Utility Perspective on DG/CHP

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Executive Summary

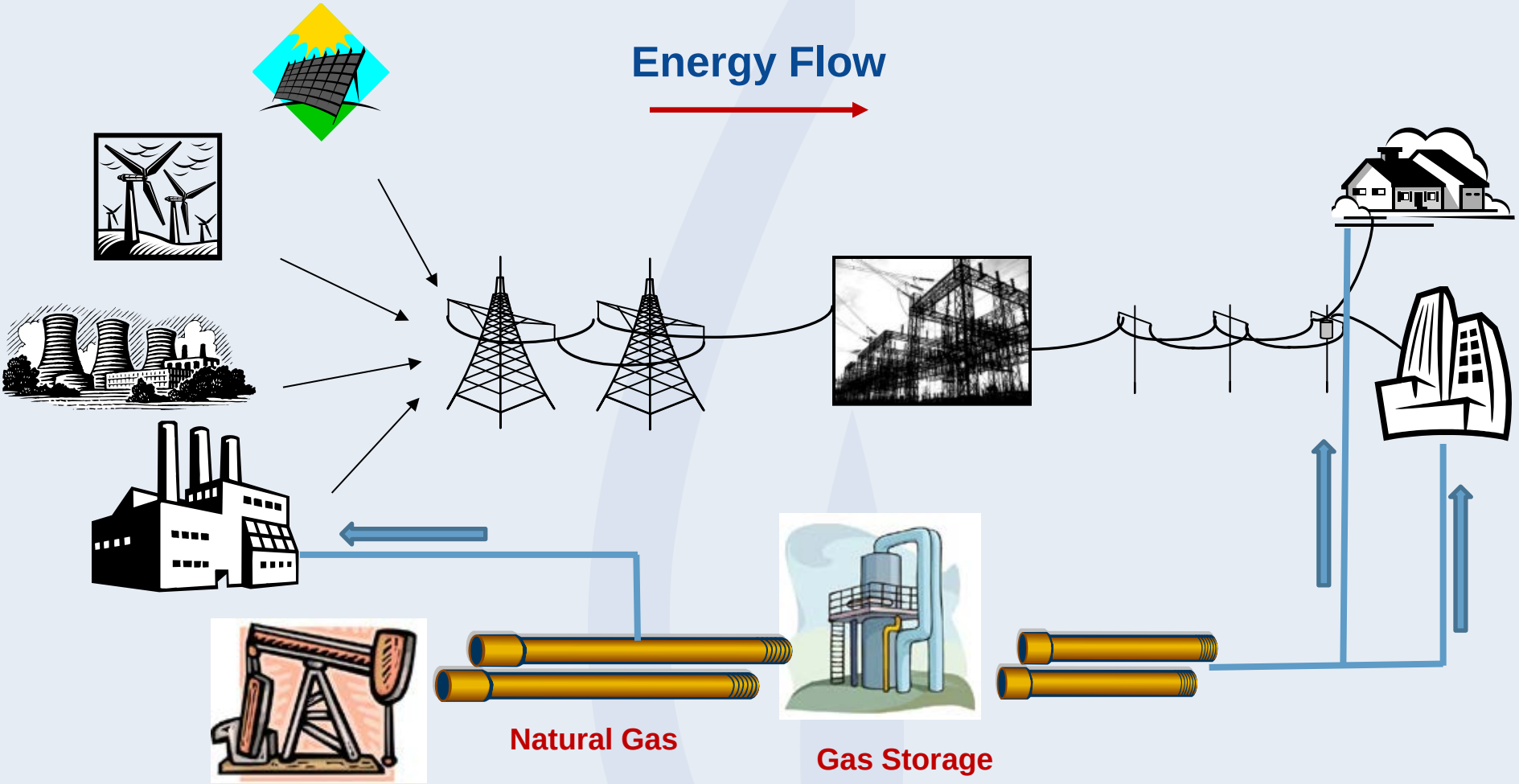
- New CHP technologies are emerging, some of which are able to meet California emission requirements*.
- Micro-CHP has the potential to be equally disruptive as solar PV.
- Federal Executive Order: add 40 GW CHP by 2020.
- California Executive Order: add 4 GW by 2020, 6.5 GW by 2030.
- But, these executive orders are not supported by policy directives.
- Some policies actually discourage CHP (e.g., departing load charges).
- Natural gas utilities are exploring various ways to accelerate adoption given a stable commodity price/supply forecast.
- Electric utilities currently have little incentive to promote CHP – active engagement by utilities can help reach growth targets
- Other countries have made progress with accelerated adoption of Micro-CHP: Germany, South Korea and Japan.
- More innovative business models and regulatory policies are needed in order to move this technology platform forward in the U.S.

