California Generation Portfolio

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California Energy Commission IEPR Staff Workshop

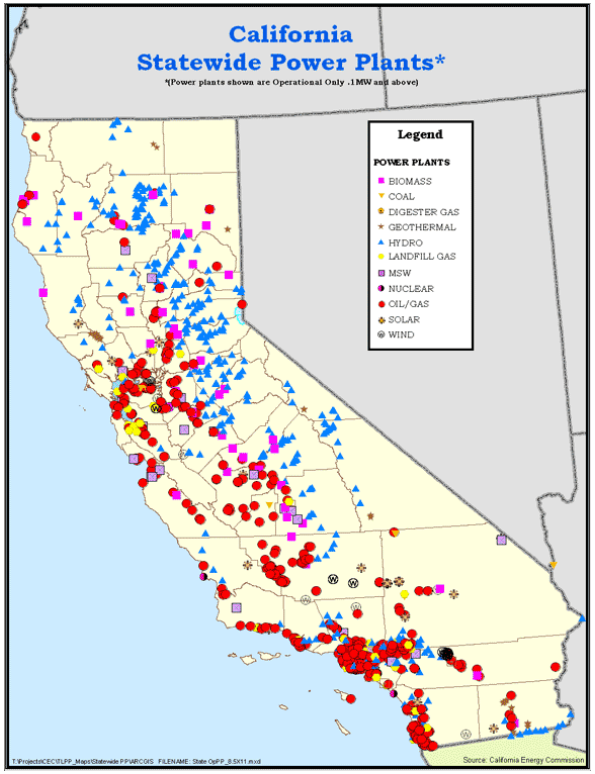
August 10, 2009

3 Topics

- The existing portfolio
- Some policies and the resulting portfolio
- Some ways that advanced generation technologies may play a role in the future

California's Electric Portfolio

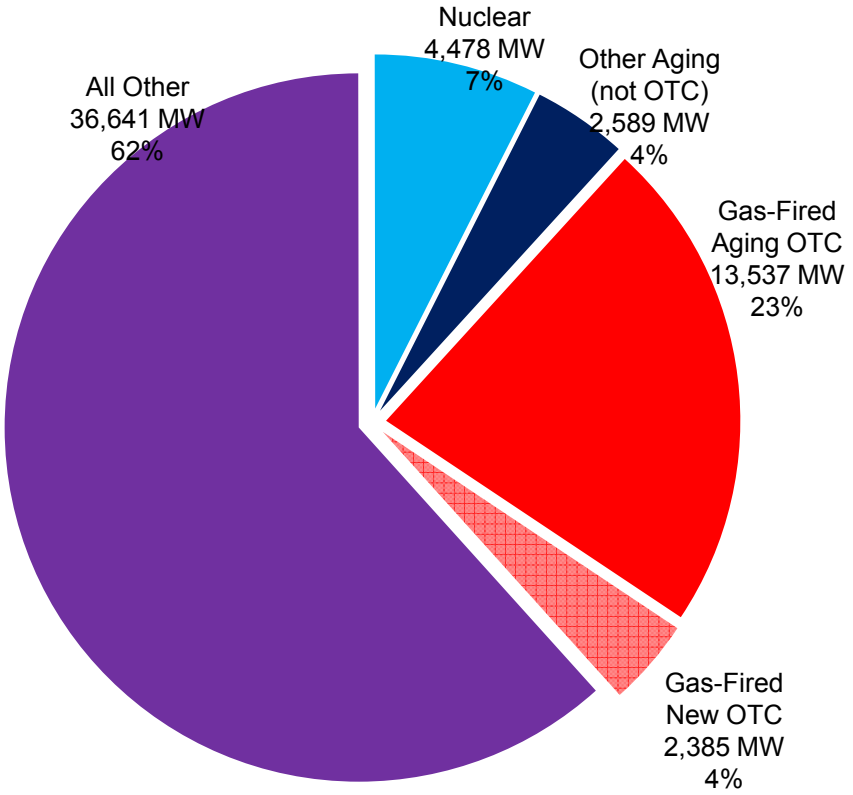
	2002	2008
California Generation plus Net Imports:	273,775	307,141
Hydroelectric	31,283	24,830
Nuclear	34,353	32,482
In-state Coal	4,133	3,977
Oil	81	92
Gas	92,346	122,594
Geothermal	13,396	12,907
Biomass	6,192	5,728
Wind	3,546	5,724
Solar	851	724
Other	--	25
Specified Coal Imports	32,543	21,969
Other Imports	55,051	76,089



