



The Los Angeles 100% Renewable Energy Study

# Advisory Group 8

June 13, 2019



# Agenda

- Call to Order
- Welcome Remarks
- Introductions
- Clean Grid LA and Strategic Long-Term Resource Plan
- LA100 Recap and Updates \*\*
- LA100—Interpreting Modeling Outputs of Long-term Scenarios\*\*
- Lunch
- LA100—Bottom-up Load Modeling for Residential and Commercial Sectors—Assumptions and Early Results\*\*
- LADWP Financial Services Organization: Overview of Financial Planning Criteria to Support Borrowing\*\*
- Wrap-up and Next Steps

*\*\*Q&A and Discussion*

# Tips for Productive Discussions

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- Let one person speak at a time
- Help to make sure everyone gets equal time to give input
- Keep input concise so others have time to participate
- Actively listen to others, seek to understand perspectives
- Offer ideas to address questions and concerns raised by others
- Hold questions until after presentations



The Los Angeles 100% Renewable Energy Study

# LA100 Recap and Updates

Jaquelin Cochran, Ph.D.

June 13, 2019



# Refresh: LA100 Objectives

LA100 aims to address the full suite of questions and issues raised in three recent Los Angeles City Council Motions:

- Determine what **investments** can be made to achieve 100% RE power system
- Examine the impacts on **local jobs** and **economic development**
- Understand the **electricity rate, air quality, and health impacts** of achieving a 100% RE system
  - Identify **environmental justice neighborhoods** to be the first beneficiaries of improvements



# LA100: What Is Unique?



LADWP must balance electricity supply and demand at all times



Most scenarios go beyond SB100, including:

- RE-only, not just clean energy with RECs
- Meeting all generation, not just retail consumption



First-of-its-kind modeling



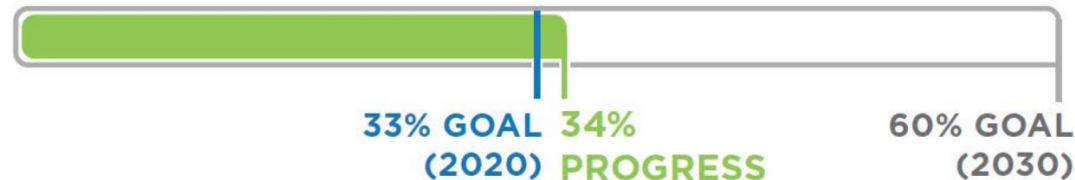
Objective, transparent, stakeholder-based analysis of pathways to 100% RE

- LA100 does not present recommendations or suggest policies
- LA100 does not evaluate implementation, such as difficulty of transmission upgrades

# What's New Since Last AG?

- **SB100** in effect (January 1, 2019)
- **PG&E bankruptcy** (January 29, 2019); investor-owned utilities' bond ratings downgraded; solar companies supplying PG&E also downgraded by ratings or fallen stock value
- **Mayor's decision** to not repower remaining once-through cooling units (February 12, 2019)
- **Clean Grid LA** initiative established by LADWP (February 12, 2019)
- **New state RE targets:** New Mexico 100% carbon-free by 2045 (March 22); Nevada—RPS 50% by 2030 (April 22); Washington carbon neutral (2030), carbon-free retail by 2045 (May 7); Colorado goal carbon-free by 2050 (May 30)
- **LA's Green New Deal "pLAN"** (introduced April 29, 2019), and broader national discussions about 100% RE futures, costs

## Estimated 2018 CA Renewables Portfolio Standard Progress



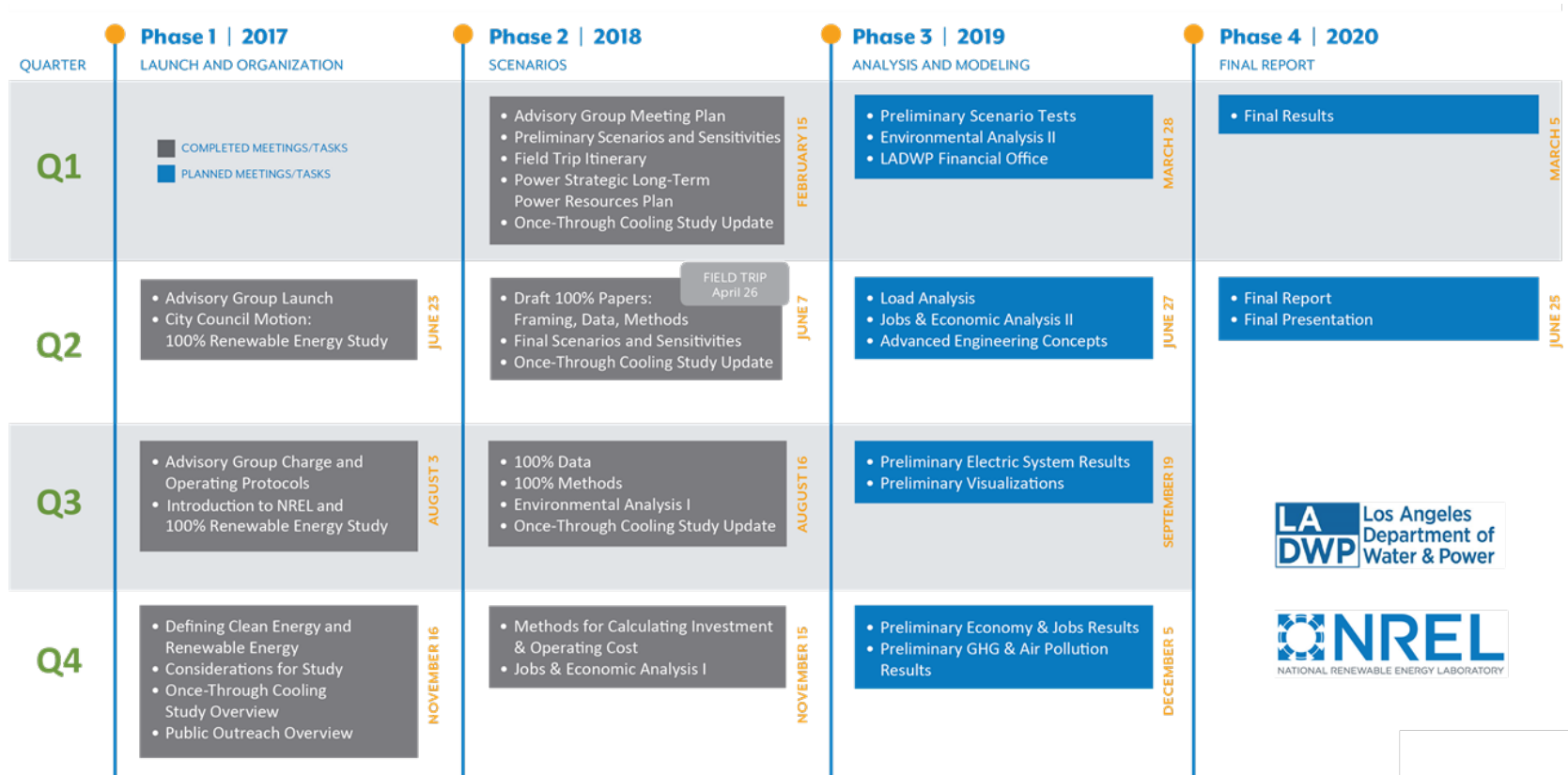
Source: California Energy Commission, staff analysis November 2018

# Integrating Mayor's Decisions into LA100

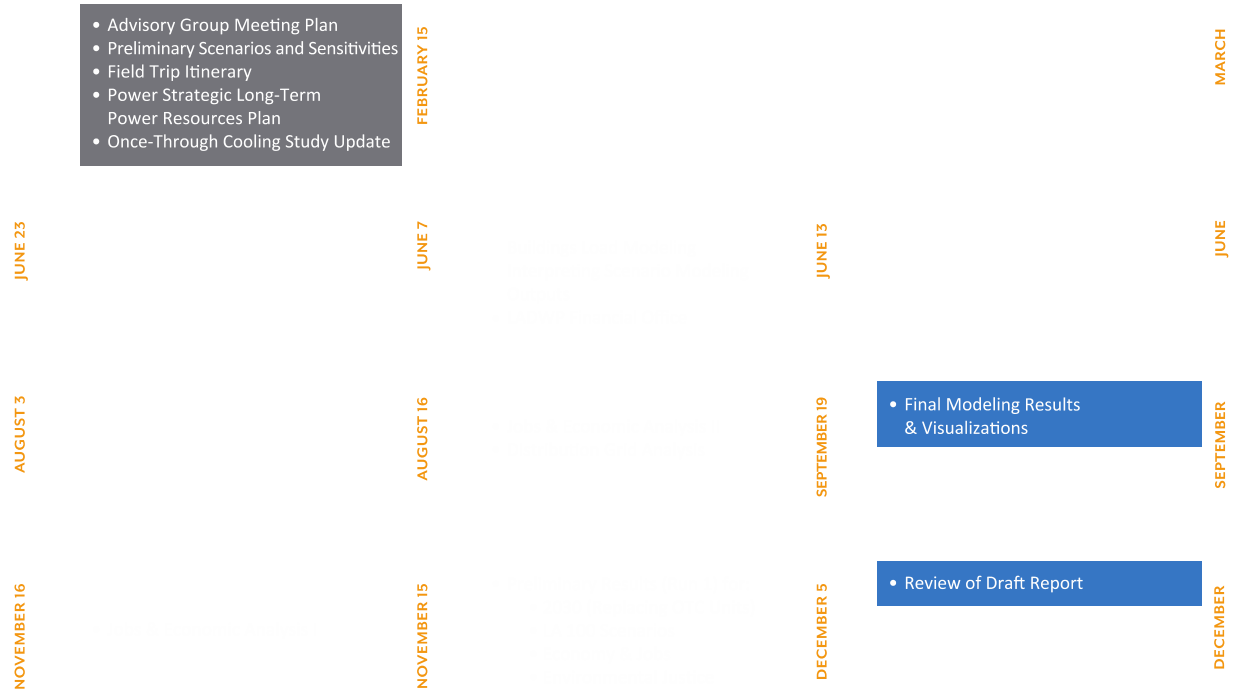
- **LA's Green New Deal (2019 Updates to Sustainable City pLAN):**
  - Add bus electrification (LADOT, LA Metro, school buses)
  - Align high electrification projections with pLAN targets (residential & commercial buildings, light-duty vehicles)
  - Evaluate pathways to local solar targets, including community solar and virtual net metering for multifamily buildings
- **No repowering:**
  - Remove repowering assumption from each scenario
  - Identify options for reliable, clean generation to replace OTC units (in-depth modeling focus on 2030) [pending LADWP approval]
- **Timeline extended 6 months** as a result of these changes
  - Impacts AG schedule