***0.07 lbs/MWh NOx, 0.10 lbs/MWh CO**

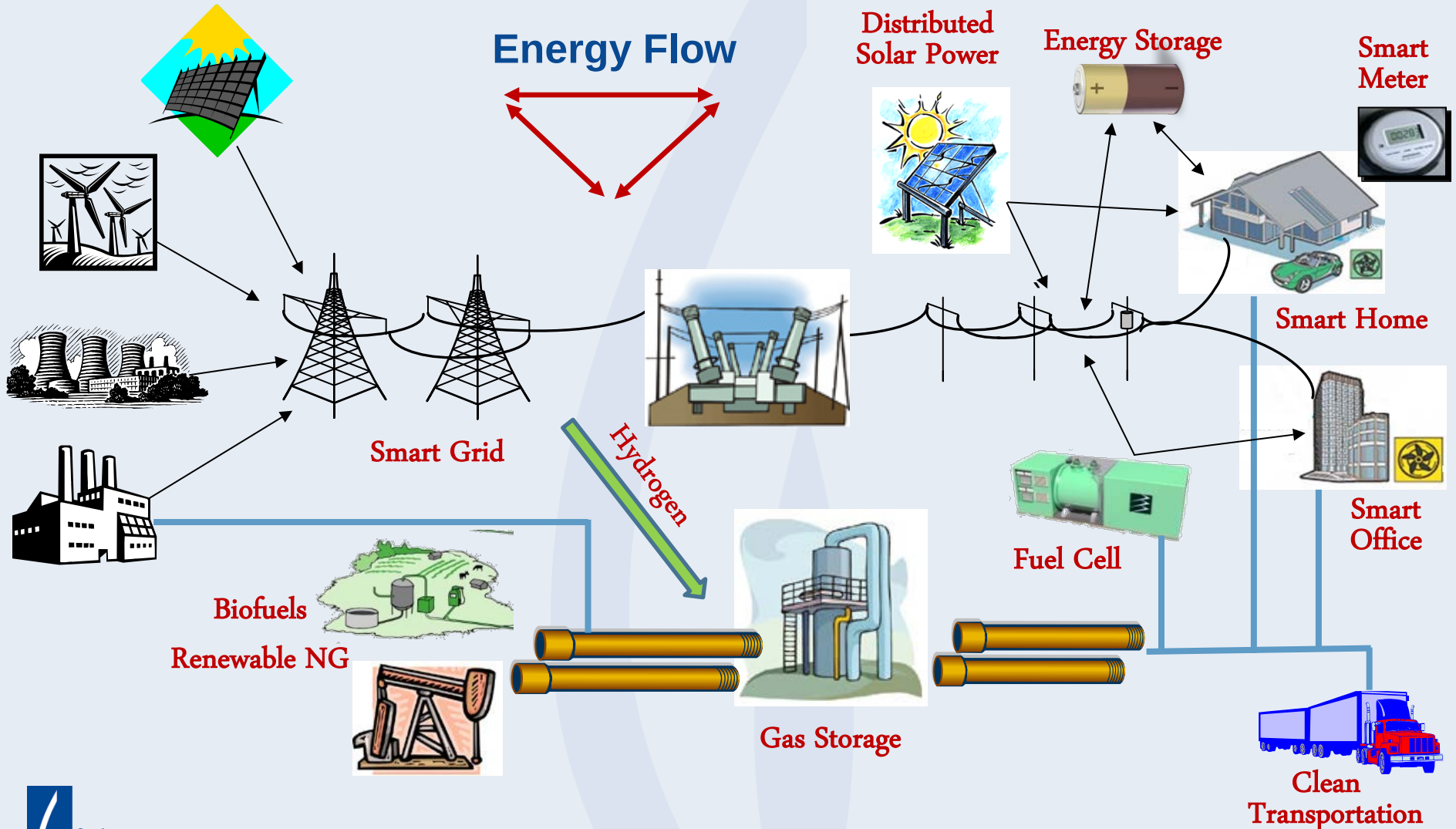
Drivers and Trends

- Utilities and regulatory agencies have long focused on the safety, reliability and security of critical infrastructure.
- Energy policy is currently focused on:
  - Increasing the use of energy efficiency/demand response
  - GHG emissions and criteria pollutant reduction
  - Energy security
- Most customers will elect to remain grid-connected. Emerging technologies will provide a wider choice of products and services.
- The electric 'smart' grid will eventually feature plug-and-play interconnection for residential on-site generators.
- 'Decoupling' momentum continues in the U.S.
- Natural gas is a clean, reliable and affordable energy resource (beyond the 'bridge').
- Utility business/regulatory models will need to adapt/evolve to emerging technologies and policy trends.