A Few Specific Drivers

- Renewable Portfolio Standard
- AB32 GHG and its implementation
  - SB1368: emission performance standard
- Increase use of CHP
- Retirement of Aging Power Plants and Once Through Cooling

California's Electric Portfolio



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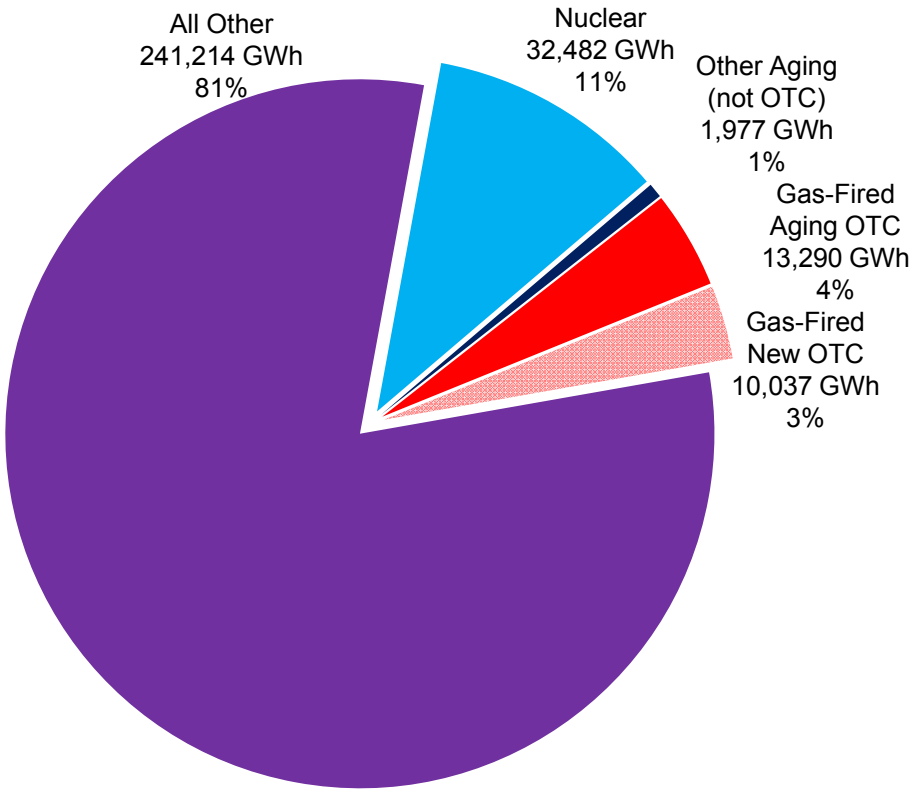

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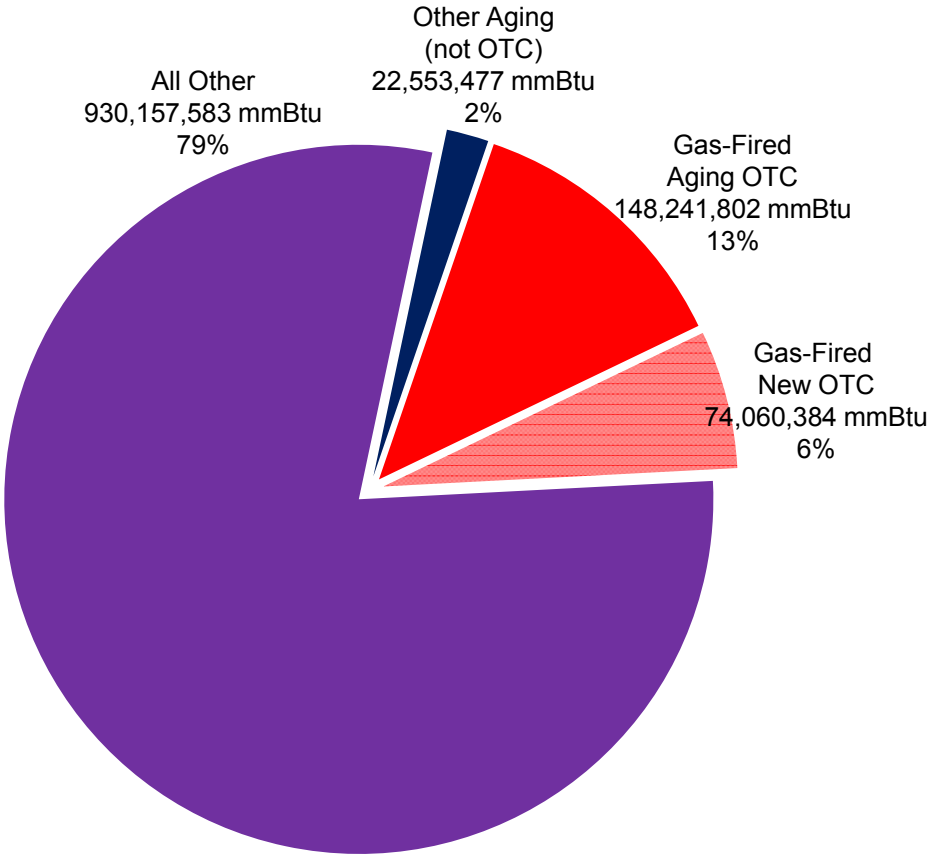

