Electric Production Cost Modeling

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Welcome to the Production Cost Modeling workshop

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– Background: Utilities, economic modeling, software

Agenda

- Relationship between Aliso Canyon and electric production costs

- Production Cost Modeling basics

- Discussion of initial Energy Division Proposal of production cost modeling software (Strategic Energy and Risk Evaluation model, or SERVM), assumptions and inputs

- Summary of trends in parties' comments

Aliso and Production Costs

- Aliso, along with other gas storage fields, provides gas to 17 gas-fired power plants in both the California ISO and LADWP transmission areas

- These power plants provide a variety of types of services to the grid
  - Peaking (serve load during times of very high demand)
  - Ramping (ability to rapidly increase power output to meet quick increases in demand)
  - Base load (provide constant, dependable power output)

Aliso-connected power plants

| #	Plant name	Capacity (MW)
1	SCE Alamitos Toll	1970
2	LADWP Haynes Generation Station	1724
3	SCE Redondo Beach	1343
4	LADWP Scattergood Generation Station	803
5	LADWP Valley Generation Station	573
6	El Segundo Energy Center, LLC	526
7	LADWP Harbor Generation Station	466
8	SCE Huntington Beach Generating Station	452
9	Southern California Public Power Authority – Magnolia	328
10	City of Glendale	288
11	Long Beach Generation, LLC	260
12	City of Pasadena	203
13	City of Anaheim - Canyon Power	200
14	City of Burbank	139
15	City of Vernon - Malburg	138
16	SCE Barre Peaker	45
17	SCE Center Peaker	45

Modeling the effects of Aliso drawdown on these power plants

- Flow rate of gas to these power plants will drop if Aliso retired or drawn down
  - Power plants will be served by Honor Rancho, Playa del Rey, and linepack (gas stored in pipe) instead

- This could affect the power plants':
  - ramping ability,
  - ability to start up on short notice,
  - and other operating parameters,
  - which in turn may affect the electric system's costs and reliability.

- Per Order Instituting Investigation (OII)17-02-002 issued in February, must quantify cost/reliability effects before making a decision

- We don't know beforehand what the magnitude of these effects are; that's why we model

Geography of Affected System
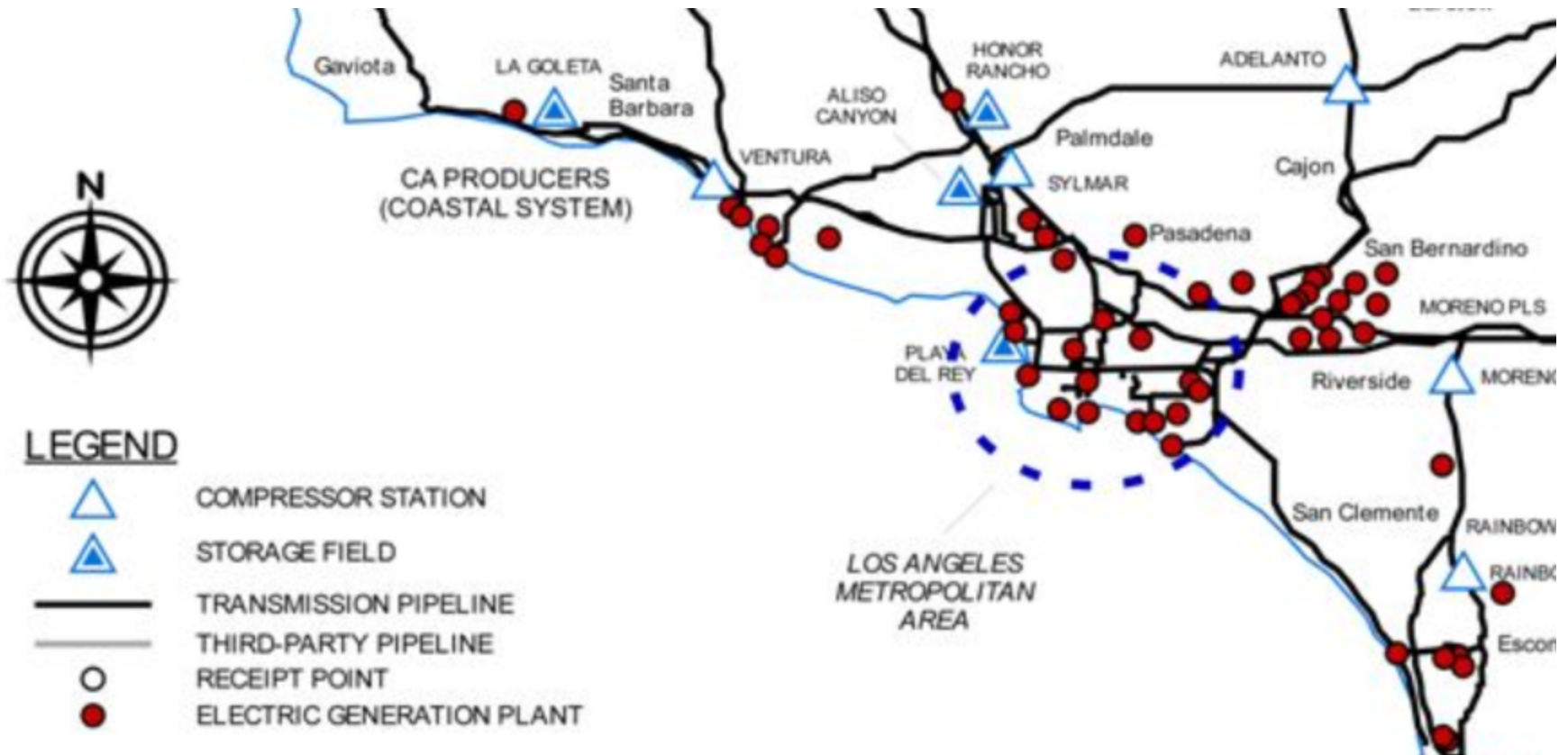
Proposed approach: Production Cost Modeling

