Framework for Evaluating Greenhouse Gas Implications of Natural Gas-Fired Power Plants in California

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Overview and Purpose

- The power grid is a complex integrated system that relies on a mix of resources
- Intermittent renewables need backup by other flexible resources (like gas)
- How does one think about how much, what type, and where natural gas-fired generation may be needed?

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Presentation Outline

1. Legislative and Policy Initiatives
2. Generation Mix and the Integrated Electricity System
3. Implications of a 33 Percent RPS Scenario
4. Electricity Sector GHG Emissions
5. Outcomes of Several Policy-Driven Futures
6. Expected Roles of Gas-Fired Generation
7. Emissions Implications

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Cornerstones of California's Energy Policy

Integrated Energy Policy Report and IEPR Update:

- Considered the impact of varying levels of EE and renewables on GHG emissions

The Energy Action Plan:

- Established "loading order" for procurement

California ARB AB 32 Scoping Plan:

- Electricity sector to meet 40% of the GHG reductions
- Specific goals for the electricity sector:
  - Expansion of energy efficiency, renewables, and CHP

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Generation Mix in an Integrated Electricity System

- Electric demand varies constantly
- California's supply mix will see increasing large fluctuations
- System-wide impacts of additional resource must be considered
- This includes the impacts of renewables being implemented to reduce GHG emissions

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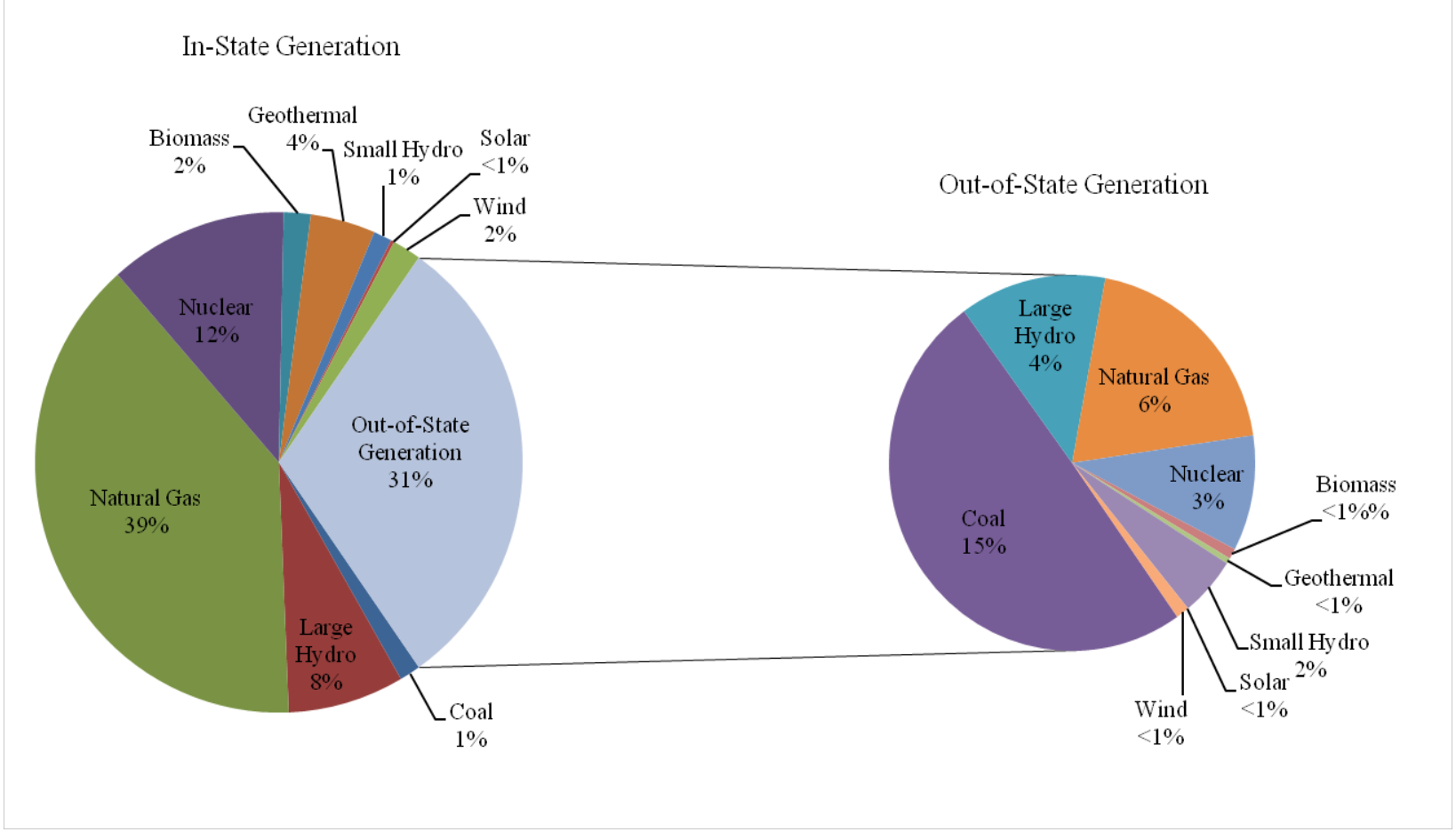
California's Electricity Resource Mix in 2007