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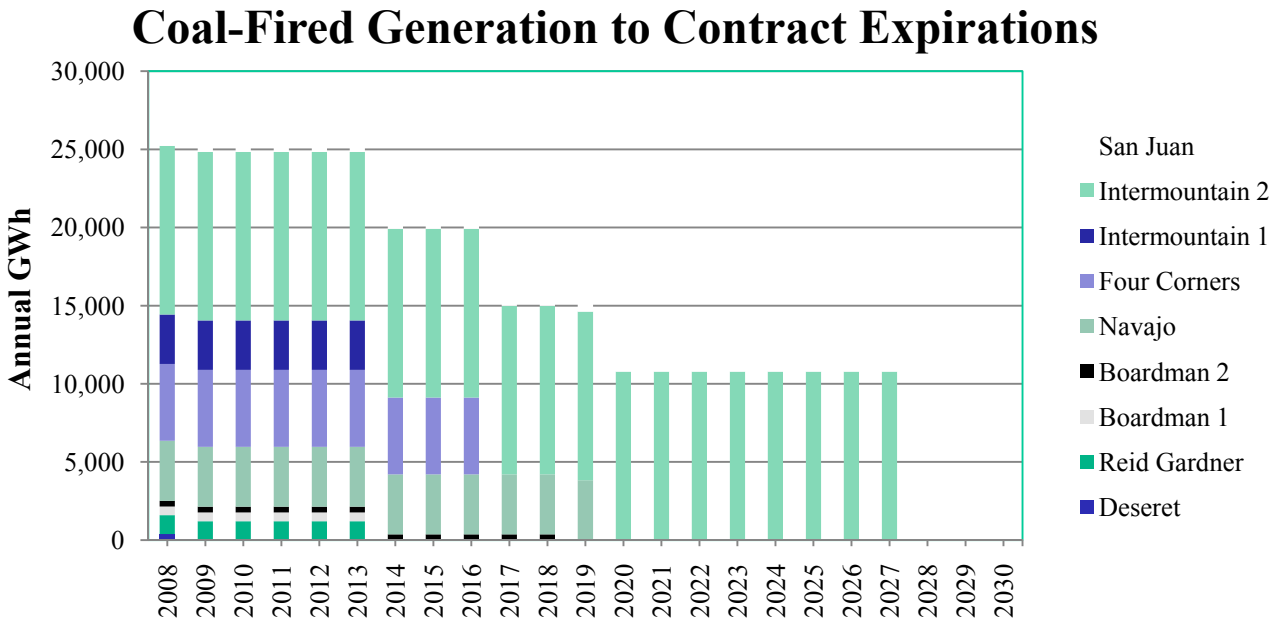
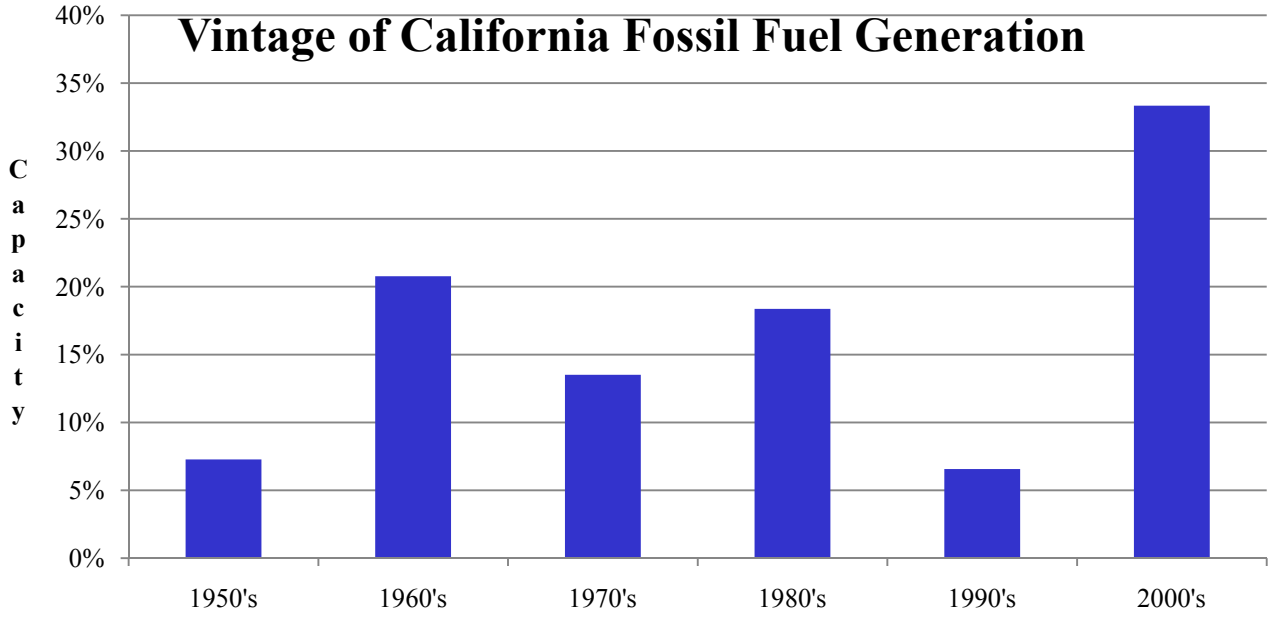