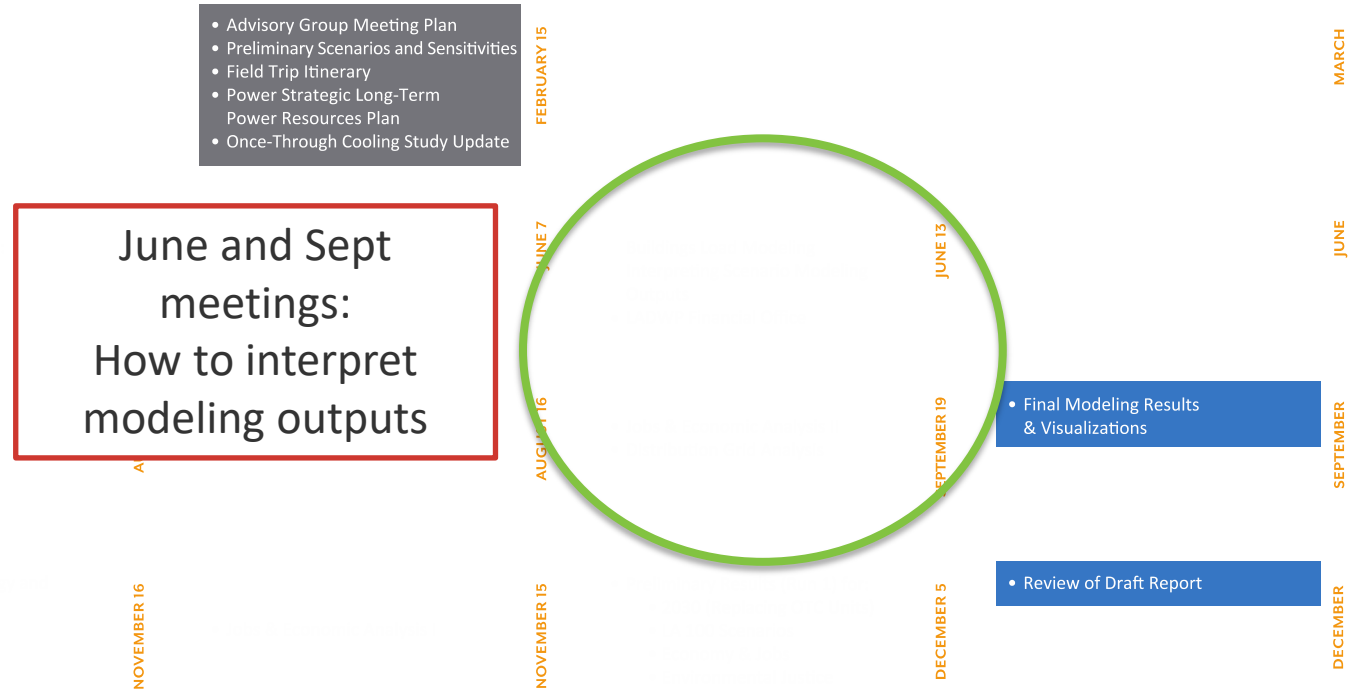
# AG Timeline (prior version)



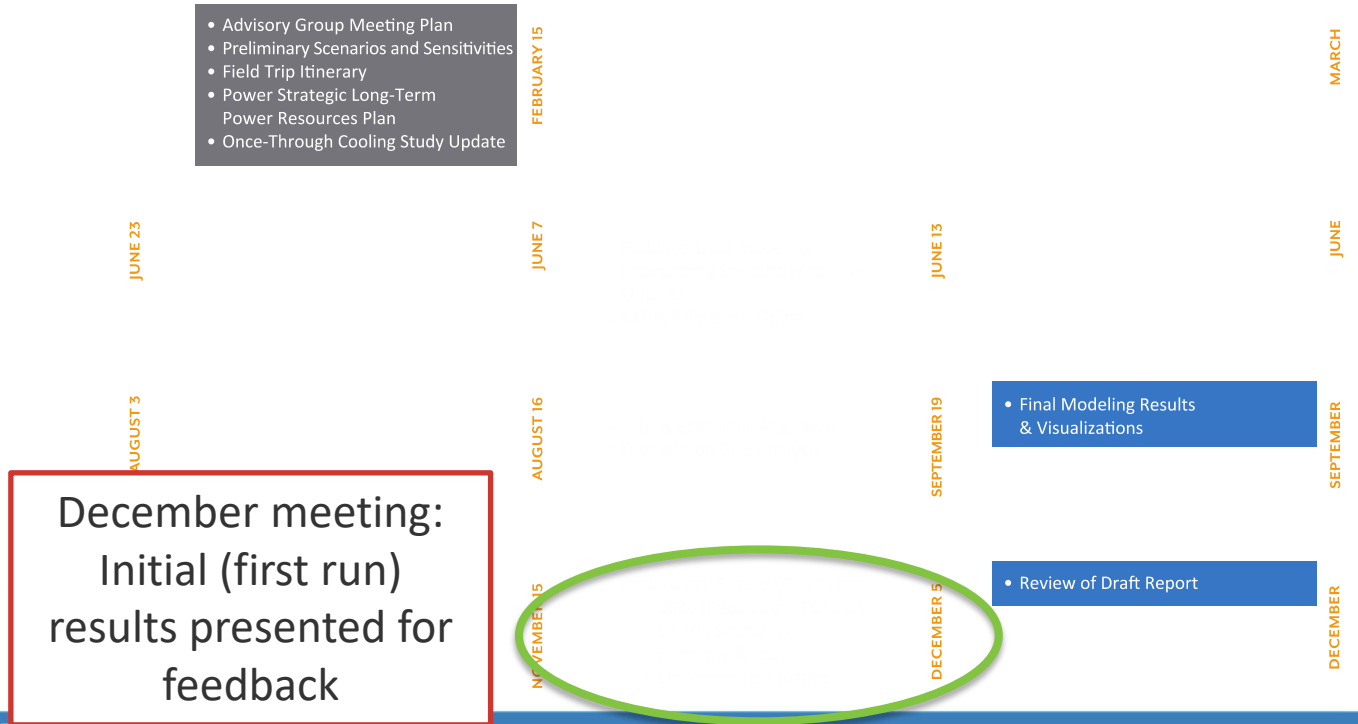
# New AG Timeline



# New AG Timeline



# New AG Timeline



# Scenario Matrix (Presented November 2018)

		Reference		LA100						
		LADWP 2017 SLTRP Recommended Case	SB 100	LA-Leads	Transmission Renaissance	High Distributed Energy Future	Emissions Free	High Load Stress	Load Modernization	Western Initiatives
		All LA100 cases reach 100% Net Renewable Energy by 2030								
Compliance Year:		2045	2045	2035/2040	2045	2045	2045	2045	2045	2045
Technologies Eligible in the Compliance Year	Biomass	Matches 2017 SLTRP Technology Mix	Y	Y	Y	Y	N	Y	Y	Y
	Biogas		Y	Y	Y	Y	N	Y	Y	Y
	Electricity to Fuel (e.g. H2)		Y	Y	Y	Y	Y	Y	Y	Y
	Fuel Cells		Y	Y	Y	Y	Y	Y	Y	Y
	Hydro - Existing		Y	Y	Y	Y	Y	Y	Y	Y
	Hydro - New		N	N	N	N	N	N	N	N
	Hydro - Upgrades		Y	Y	Y	Y	Y	Y	Y	Y
	Natural Gas		Y	N	N	N	N	Y	N	N
	Nuclear - Existing		Y	Y	N	N	Y	Y	N	N
	Nuclear - New		N	N	N	N	N	N	N	N
Wind, Solar, Geo Storage	Y	Y	Y	Y	Y	Y	Y	Y		
DG	Distributed Adoption	Reference	Balanced	High	Low	High	Balanced	Balanced	Balanced	Balanced
RECS	Financial Mechanisms (RECS/Allowances)	Y	Y	N	N	N	N	Y	N	N
Load	Energy Efficiency	Reference	Moderate	High	Moderate	High	Moderate	Reference	High	Moderate
	Demand Response	Reference	Moderate	High	Moderate	High	Moderate	Reference	High	Moderate
	Electrification	Reference	Moderate	High	Moderate	High	Moderate	High	High	Moderate
Transmission	New or Upgraded Transmission Allowed?	Matches 2017 SLTRP	Only Along Existing or Planned Corridors	Only Along Existing or Planned Corridors	New Corridors Allowed	No New Transmission	Only Along Existing or Planned Corridors	Only Along Existing or Planned Corridors	Only Along Existing or Planned Corridors	Only Along Existing or Planned Corridors
WECC	WECC VRE Penetration	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	High

# New Scenario Matrix

		LA100 Scenarios							
		SB100	LA-Leads	Transmission Renaissance	High Distributed Energy Future	Emissions Free	High Load Stress	Load Modernization	Western Initiatives
2030 RE Target		60%	100% Net Renewable Energy						
Compliance Year for 100%		2045	2035/2040	2045	2045	2045	2045	2045	2045
Technologies Eligible in the Compliance Year	Biomass	Y	Y	Y	Y	No	Y	Y	Y
	Biogas	Y	Y	Y	Y	No	Y	Y	Y
	Electricity to Fuel (e.g. H2)	Y	Y	Y	Y	Y	Y	Y	Y
	Fuel Cells	Y	Y	Y	Y	Y	Y	Y	Y
	Hydro - Existing	Y	Y	Y	Y	Y	Y	Y	Y
	Hydro - New	N	N	N	N	N	N	N	N
	Hydro - Upgrades	Y	Y	Y	Y	Y	Y	Y	Y
	Natural Gas	Yes	N	N	N	N	Yes	N	N
	Nuclear - Existing	Y	Y	No	No	Y	Y	No	No
	Nuclear - New	N	N	N	N	N	N	N	N
	Wind, Solar, Geo Storage	Y	Y	Y	Y	Y	Y	Y	Y
	Repowering OTC	Haynes, Scattergood, Harbor	N	N	N	N	N	N	N
DG	Distributed Adoption	Reference	High	Low	High	Balanced	Balanced	Balanced	Balanced
RECS	Financial Mechanisms (RECS/Allowances)	Yes	N	N	N	N	Yes	N	N
Load	Energy Efficiency	Reference	High	Moderate	High	Moderate	Reference	High	Moderate
	Demand Response	Reference	High	Moderate	High	Moderate	Reference	High	Moderate
	Electrification	Reference	High	Moderate	High	Moderate	High	High	Moderate
Transmission	New or Upgraded Transmission Allowed?	Matches 2017 SLTRP	Only Along Existing or Planned Corridors	New Corridors Allowed	No New Transmission	Only Along Existing or Planned Corridors	Only Along Existing or Planned Corridors	Only Along Existing or Planned Corridors	Only Along Existing or Planned Corridors
WECC	WECC VRE Penetration	Reference	Reference	Reference	Reference	Reference	Reference	Reference	High

Removed reference cases

SB100 incorporated as one of the LA100 scenarios

All scenarios assume no repowering

Questions?