Source: Energy Commission 2008

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Meeting a 33 Percent RPS

- AB 32 goals to be met in part by a 33% RPS
- Intermittent renewables will likely be extensive
  - Significant load following and regulation capacity additions will be necessary to integrate these resources
- Planners must consider the integrated nature of the system to ensure reliability
- To meet 2050 GHG targets, new technologies and institutions will likely be necessary

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Historic Greenhouse Gas Emissions

- GHG reduction targets set by benchmarking future emissions against historical emissions
- Two primary data sets for California GHG emissions:
  - The CEC's *Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004*
  - Data compiled by the California ARB

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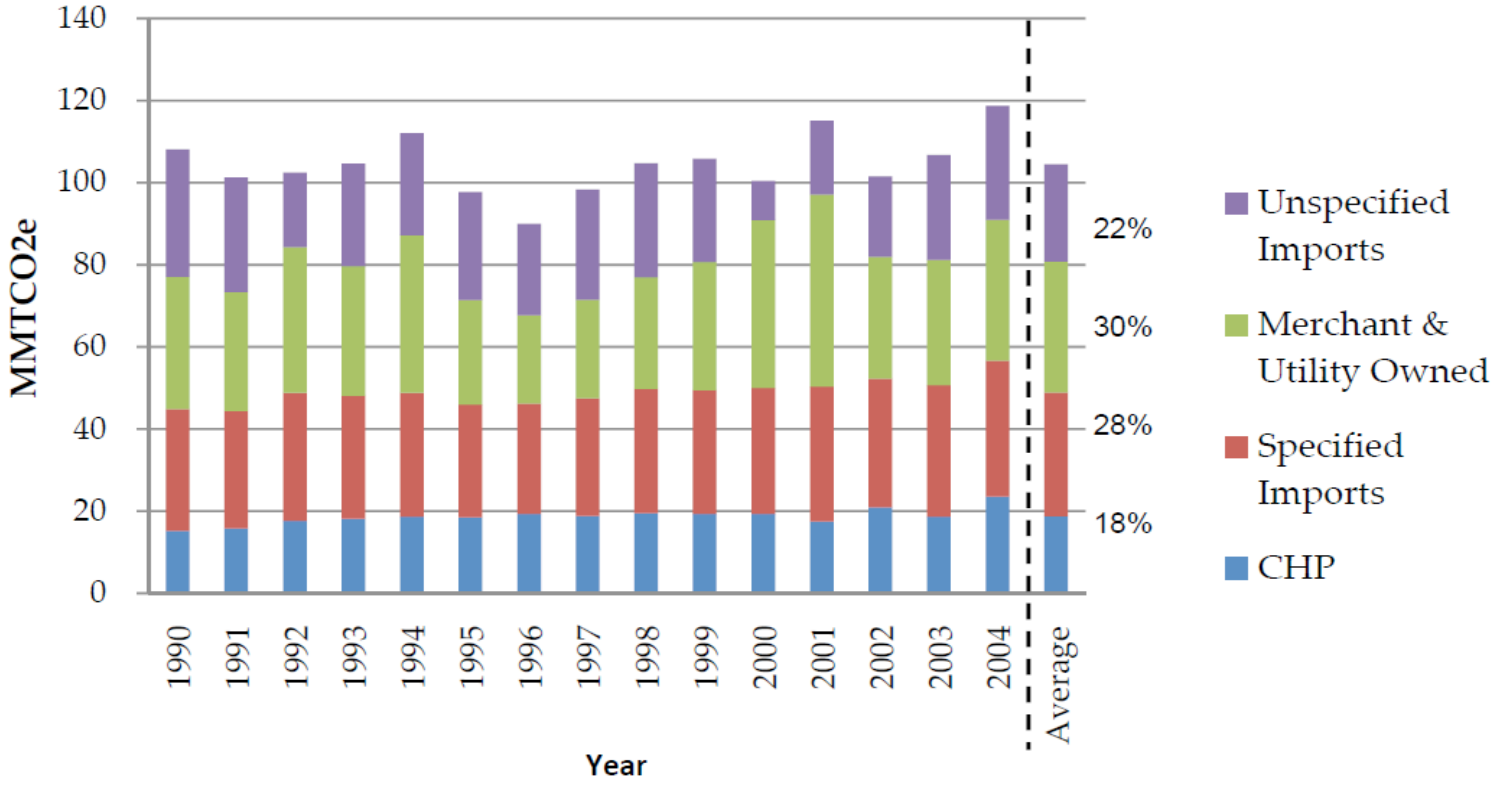
California Electricity-Related GHG Emissions from 1990 to 2004