- What is a Production Cost Model?
  - Software tool that answers the question: Given a set of generating resources, load, weather, and dispatch constraints, what will electric production costs and reliability be?
  - Simulates electric grid operations and produces a distribution of cost/reliability outcomes and their associated probabilities

Note: Can model a range of scenarios

- Could the power plants be served with just Honor Rancho, Playa del Rey, and linepack?
  - If so, at what cost/reliability?

- Some of the 17 power plants will be retired or replaced. For example, a few are Once-Through Cooling (OTC) and their use will be phased out after 2020 (per Section 316(b) of the Clean Water Act).
  - If renewables will replace these gas-fired plants, to what extent will this reduce the need for gas transport?
  - Could the 17 plants be offline or as emergency, reliability-only "backup" resources?

- Can specify multiple preferences on preserving grid reliability versus low-cost dispatch, i.e. "tell the model what we care about"

Production Cost Modeling Process

- Inputs: Hourly load forecasts, weather profiles, set of generating resources, fuel flows and price.
  - Specify combinations of the above, along with the probability that they occur, to run as cases

- Constraints: Transmission, reliability requirements, operating reserves.

- Simulate hourly economic dispatch.
  - Simultaneously run multiple cases and produce a distribution of outcomes.

Production Cost Modeling Outputs

- Produce a distribution of outcomes. Main outputs are:
  - Electric production cost
  - Hourly generation dispatch
  - Reliability metrics
    - Loss of Load Expectation (LOLE): expected **frequency** of Loss of Load Events (but not duration or magnitude)
    - Loss of Load Hours (LOLH): expected **duration** of Loss of Load Events (but not frequency or magnitude)
    - Expected Unserved Energy (EUE): expected **magnitude** of Loss of Load Events (but not frequency or duration)
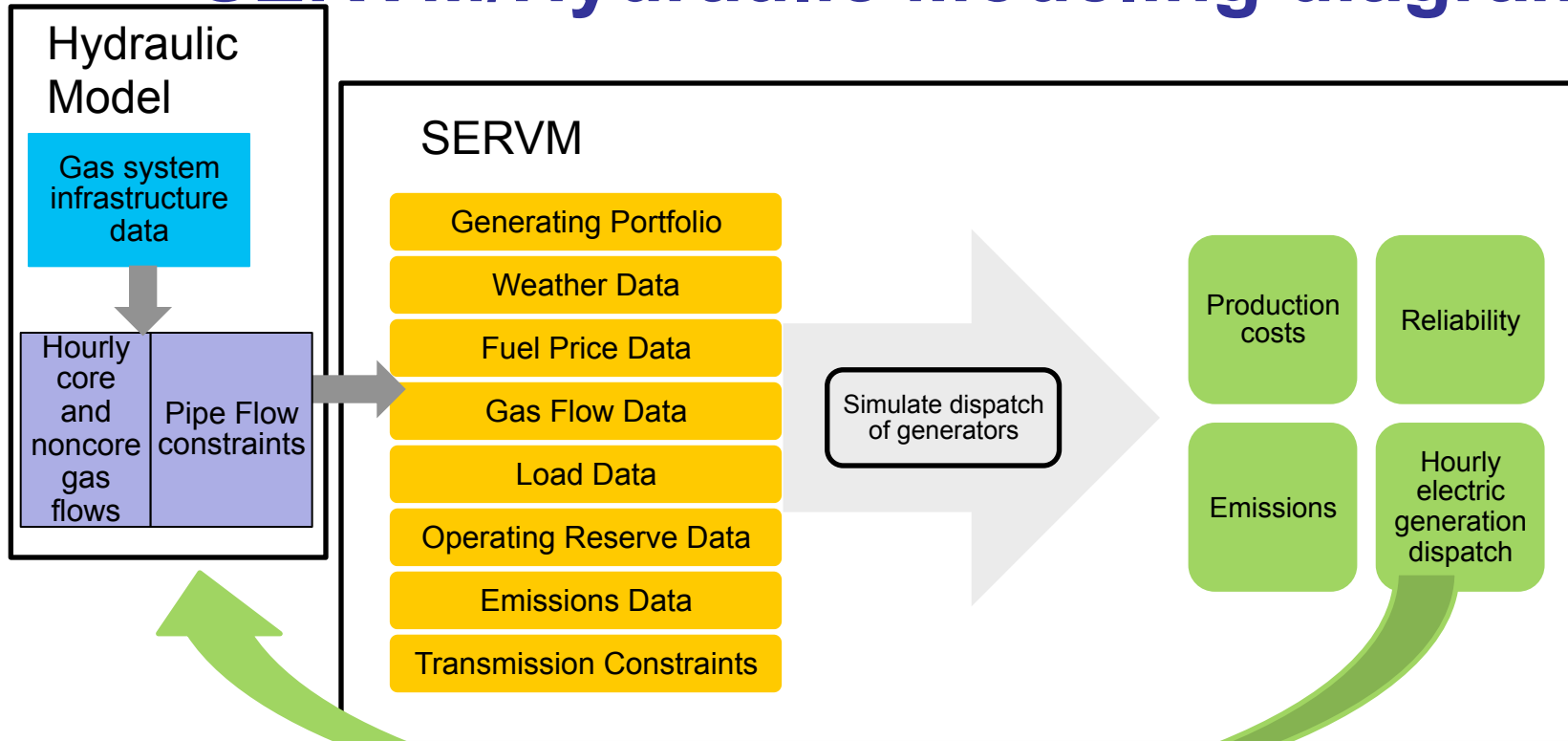
Initial ED Modeling Proposal