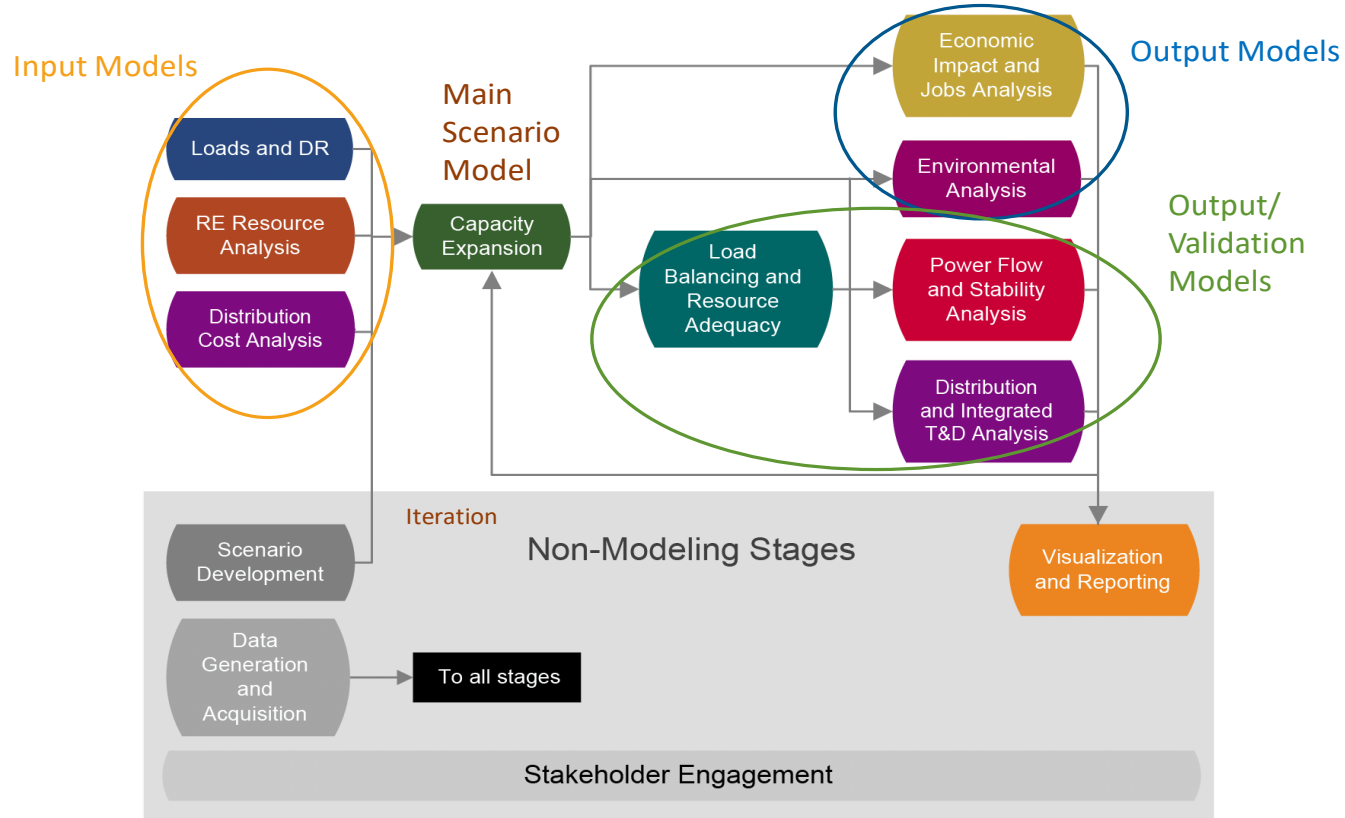
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# LA100: Modeling Overview & Status

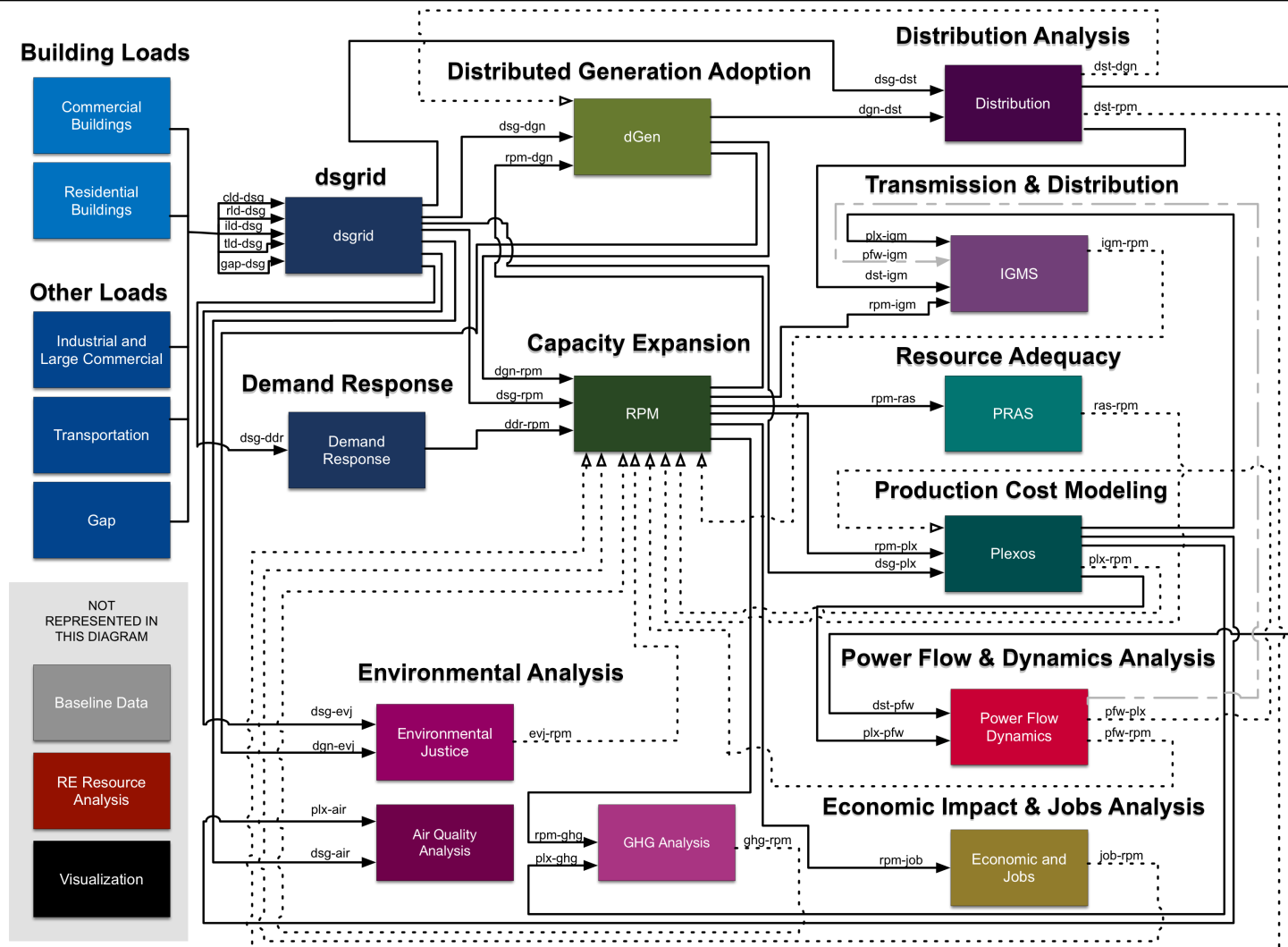
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# Modeling Framework