- Imported power accounted for about half of total emissions



Source: ARB 2007

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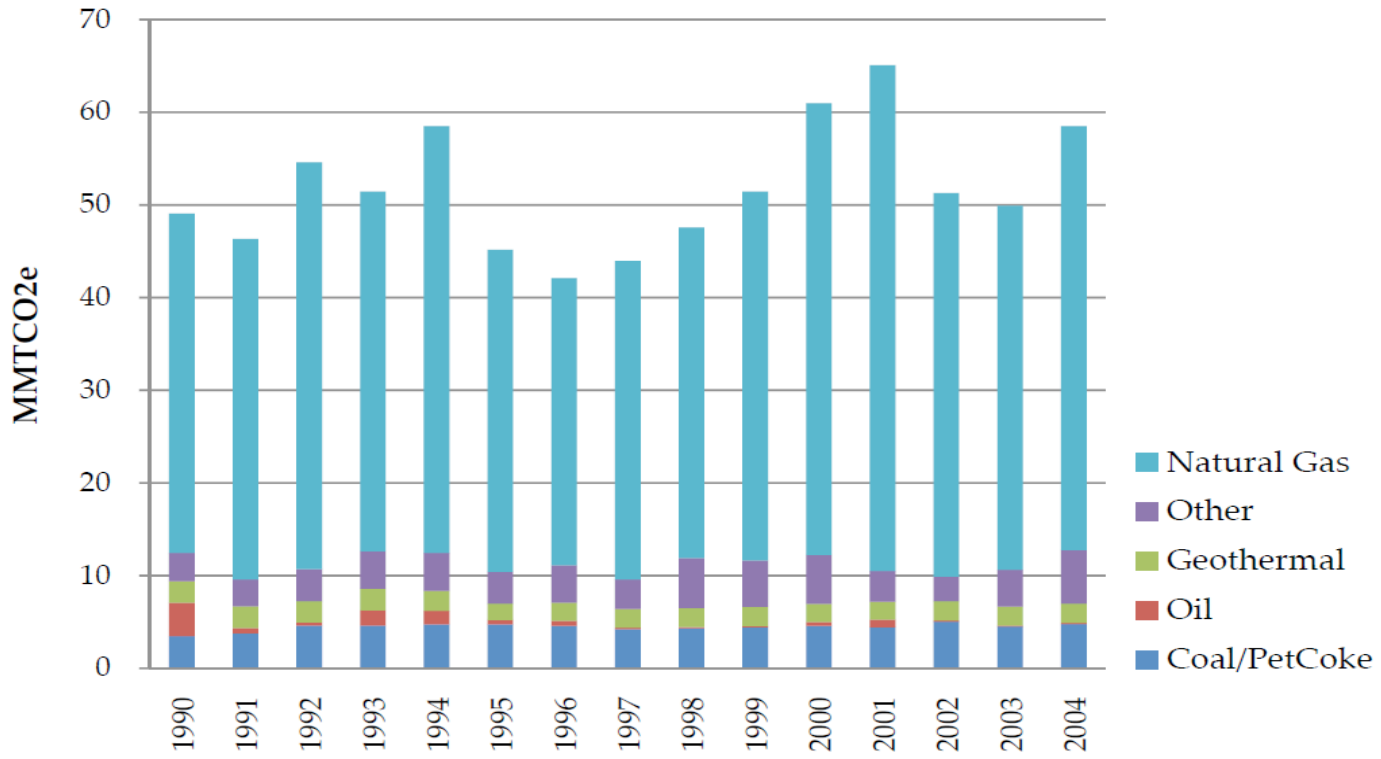
California In-State Electricity-Related GHG Emissions from 1990 to 2004

