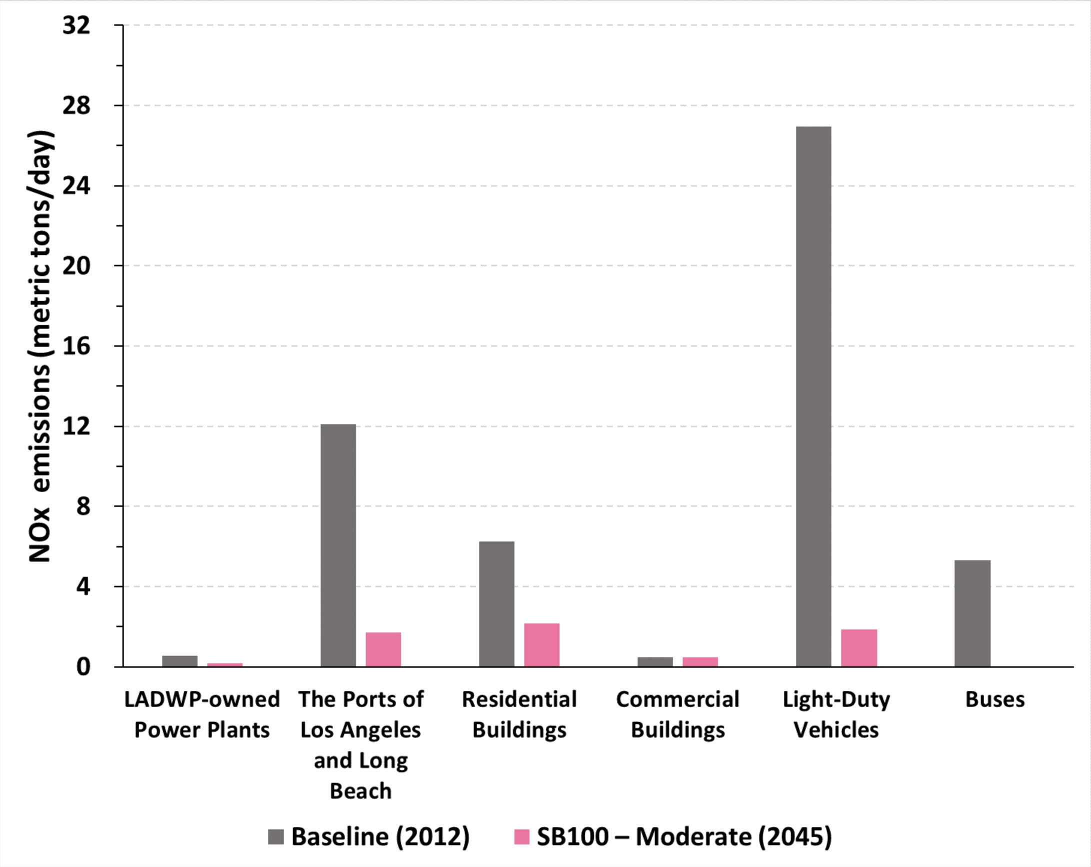
Limitations of Transmission Capacity



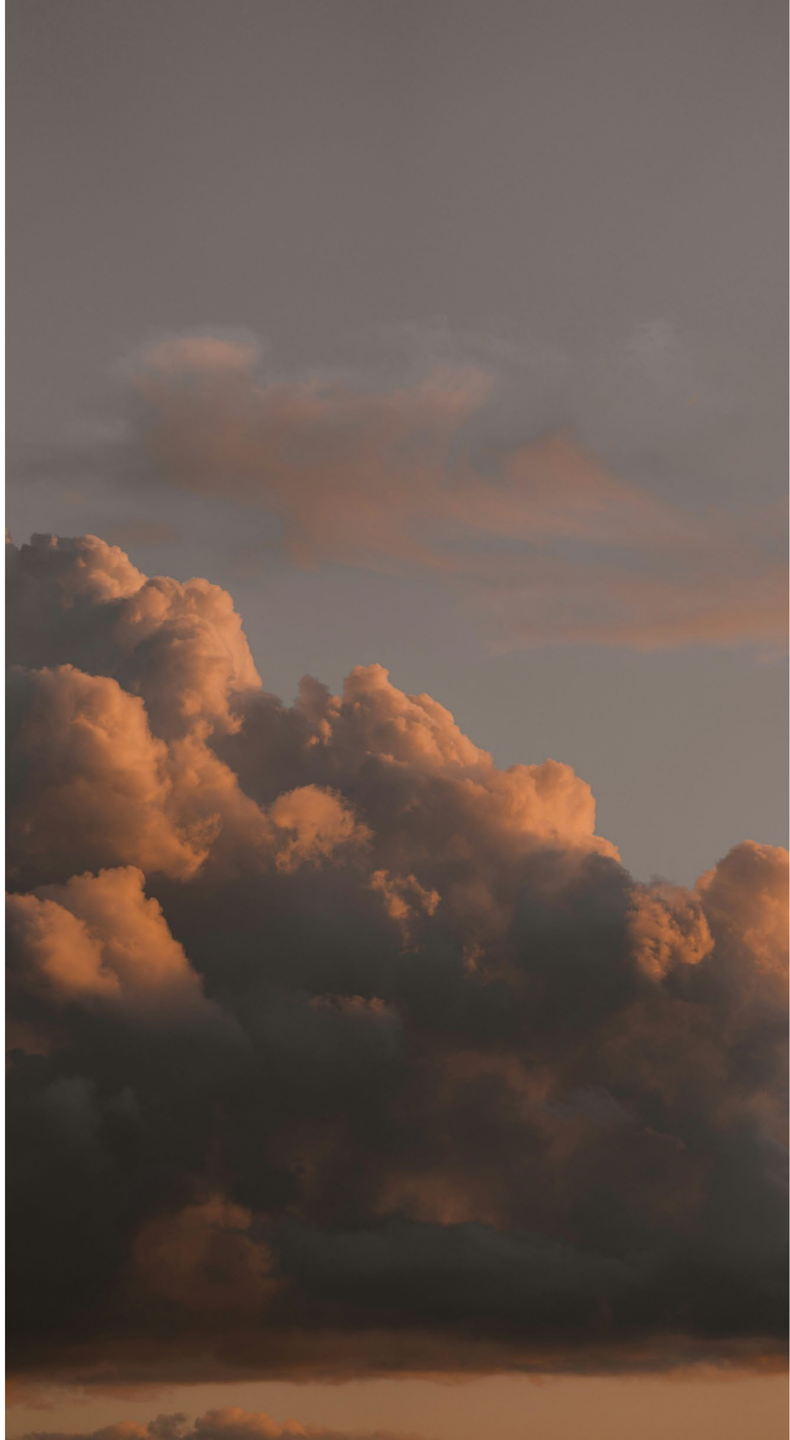


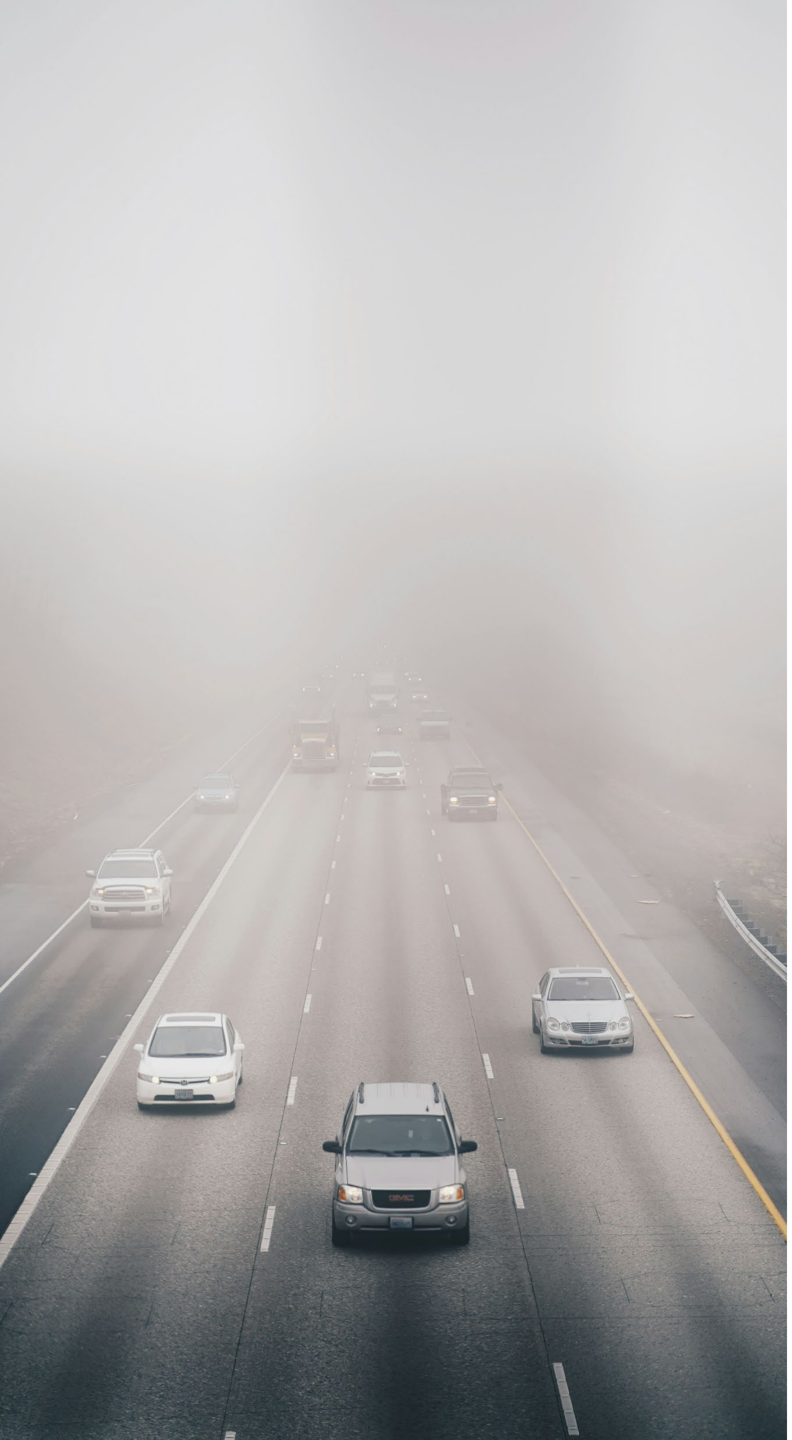
West Los Angeles is in a transmission cul-de-sac, where import from the north is limited. Scattergood Generating Station **critically supplements** the **capacity shortfall** for this region.

Reliability Needed to Drive Electrification



Electrification results in significant reductions in local pollution, greatly improving regional air quality!





Regional Air Quality Improves through Electrification

*"**Truck electrification** substantially improves air quality and health, particularly in **traffic-impacted disadvantaged communities**…more than closing in-basin LADWP fossil fuel power plants.*

*Heavy-duty trucks generated **51%** of LA on-road transportation nitrogen oxides and **32%** of particulate matter pollution in 2022, though they made up only **5%** of registered vehicles.*