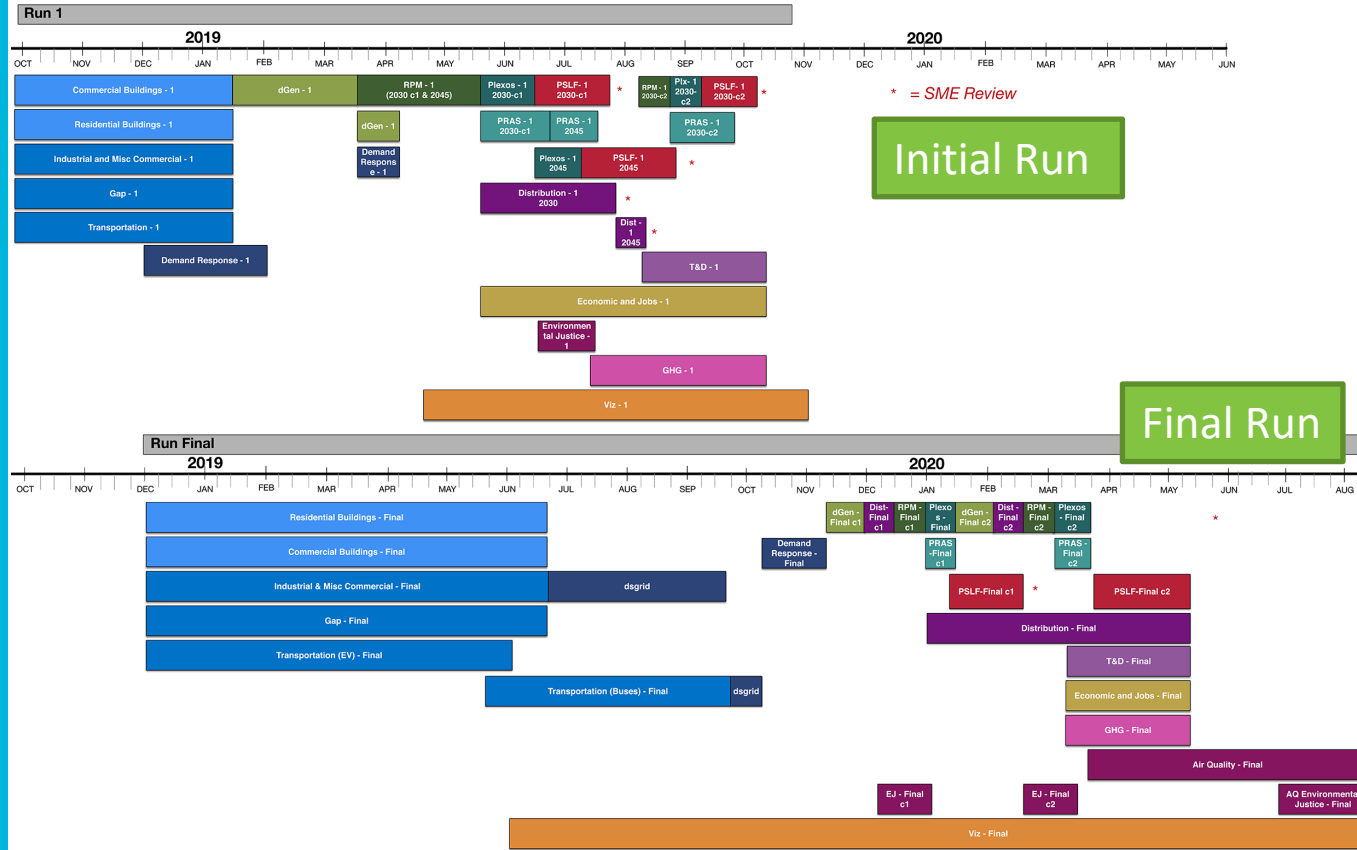


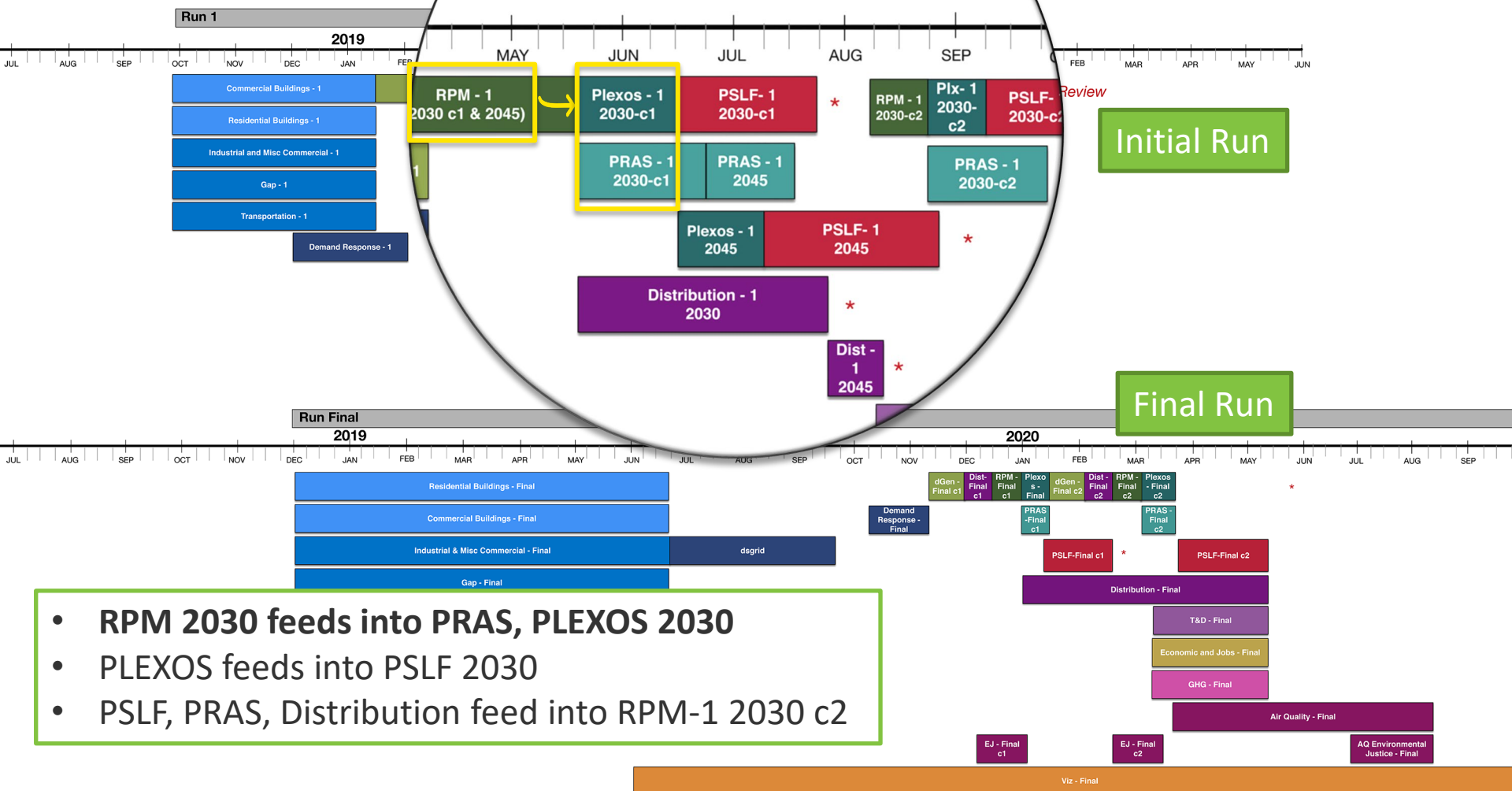
# Detailed Modeling Framework Showing Data Handoffs Between Models



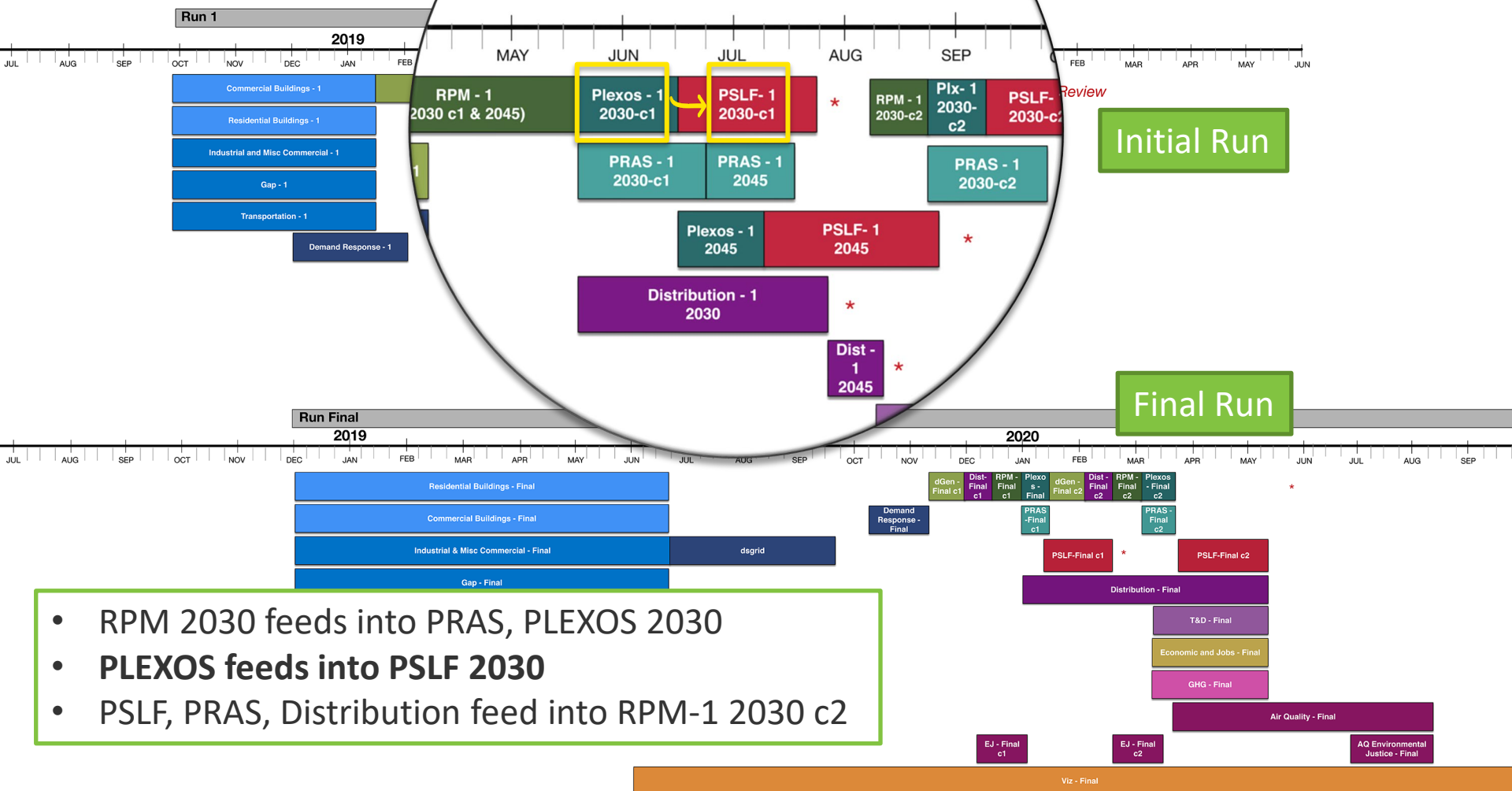
# Our Timeline of Modeling Dependencies

Results from first round feed into second round of modeling e.g., If power flow shows reliability violations, updates are made to capacity or operations