Age of California's Thermal Electric Plants



Once Through Cooling and Aging Power Plants (OTC/APP)

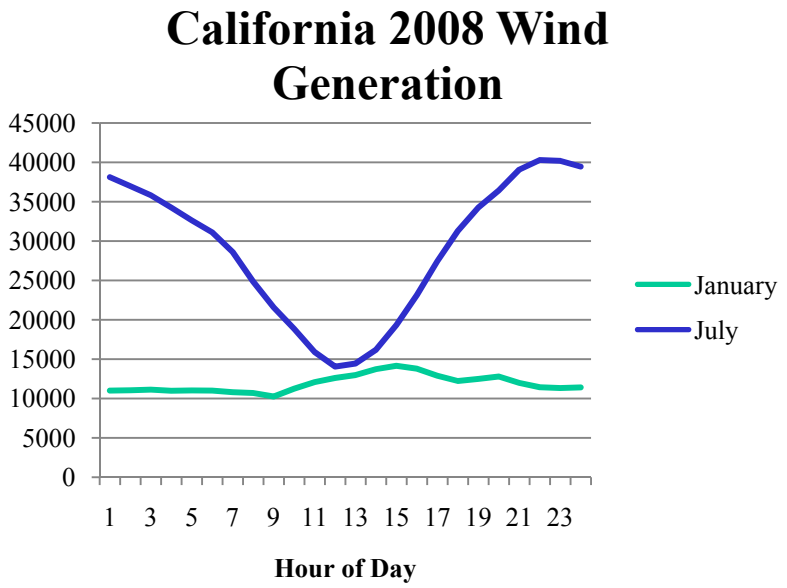
- Provide capacity
- Relatively low utilization rate
- High cost of operation
- Will need to be replaced for local reliability
  - Locational need

Renewable Targets

Executive Order S-14-08 requires that California utilities reach the 33% renewables goal by 2020.

Integrating Wind and Solar

- Wind and Solar are intermittent resources
- Daily and seasonal patterns of generation
- Variable at any time



Integrating Wind and Solar

Changing need for firming

- Changing need for ramping and turn-down capability
  - Flexibility: ability to operate over 40 to 100% of capacity
- Changing mix of “baseload”

Other Renewable Issues

- Potential to create a mix of renewables to provide reliable dispatchable capacity?
  - Biomass or other?
  - Geothermal
  - Storage

GHG Policies

- AB32 20% below 1990 by 2020 and 80% by 2050
- Two Roles
  - Directly with higher efficiency
  - Indirectly by the role in an integrated system with increased share from intermittent resources

Need for Advanced Combined Heat and Power Technologies

- Currently is a small percent of existing portfolio AB32 target: 400 MW /32,000 GWH
- More efficient use of gas
  - Decrease GHG
- Dispatchable

Conclusions

Advanced Generation Technologies are needed to incorporate intermittent renewables replace coal, APP/OTC steam turbines.

- efficient
- flexible
- clean
- affordable
- system reliability