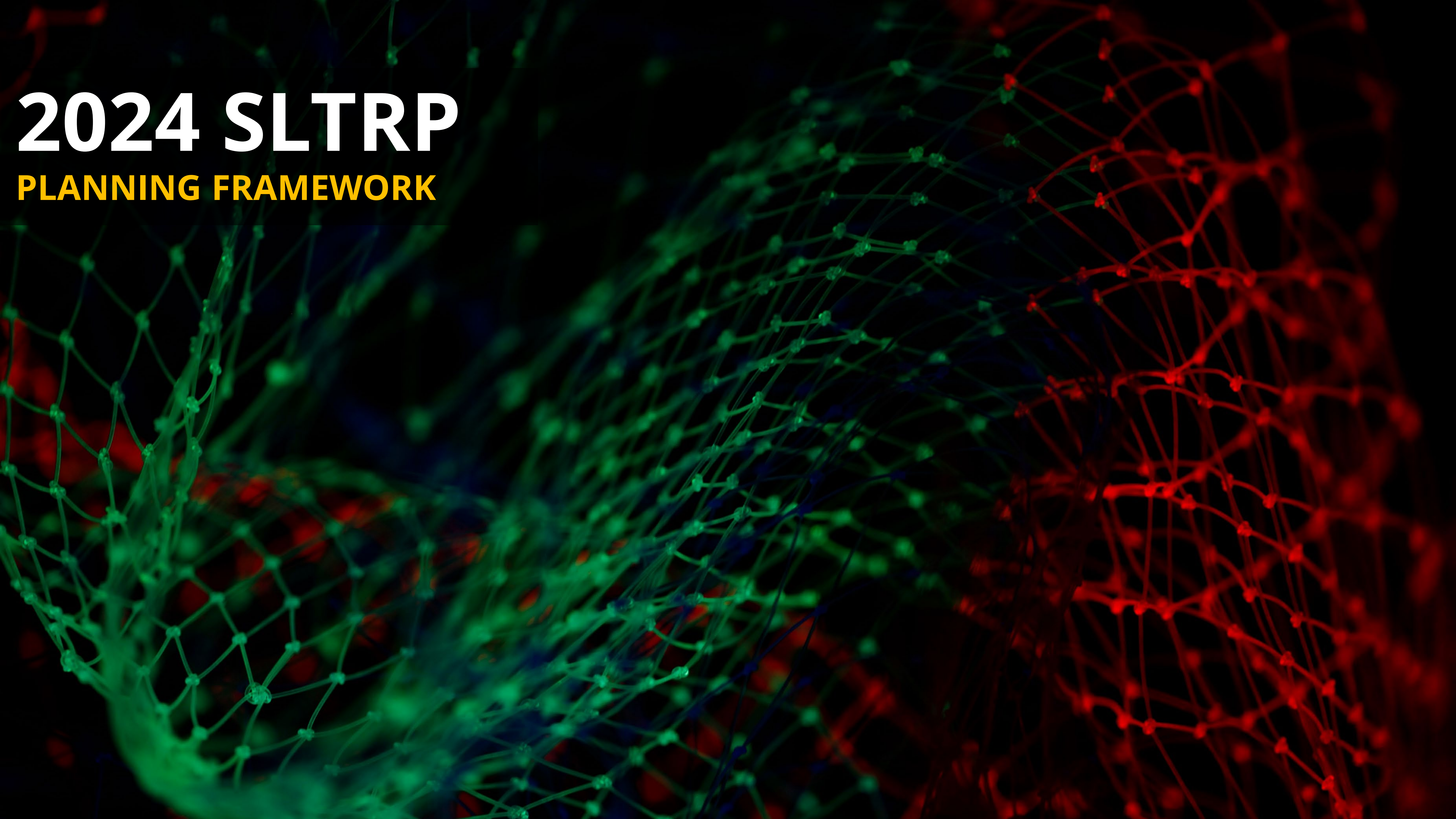
Electrification of heavy-duty trucks, particularly the heaviest trucks like fire trucks, dump trucks, fuel trucks, and long-haul tractors, would improve air quality and health."