- ED issued a "Proposed Scenarios Framework" on June 26 describing a production cost modeling approach

- Proposed to use SERVM model: Proprietary production cost model developed by Astrapé consulting, used in Resource Adequacy (RA) proceeding

SERVM/Hydraulic Modeling diagram

Hydraulic Model

- Gas system infrastructure data
- Hourly core and noncore gas flows | Pipe Flow constraints

SERVM

SERVM inputs:
- Generating Portfolio
- Weather Data
- Fuel Price Data
- Gas Flow Data
- Load Data
- Operating Reserve Data
- Emissions Data
- Transmission Constraints

Simulate dispatch of generators

- Production costs
- Reliability
- Emissions
- Hourly electric generation dispatch

SERVM inputs
SERVM outputs
Hydraulic Modeling inputs
Hydraulic Modeling outputs

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- Convert electric dispatch back to hourly gas usage.
- This gas usage is fed back to hydraulic model.
- Re-run hydraulic model and ensure that gas system operates within acceptable pressure bounds
- This is similar to standard gas/electric utility operations planning

Initial ED Modeling Proposal: Inputs / Assumptions

- Study Years: 2018, 2022, and 2027

- Starting point for inventory level: Energy Division Report issued per PU Code Section 715 (715 Report)

- Resource Adequacy (RA) Base Case for weather, load, generation, etc. For information farther than 1 year out, use Integrated Resource Planning (IRP).

- Generation: Information from CAISO and Transmission Expansion Planning Policy Committee (TEPPC) Common Case. Includes RPS and behind-the-meter solar. Will also take into account utility capacity expansion plans (e.g. LADWP)

- Weather: National Oceanic and Atmospheric Administration (NOAA) data

- Constraints: maximum tubing-only flow from Honor Rancho and Playa del Rey

- Desired reliability: maximum of 1 outage event per ten years

- For information related to forced or scheduled power plant outages, Energy Division will calculate the latest performance indices from the North American Electric Reliability Corporation's (NERC) Generator Availability Data Systems (GADS).

- Gas price forecast: California Energy Commission's (CEC) Integrated Energy Policy Report (IEPR), which includes the North American Market Gas-Trade (NAMGas) model report.

Note on informal comments

- Thank you for your comments submitted July 24th on the Proposed Scenarios Framework

- Please note that the scope of this session is restricted to production cost modeling, which concerns systemwide cost and reliability

- Separately, CAISO and LADWP will run power flow analyses
  - Will assess local reliability effects of Aliso drawdown
  - Will determine effects of N – 1 events

Trends in comments

- TIMEFRAME
  - Start modeling in 2019, not 2018
  - Include 2030 to account for an RPS requirement of 60%
  - Reconsider using 8760 calendar year timeframes: consider focusing on peak hours / peak days, extreme weather events, or consecutive April-March injection/withdrawal cycles

- INPUTS
  - Incorporate growth of renewables and storage in assessing the need for Aliso Canyon
  - Model LADWP system and CAISO system consistently and entirely (not just the 17 power plants)
  - Maximize consistency with RA/IRP proceedings
  - Gas prices should not be static model inputs; should capture effects of constrained gas supply on gas prices

Trends in comments (cont'd)

- METHODOLOGY
  - Validate model results for forecast years against historical years (2016, 2017)
  - Consider "stress case" of loss of other resources (gas/electric transmission, power plants)
  - Clarify how electric imports will change under various levels of Aliso utilization

- GENERAL
  - Expose stakeholders to SERVM for an adequate amount of time and ensure public understanding of its inputs and processes

Thank you!
For Additional Information:
http://www.cpuc.ca.gov/aliso/
http://www.cpuc.ca.gov/AlisoOII/