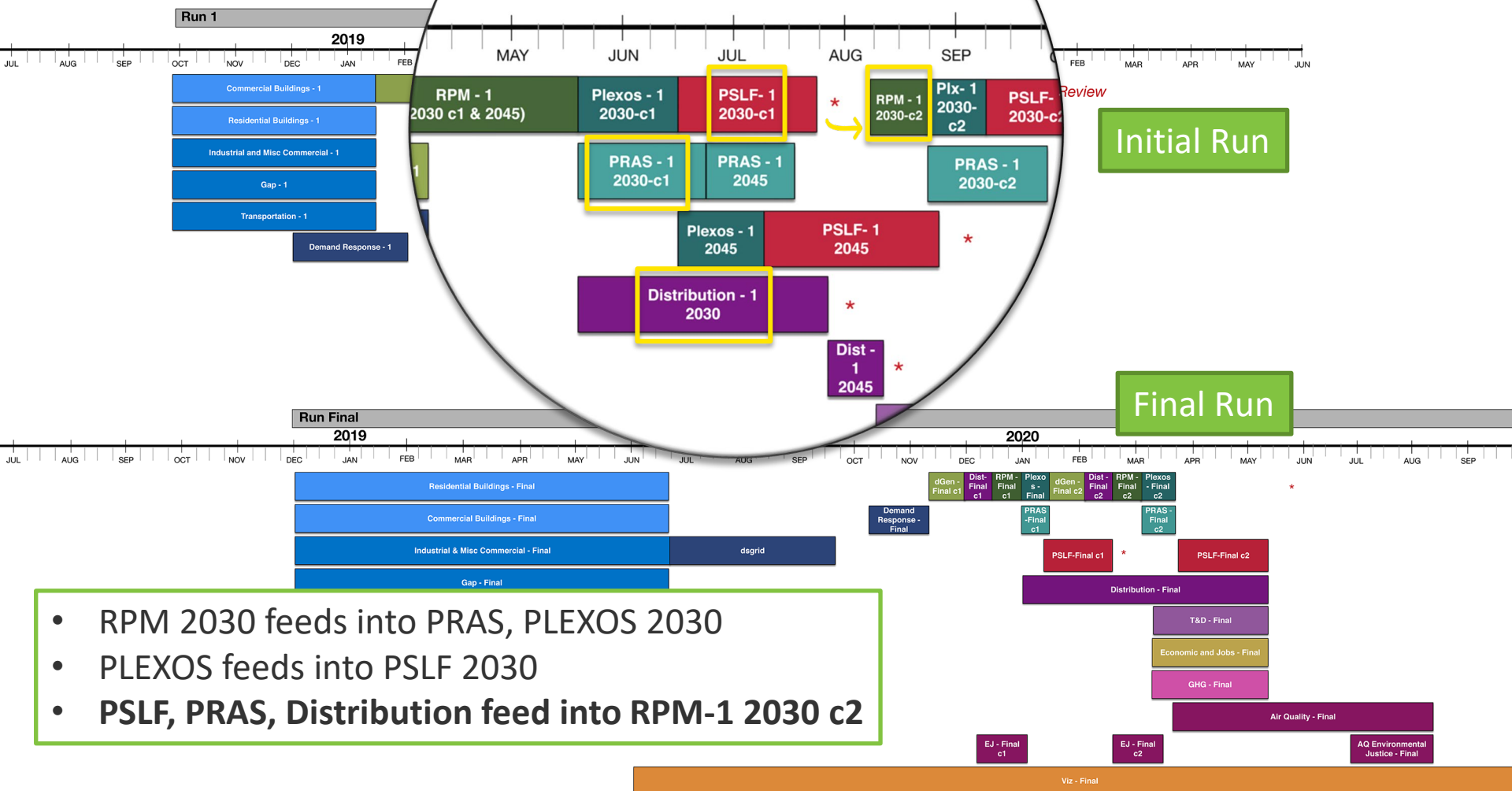




- RPM 2030 feeds into PRAS, PLEXOS 2030
- PLEXOS feeds into PSLF 2030
- PSLF, PRAS, Distribution feed into RPM-1 2030 c2



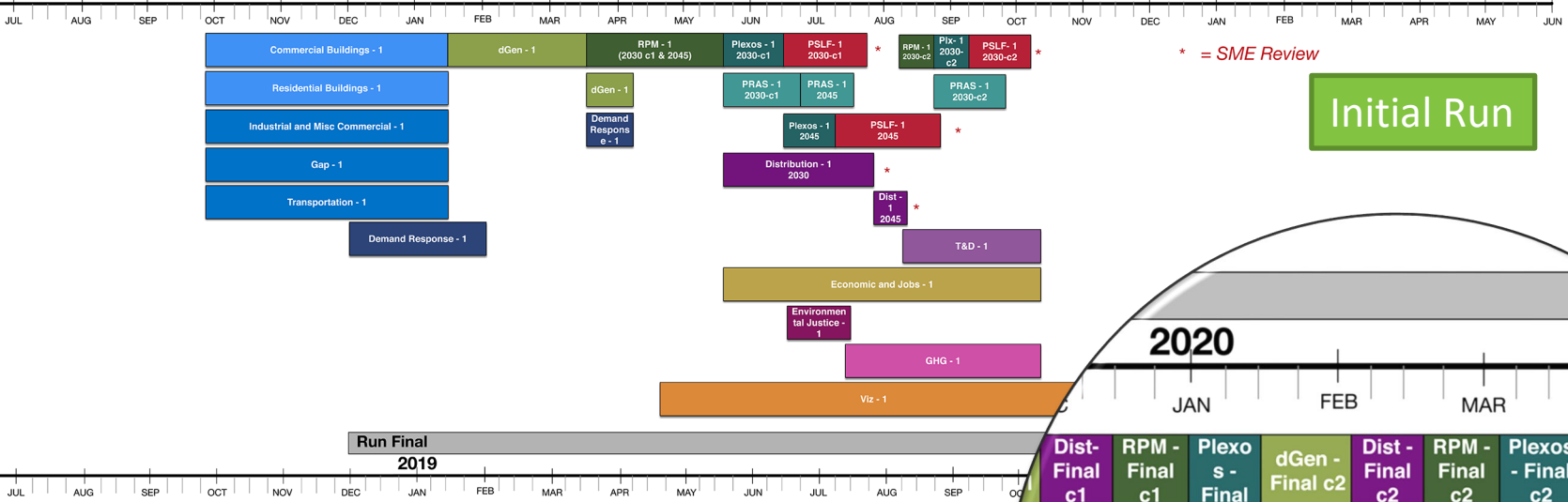
- RPM 2030 feeds into PRAS, PLEXOS 2030
- **PLEXOS feeds into PSLF 2030**
- PSLF, PRAS, Distribution feed into RPM-1 2030 c2



Run 1

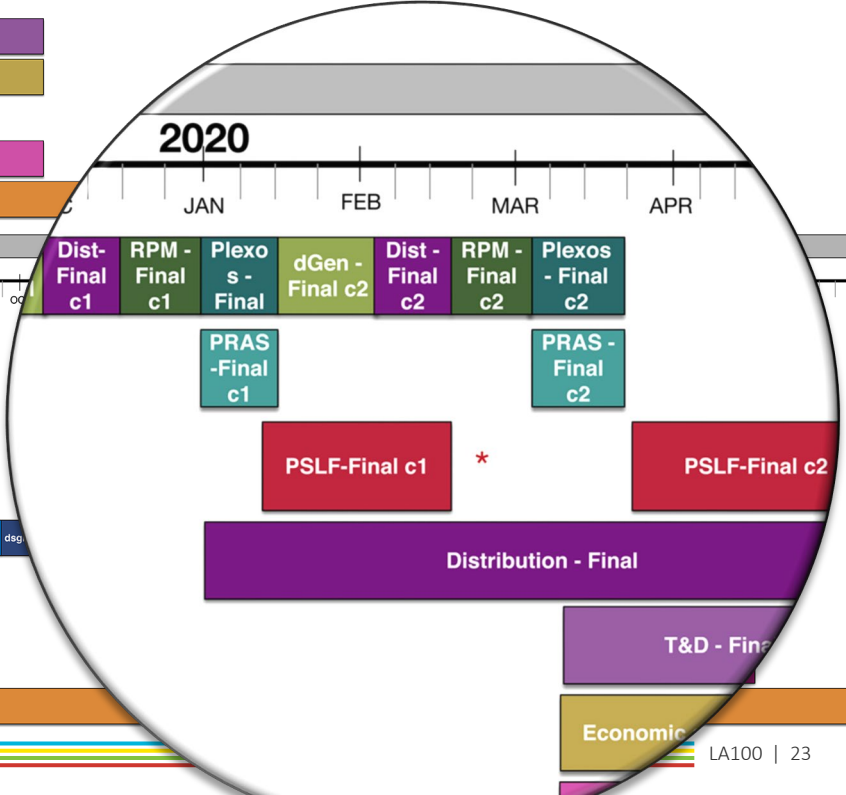
2019

2020

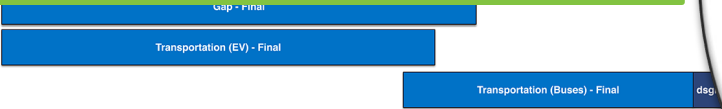


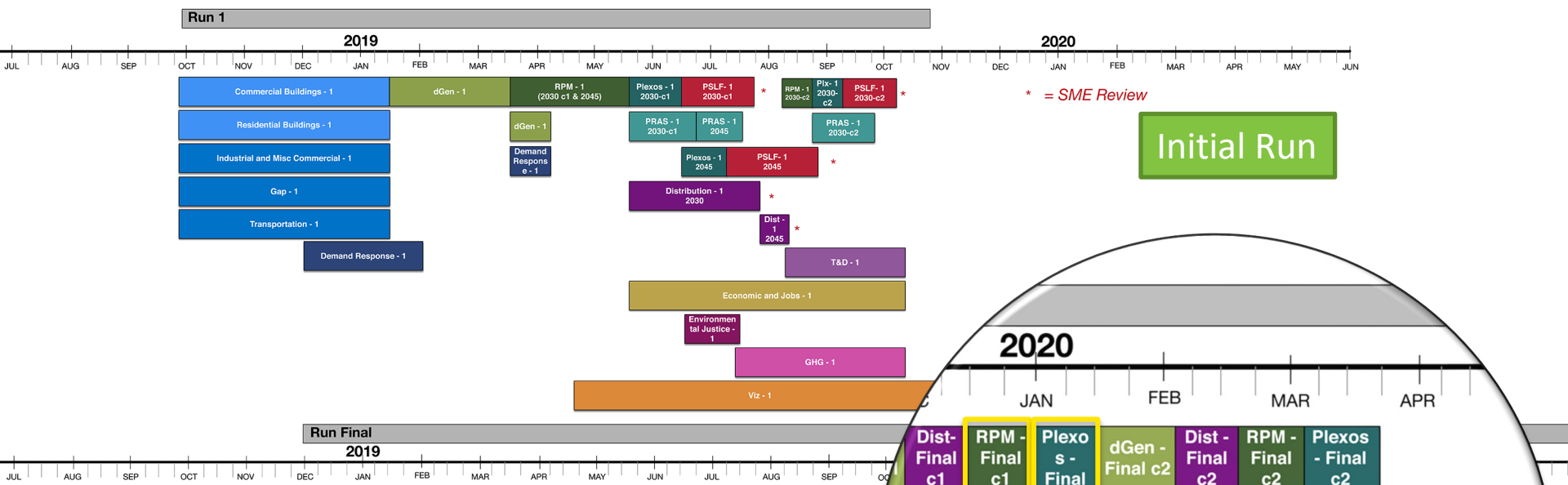
Initial Run

2020



Then we move to Final Run to run the cycle again with updated loads.