—LA100 Equity Strategies, Executive Summary

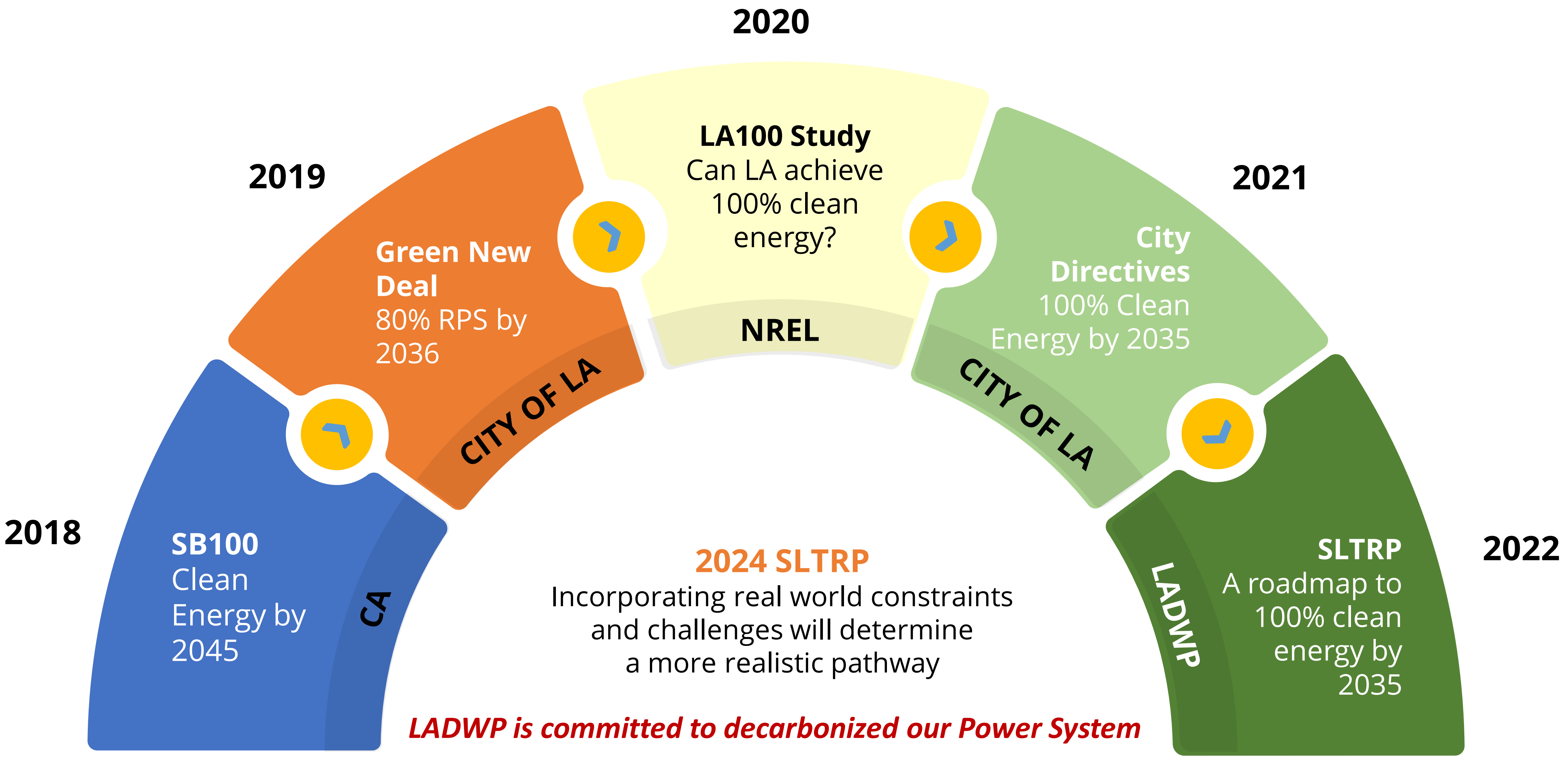
Break for Q&A

2024 SLTRP

PLANNING FRAMEWORK

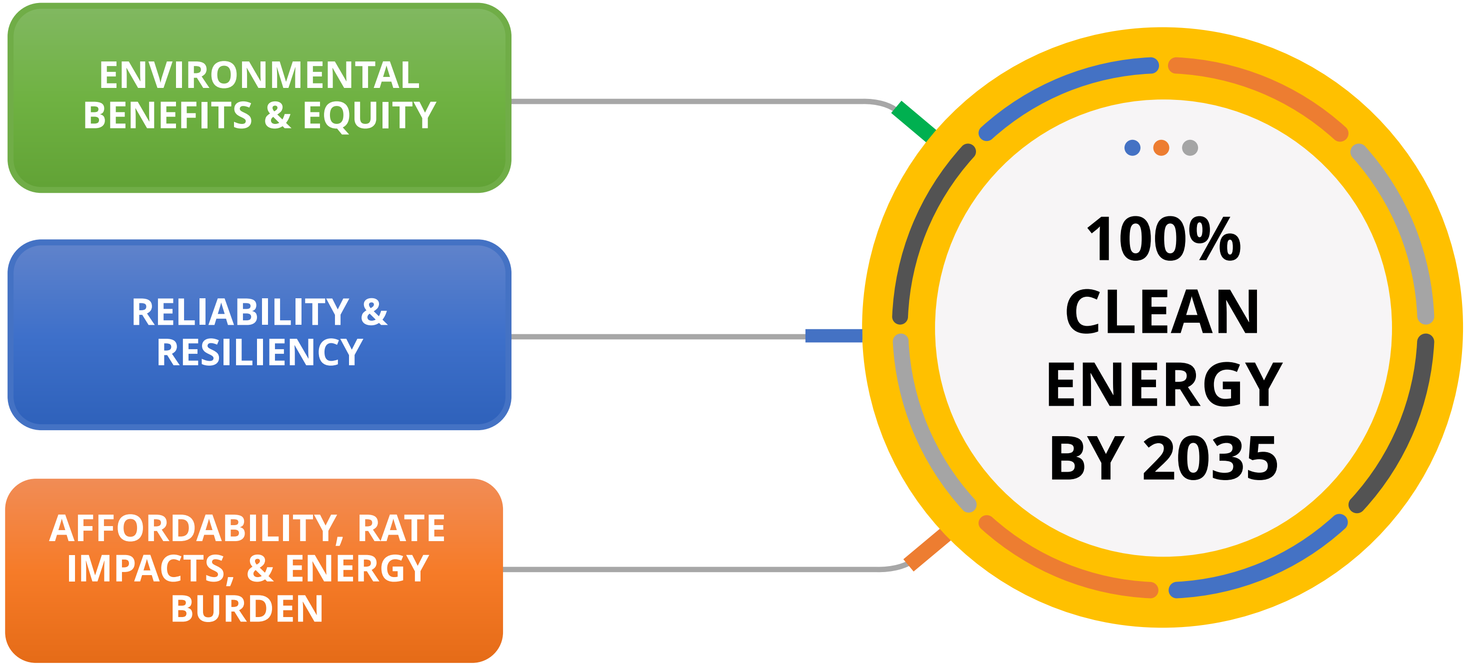


POLICY DRIVING THE 2024 SLTRP



GUIDING PRINCIPLES

The SLTRP is a Roadmap to Meet Our Future Energy Needs



OUTCOME:

Develop a Recommended Scenario That Guides Our Near-term Actions and Future Energy Planning

the
2022 SLTRP is a
conceptual
plan

Challenges to be Addressed

As part of the 2024 SLTRP

1	**Challenge 1:** **System Reliability – Outage Scheduling – PSRP Distribution**
2	**Challenge 2:** **Financial Health, Rate Affordability and Equity**
3	**Challenge 3:** **Availability & Advancement of Technologies**
4	**Challenge 4:** **(IHRP) Implementation Feasibility – Personnel Requirements**

Constraints Incorporation. The 2024 SLTRP will need to incorporate constraints to optimize the buildout of resources in a need to find balance between **reliability, the environment, affordability, and equity**.

High Level SLTRP

Balancing Future Demand with Future Resources.

A

Production Cost Modeling (PCM)

Is a comprehensive process used to forecast future costs and performance of different energy sources. The primary goal is to evaluate the total costs associated with generating electricity over a long-term horizon

B

Capacity Expansion Modeling (CEM)

The primary goal of CEM is to identify the most cost-effective investments in new energy generation and storage capacities over a long-term planning horizon. This includes determining what types of power plants to build, when to build them, and where they should be located.

C

Resource Adequacy Analysis

Focuses on ensuring that there is sufficient capacity to always meet the electric power demand. This analysis is essential for maintaining the reliability and stability of the power grid.

- LCOE / Total Costs
- GHG Emissions
- Reliability Scoring
- Contingency Planning
- Build & Adoption Rates
- Financial Forecasts
- Energy Burden
- Affordability
- Technology Performance
- Loss of Load
- Peak Load Coverage
- Ramp Rates

GRANT FUNDING BENEFITS

Building a Sustainable Process for the Betterment of the Power System

1. **Community Focus.** All major funding sources require a comprehensive community engagement plan to equitably invest awarded funds.
2. **Offsetting Project Costs.** Lowering the cost of clean energy initiatives and infrastructure developments with external funding.
3. **Unlocking Community Value.** External funding provides an opportunity for LADWP to invest in clean energy incentives, programs, or projects without traditional limitations.