- Emissions from in-state generators still exhibited considerable variance



Source: ARB 2007.

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Causes of Variation in Year-to-year Emissions

- Demand
  - Fluctuates based on weather conditions, economy
- Hydroelectric output
  - Large year-to-year variations in hydro availability
- Imported electricity
  - Inconsistent protocols for counting imported energy and associated emissions
- Nuclear output
  - Extended outages
- Going forward, will need to normalize data and use consistent import accounting

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Policy-Driven Futures Analysis

- Framework
  - How might various policy futures affect need for new gas generation?
  - Task: Rely on existing studies to estimate GHG and cost implications of different policies
- Primary Sources
  - Scenarios Report (part of 2007 IEPR)
  - Ocean Protection Council Once Through Cooling Report
  - CAISO Integration of Renewable Resources report

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Scenarios Considered

1. "Frozen Policy" case (Scenarios Report case 1b)
   - Aggressive EE goals, gas plant retirement, modest increase in renewables
2. Increased renewables generation (Scenarios Report case 4a)
   - Phase in renewables to 31% by 2020
3. Increased renewables and accelerated plant retirement
   - Phase in renewables to 31% by 2020 plus accelerate retirement of 4,000 MW of old gas plants
4. Increased renewables and distributed generation
   - Phase in renewables to 31% by 2020 plus accelerated DG penetration

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Policy Driven Futures: Indicative Findings

- "Frozen Policy" suggests GHG emissions can be held at 2009 levels through 2020
  - New gas generation needed primarily for peaking and quick start
- More aggressive renewable policies can reduce GHG emissions by 20% in 2020
- Accelerated retirements and increased DG would have very modest impact on GHG emissions
- Additional work needed to account for:
  - Local reliability needs
  - Renewable integration
  - Transmission issues

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Need for New Gas-Fired Generation

- In the long run, ARB will translate its Scoping Plan into specific regulations
- In the short run, the Energy Commission must consider need for gas-fired generation in siting cases:
  - How to balance grid operational needs and renewable integration against GHG impacts of gas-fired generation

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Expected Roles for Gas-Fired Generation

Description	Role of Plant
Intermittent Generation Support	Support intermittent renewable generation
Local Capacity Requirements	Strategically located generation to mitigate grid problems and potentially reduce the need for transmission infrastructure
Grid Operations Support	Support specific grid operational needs
Extreme Load/System Emergencies Support	Meet peak demand under extreme conditions
General Energy Support	Provide reliable supply of cost-competitive energy to the grid during low hydro and wind periods, and nuclear outages

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Issues for Future Consideration

- Areas for further system study
  - Local reliability constraints
  - Transmission and transmission gateways
  - Increased need for ancillary services
- Issues for siting-related analysis
  - Type of gas plants
  - Location of gas plants
  - Role of gas plants

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GHG Emissions Implications of Gas-Fired Generation

- Net GHG emissions *will decline* with new gas-fired power plants if gas generation is added:
  - As part of reaching the 33% RPS
  - That improves the overall system efficiency
  - To serve load growth/capacity needs more efficiently than the existing fleet

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