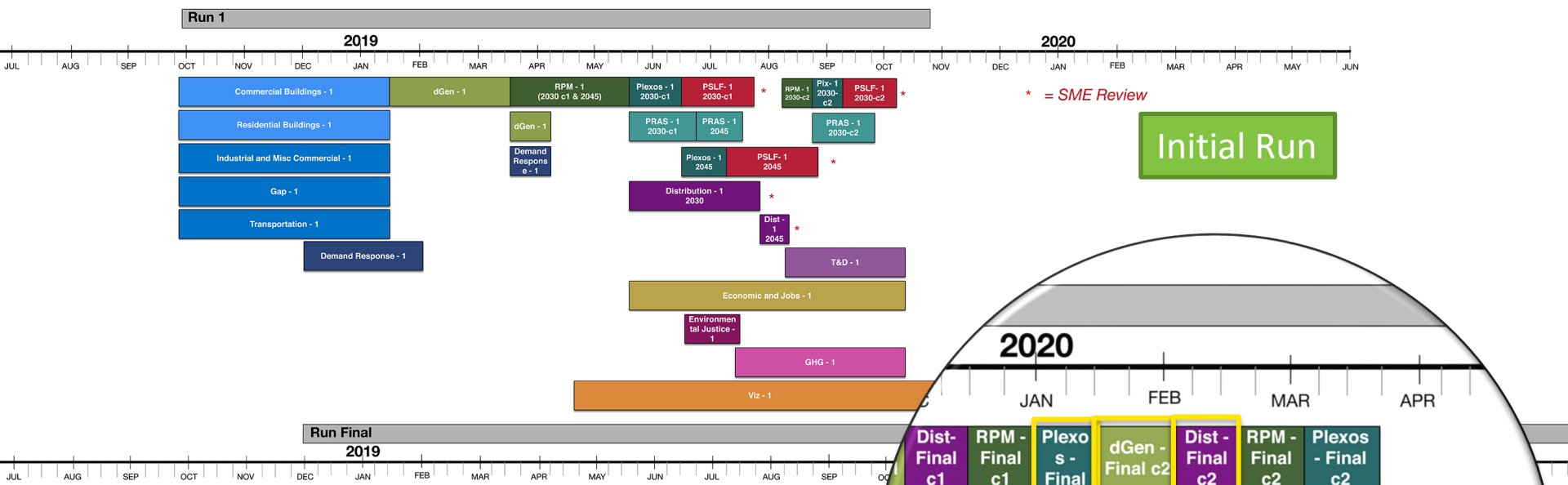




Then we move to Final Run to run the cycle again with updated loads.

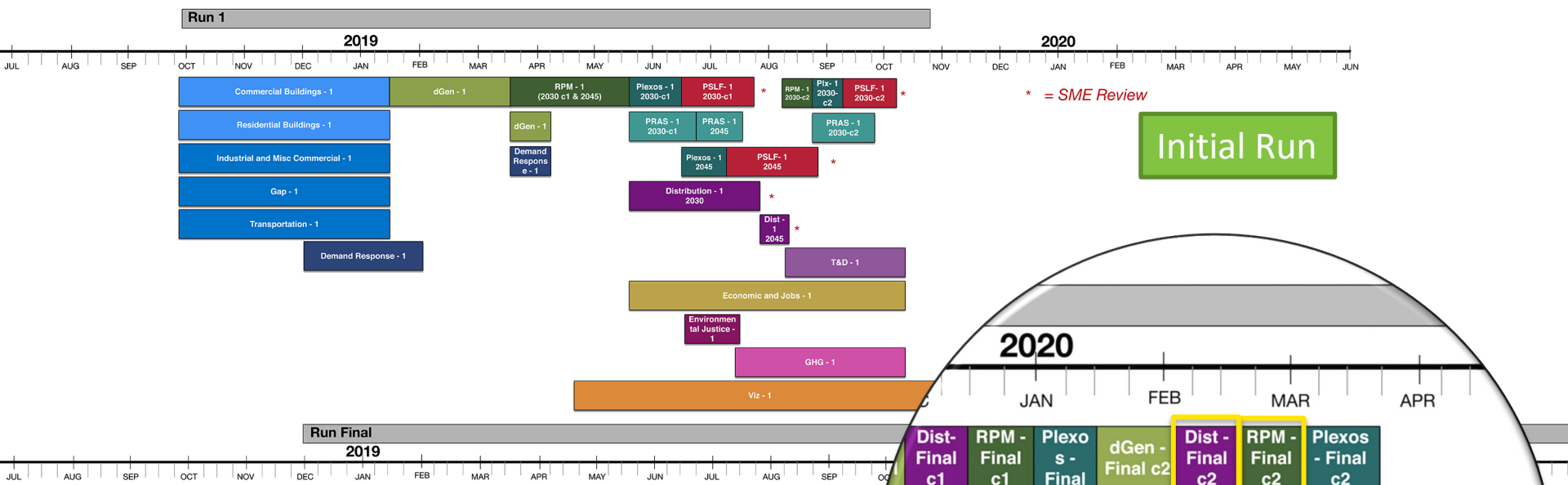
- **RPM feeds into PRAS, PLEXOS**
- **PLEXOS feeds into PSLF; RPM to dGen, then Distribution**
- **PSLF, PRAS, Distribution feed into RPM Final**





Then we move to Final Run to run the cycle again with updated loads.

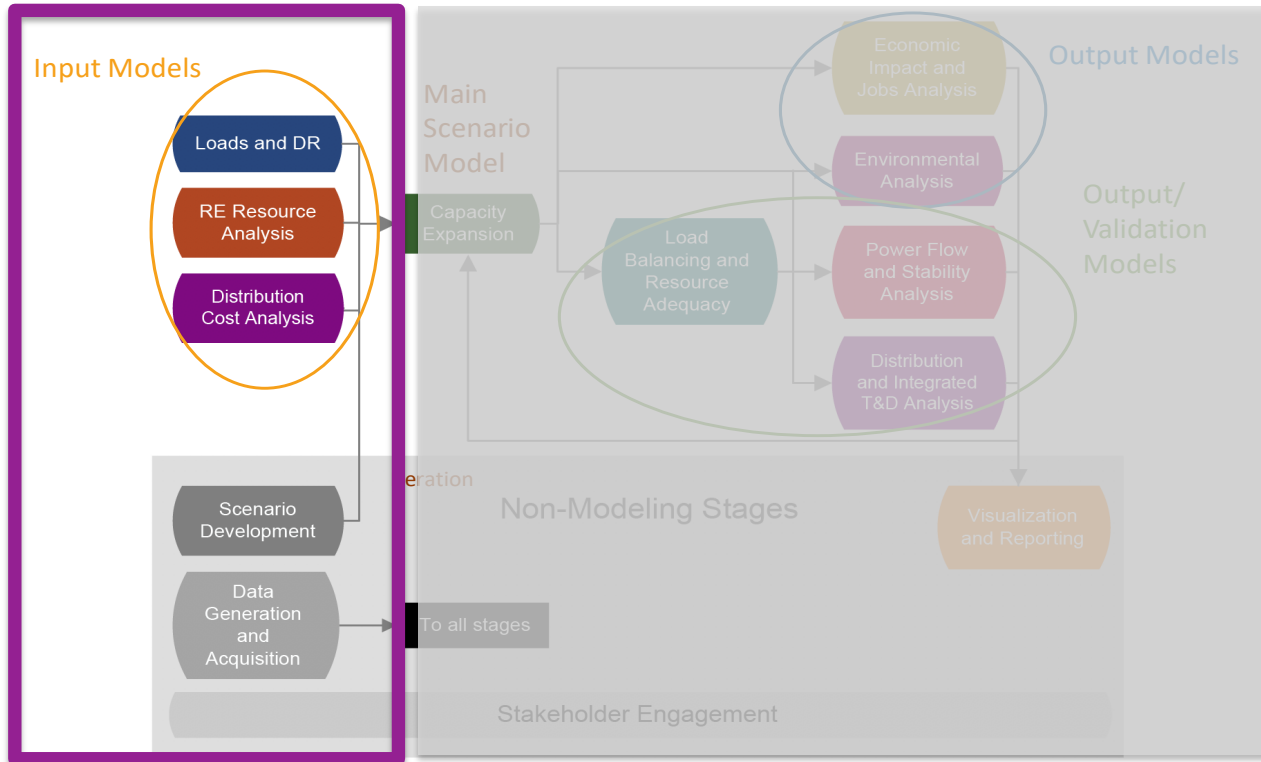
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Then we move to Final Run to run the cycle again with updated loads.

- RPM feeds into PRAS, PLEXOS
- PLEXOS feeds into PSLF; RPM to dGen, then Distribution
- **PSLF, PRAS, Distribution feed into RPM Final**

# Input Models—Status Update



## Complete:

- Final Run: Load modeling, except electric buses (new)
- Energy efficiency assumptions
- RE generation profiles

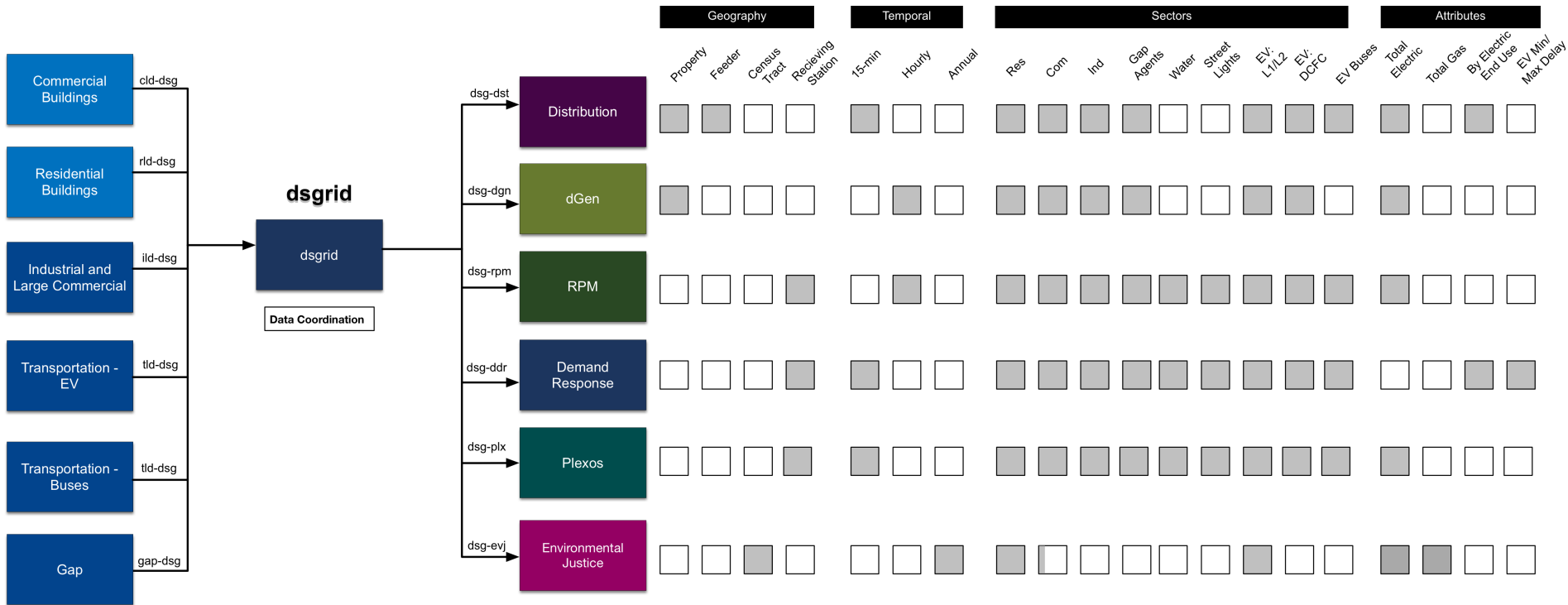
## Ongoing refinement:

- Rooftop PV availability
- Data management between models

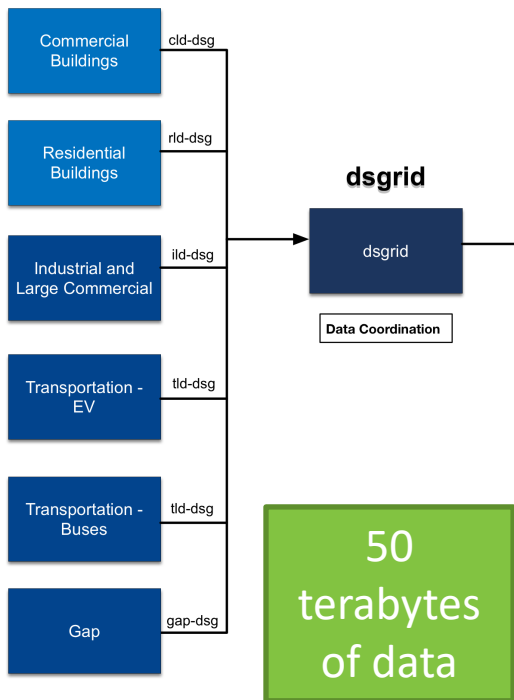
## In development:

- Distribution network—modeling and costs
- Electric bus (school, transit) charging profiles

# Progress Update: Load Data Allocation to Downstream Models



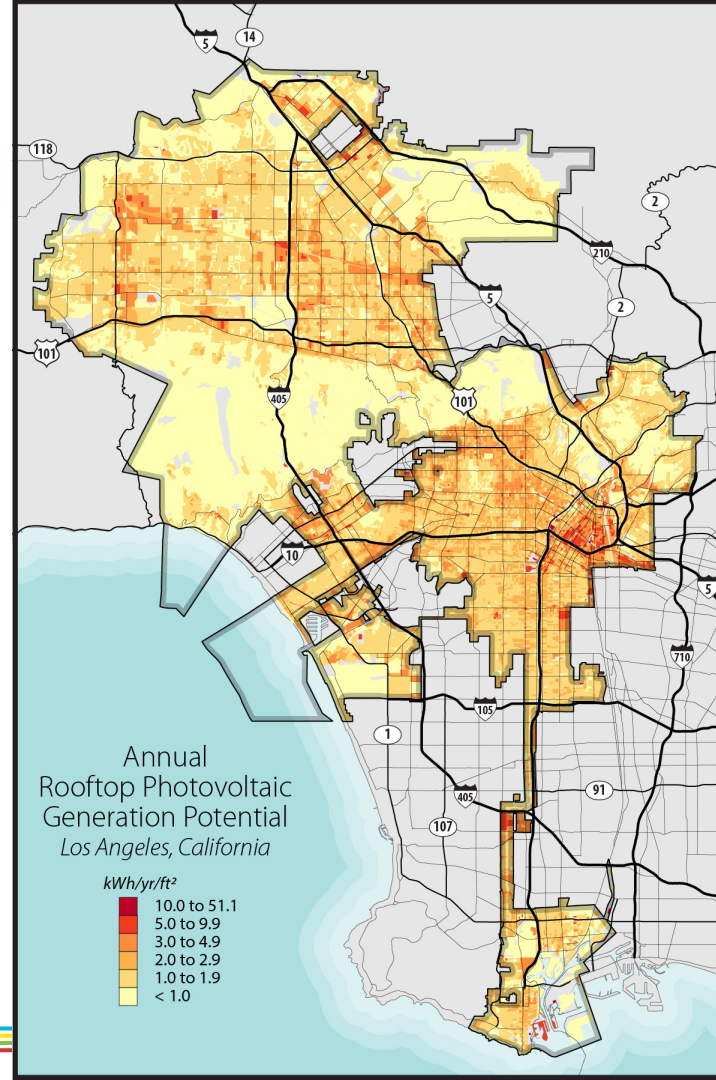
# Progress Update: Load Data Allocation to Downstream Models



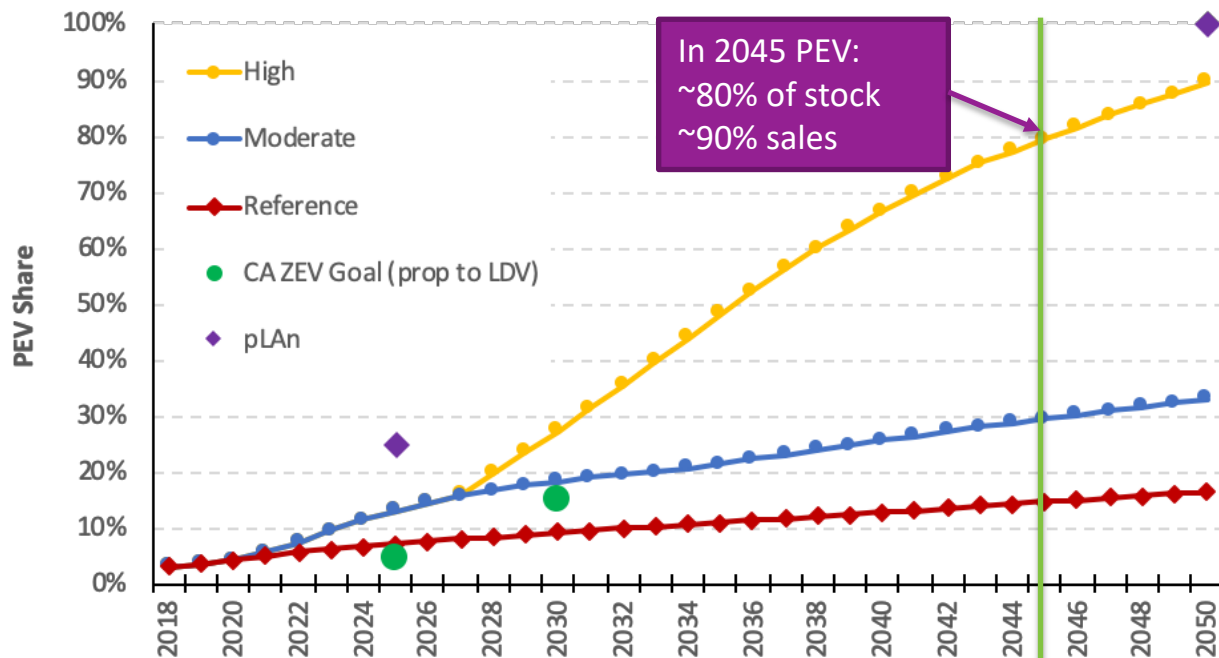
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End Use	<input type="checkbox"/>	<input type="checkbox"/>
Max Delay	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>
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# Progress Update: Analysis of 2045 Rooftop Solar

## Technical Potential



# Progress Update: Projections of Light-Duty Electric Vehicles Adoption, by Scenario



Plug-in EV Share by Projection:

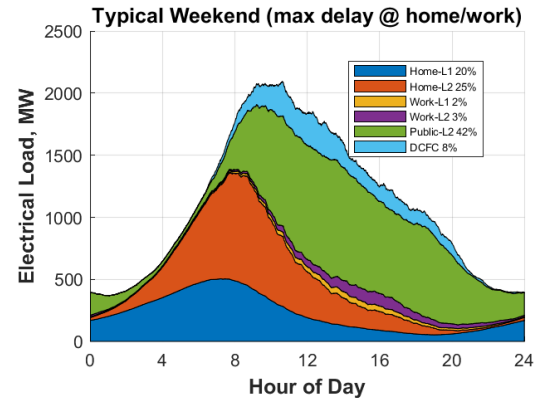
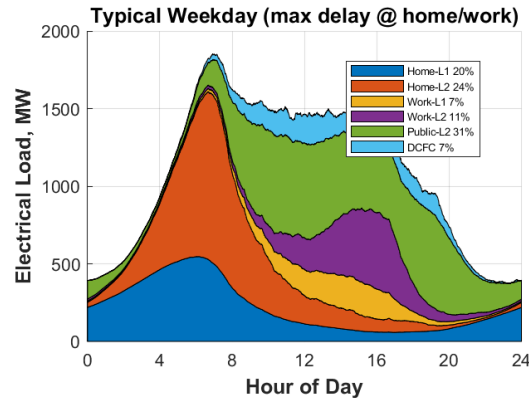
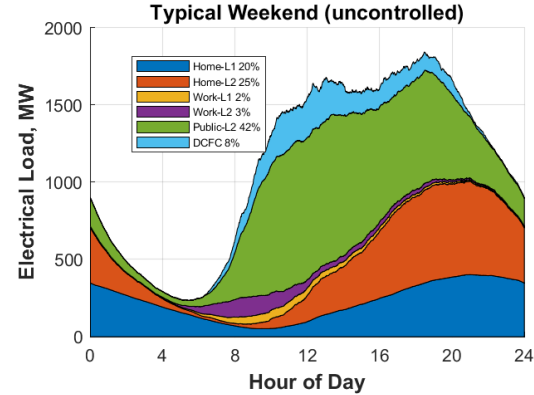
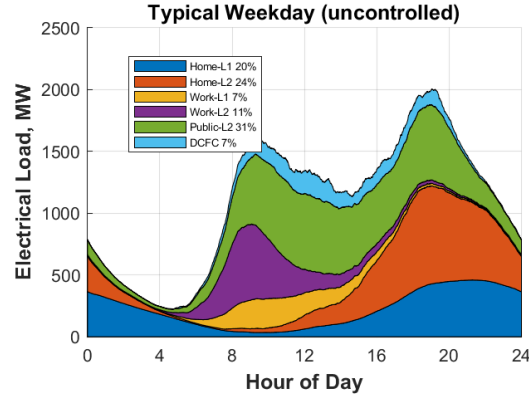
Moderate: 30% of Stock