March 2024

Power System Loans & Grants Quarterly Dashboard

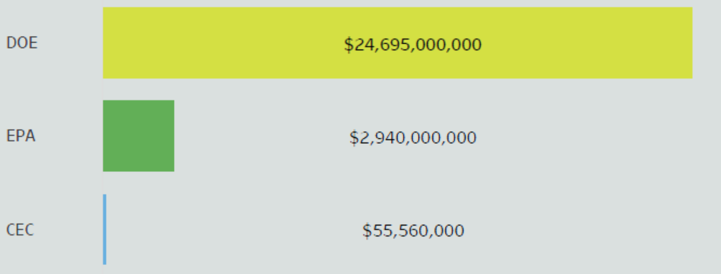
$82.36B Total Tracked Funding

$27.69B Currently Available

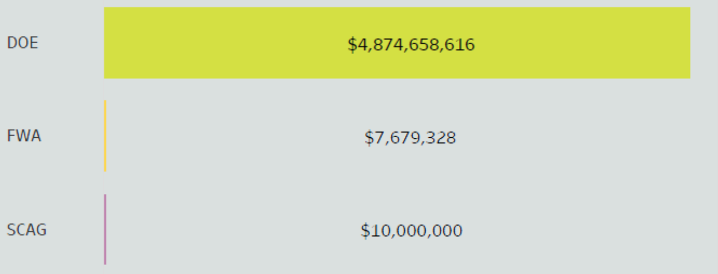
$4.89B Funding Requested

$51.68M Awarded to LADWP

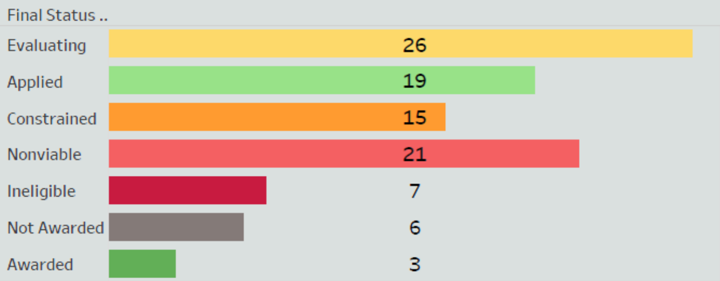
Total Available Funds by Agency



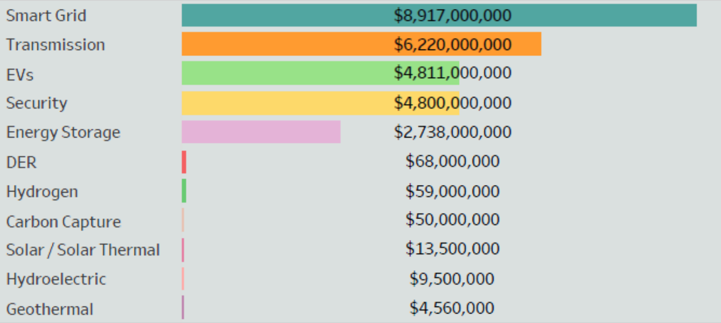
Total Requested Funds by Agency



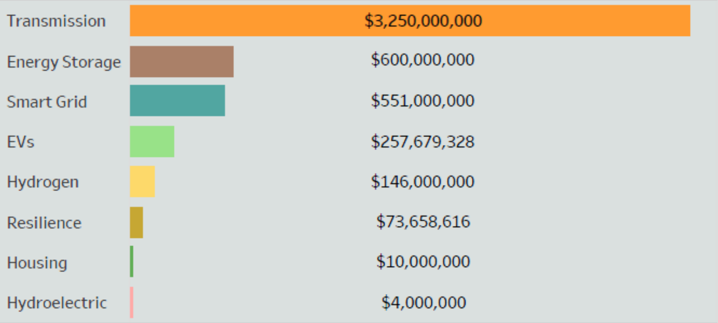
Performance (Count)



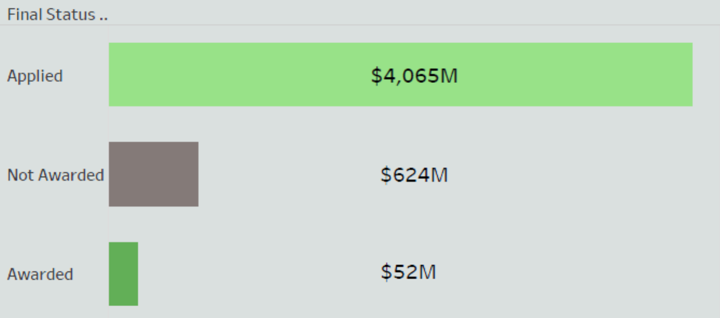
Total Available Funds by Type



Total Requested Funds by Type



Performance ($)



Pending Awards/Responses

FOA Agency	FOA Name	LADWP's Proposed Project Title	
DOE	Grid Resilience and Innovation Partnerships (GRIP) Program Round #2	Circuit Monitoring and Cable Replacement Acceleration for Underground Cable Systems	$50,000,000
		Deploying DER Innovations in Disadvantaged Communities to Create a Southern California Regional Virtual Power Plant Ahead of the 2028 Olympic and Paralympic Games	$50,000,000
		Kern-Southland Energy Link	$1,000,000,000
		Remote Operable Equipment	$25,000,000
		Substation Automation for Flexible Grid Operations	$28,000,000
		TransWest Express Transmission Project	$1,000,000,000
		Valley Long Duration Energy Storage (Valley LDES)	$100,000,000
		Victorville-Century Line 1 and 2 Conversion to HVDC Bipole System	$1,000,000,000
	Strategies to Increase Hydropower Flexibility	San Fernando Valley Hybrid Hydropower	$4,000,000
Grand Total			$3,257,000,000

Next Steps – SLTRP Meeting Map

Phase 1 (2024) Launch & Laying Foundation	Phase 2 (2024) Case Development	Phase 3 (2024) Modeling	Phase 4 (2024) Results	Phase 5 (2024) Outreach
Meeting #1: March 2024 Kick-off	**Meeting #3:** May 2024 Develop Cases	July through August 2024 Modeling Underway	**Meeting #5:** September 2024 Present Results	October 2024 Conduct Community Outreach Meetings
Meeting #2: April 2024 Building Blocks – Assumptions	**Meeting #4:** June 2024 Develop Sensitivities			**Meeting #6:** November 2024 Debrief on Public Outreach

2024 SLTRP Advisory Group Draft Meeting Plan
Please note that dates are tentative and subject to change based on needs of the SLTRP process.

Email: PowerSLTRP@ladwp.com

2024 SLTRP

QUESTIONNAIRE

Questionaire

ALL FEEDBACK IS ANONYMOUS!

Joint at

MENTI.COM

Use Code

6319 5207

Los Angeles Department of Water & Power

Final Q&A

Los Angeles Department of Water & Power

APPENDIX

Technology Risks (1/2)

Demand Response (DR)

- **Need for strong incentives.** Lack of customer participation can result in DR resource dependability.
- **Cybersecurity risks and data breaches.** Concerns with collection and analyses of customer data
- **Inaccurate real time electricity consumption.** Poor meter infrastructure can lead to inaccurate control measures.

Hydroelectric

- **Large capital cost.**
- **Environmental concerns**. Land constraints for proposed projects and vulnerability to earthquakes.
- **Need for water flow analyses.** Alteration of water flows upstream and downstream must be considered by stakeholders

Nuclear

- **Large capital cost.**
- **Environmental concerns.** Management of reactor cooling and radioactive waste disposal is critical. Vulnerability to earthquakes.
- **Construction delays.** Regulatory requirements and compliance may take longer than usual processing.
- **Lack of input/output flexibility.** Mainly used as baseload power.

Wind

- **Intermittency.** Not steady; Only occurring at specific intervals/times.
- **Negative impacts to wildlife.** Mainly to birds.
- **Transmission vulnerabilities.** Mainly placed in remote generation locations.
- **Lack of reliable material recycling.** Challenging management of manufacturing, recycling, disposal of wind turbine parts.

Flow Batteries

- **High Cost.** Cost more than lithium-ion technology and other material costs can be substantial.
- **Chemical Hazards.** Electrolyte solution can be corrosive, toxic, and harmful to environment.
- **Size/Space Limitations.** Require large physical footprint to store energy

Technology Risks (2/2)

Lithium-Ion Batteries

- **Safety.** Can generate heat and lead to thermal runway, fires, and explosions if not handled properly.
- **Supply chain and material availability.** Requires lithium, cobalt, nickel, which have price fluctuations and compromise dependability based on cost.
- **Recommended charging range.** Manufacturer provided charging range. If surpassed, can lead to safety hazards, decreased longevity, and alter functionality

Pumped Storage

- **Environmental concerns.** Requires construction of reservoirs and dams, disrupting nearby habitats.
- **High Cost Upfront.** Requires significant investment upfront associated with land acquisition, construction, and transmission.
- **Water Availability.** Pumped storage systems rely on water availability for operation.

Combined-cycle/Gas Turbines

- **High GHG Emissions.** Fuel costs can be volatile.
- **Lack of reliability.** Diminishing Fuel Supply.
- **Inefficient Operations to Meet Demands.** Long start up times of units.
- **Maintenance Issues and Timely Repairs.** Fuel Supply Leaks and Boiler/Turbine/Generator Failure.

Geothermal

- **Resource Uncertainty.** Lack of geothermal resources that can be economically developed
- **High Cost.** Drilling test wells can amount to $10 million - $30 million per well, with 66% of wells unsuitable for electricity generation
- **Temperature dependent efficiency.**

Local Solar

- **Supply chain issues.** Tariffs.
- **Unknown future capacity.** Dependent on incentives.
- **Diminishing value.** Increased supply may alter value.
- Variable energy output.
- **Monitoring/Metering Challenges.** Equipment is not highly accessible within the city of Los Angeles.

Utility-Scale Solar PV

- **Intermittency.** Depends on weather patterns.
- **Construction delays.** Permitting and adhering to environmental regulations can prolong projects.
- **Supply chain issues.** Tariffs.
- **Variable Energy Output.**
- **Safety.** Possibility of Battery Fires.