High: 80% in 2045; 90% in 2050

# Progress Update: Projections of Light-Duty Electric Vehicles Charging Profiles

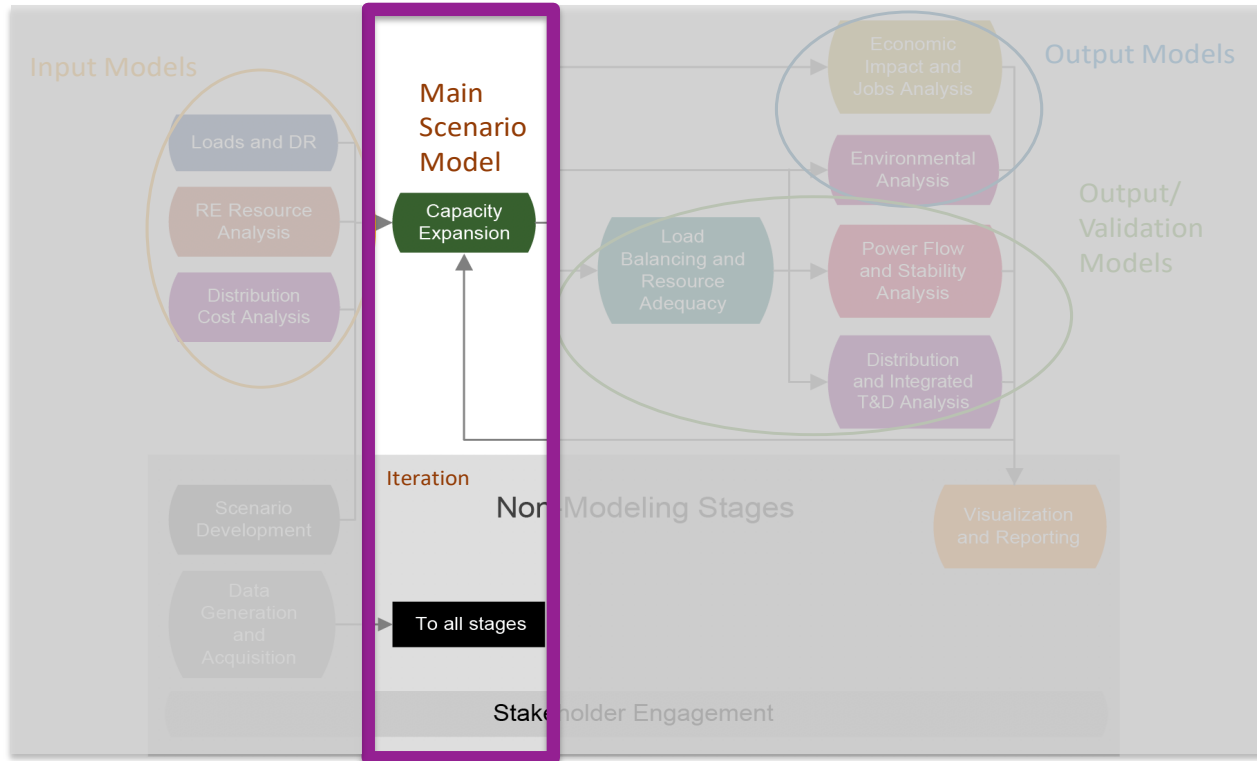
## High Electrification

- 2.6M EVs in 2045
- 60% access to residential charging
- 50% access to workplace charging





# Capacity Expansion: Initial Scenario Modeling



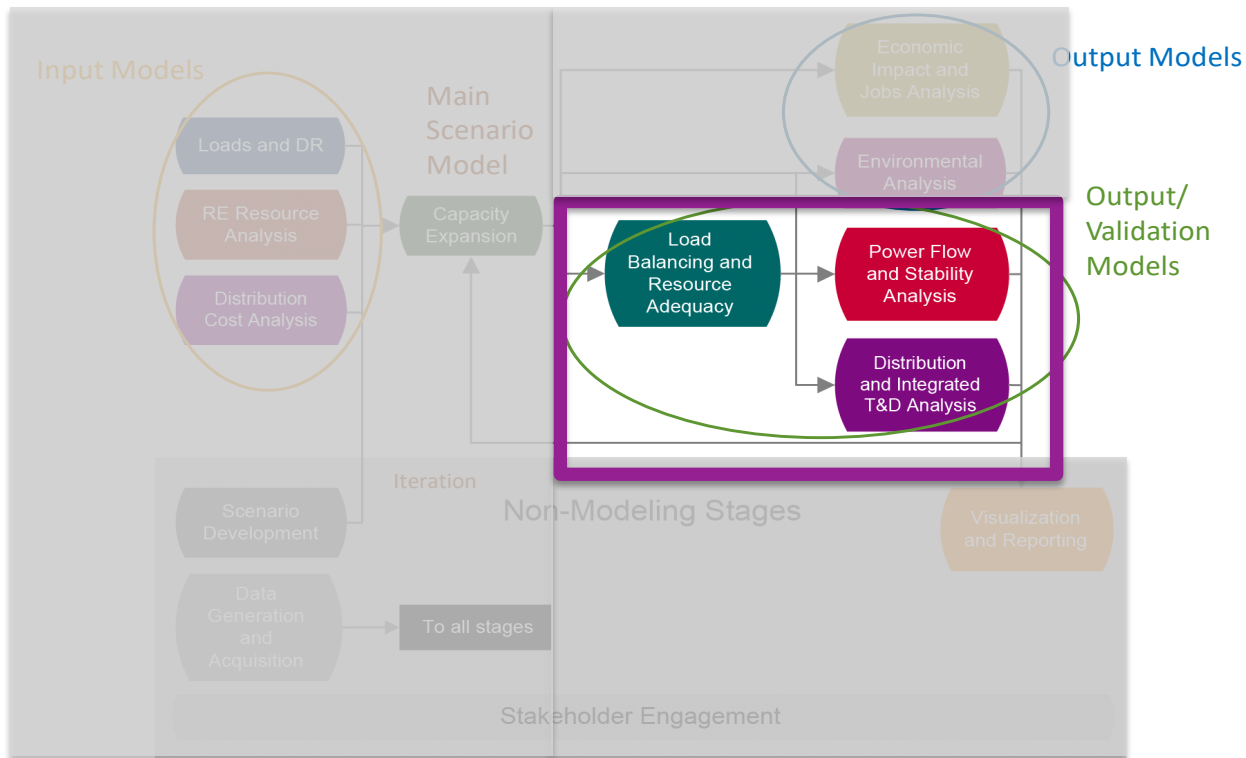
## Complete:

- LADWP initial feedback on characterization of generation and transmission (modeling inputs)
- Initial Run modeling of all scenarios
  - Will be previewing outputs following this presentation

## In development:

- Final Run
- Replacement options to exclude repowering
- Evaluation of additional technologies (e.g., undersea cables)

# Load Balancing and Stability: Refining Assumptions, Testing



## Complete:

- 2017 SLTRP case tested (PCM, Power flow)
- LADWP initial feedback on assumptions (e.g., hydro operations, reserves, contingencies)

## Underway:

- Initial Run modeling of all scenarios

## In development:

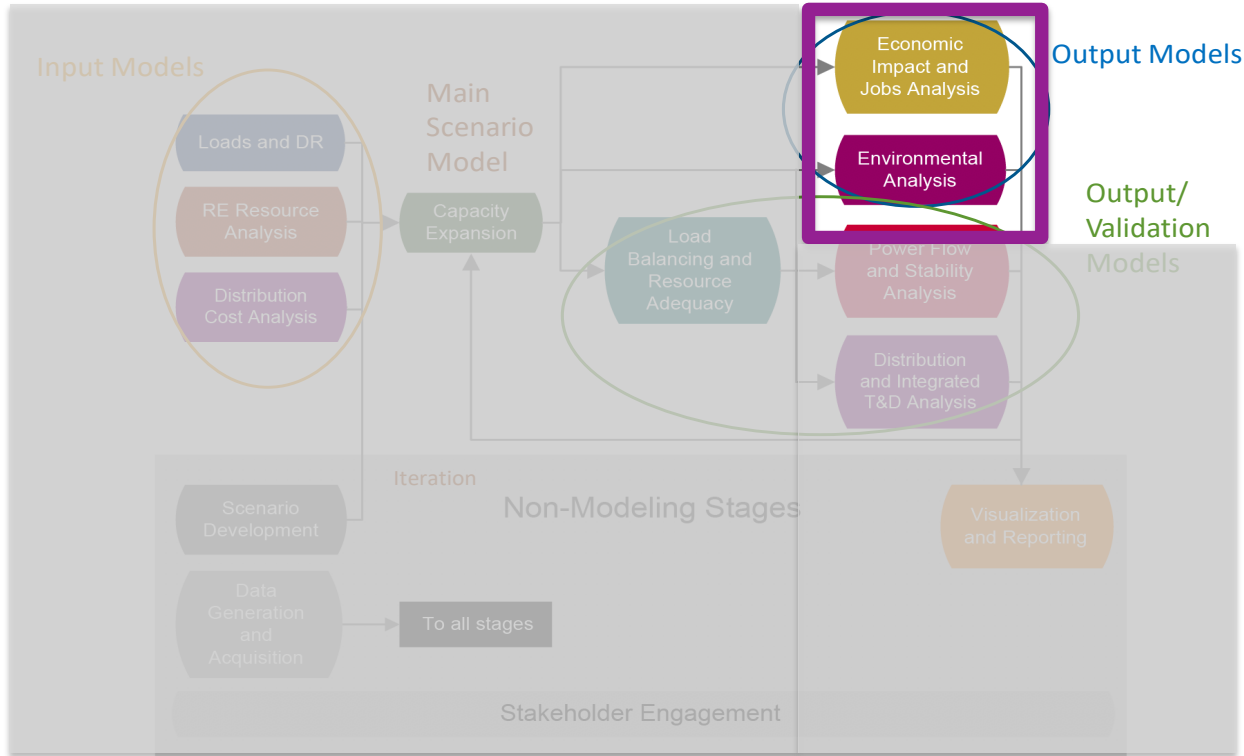
- RE forecast profiles

# Reliability Check as Part of Validation Process

## Approach:

- 2017 SLTRP is the most recent projection that has been vetted by an Advisory Group and deemed achievable and reliable
- 2017 SLTRP projects to 2037 and had been one of our reference scenarios, but was removed because it includes repowering of OTC units
- As part of our validation process, we will use 2017 SLTRP (extended to 2045, in line with SB100) as a basis to evaluate reliability of our LA100 scenarios

# Economic and Environmental Impacts: Modeling Methods Developed; Awaiting Initial Run Results



## Complete:

- Models (economic impacts, air quality) calibrated for LA

## Under development:

- Public health model
- Environmental justice analysis

# Questions?

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The Los Angeles 100% Renewable Energy Study