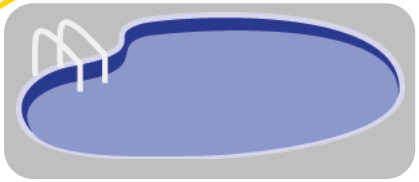
The Utility World Today



The Utility World Tomorrow



Smart ZNE Home



Variable Speed Pool Pump

Solar PV

Solar Thermal

Hydronic Space Heating

Pool Heater

Firepit

BBQ

Energy Management System

Smart Thermostat

Fireplace

INTERNET

Smart Appliances

Hot Water Storage

CNG Refueling

Tankless Water Heater

MicroCHP

Air Conditioner

Smart Meter

Hot Water Circulating Pump

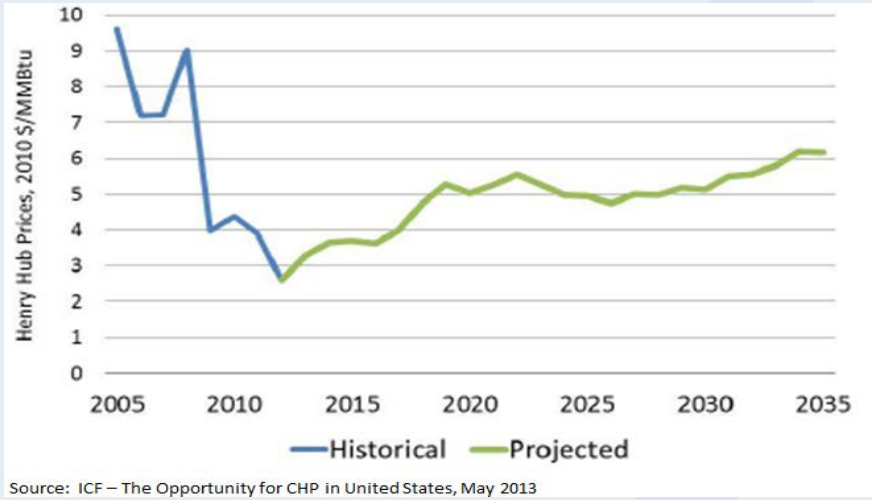
The Natural Gas Utility

- Supply/price forecast stability
- Domestic fuel = energy security
- Declining throughput per customer
- Opportunities for commodity growth:
  - On-site generation (e.g., CHP)
  - Transportation (CNG, LNG)
- Carbon footprint reduction
  - Supply side (e.g., biofuels, H_2 injection)
  - End-use (capture & utilization of CO_2)
- New business models under consideration to accelerate adoption of CHP

Favorable Supply/Price Forecast

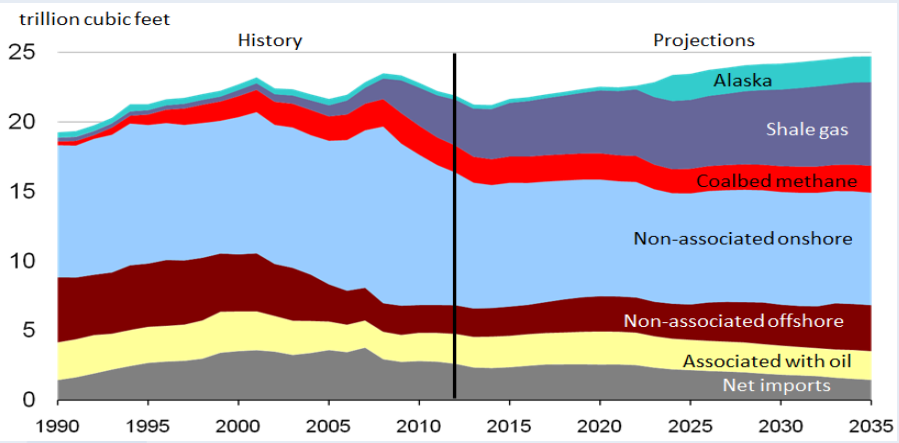
- Abundant supply/stable price outlook.
- Cost of production forecast to decline 20% over next 5 years.
- Moderate demand growth.

Natural Gas Price Forecast



Source: ICF – The Opportunity for CHP in United States, May 2013

Natural Gas Supply

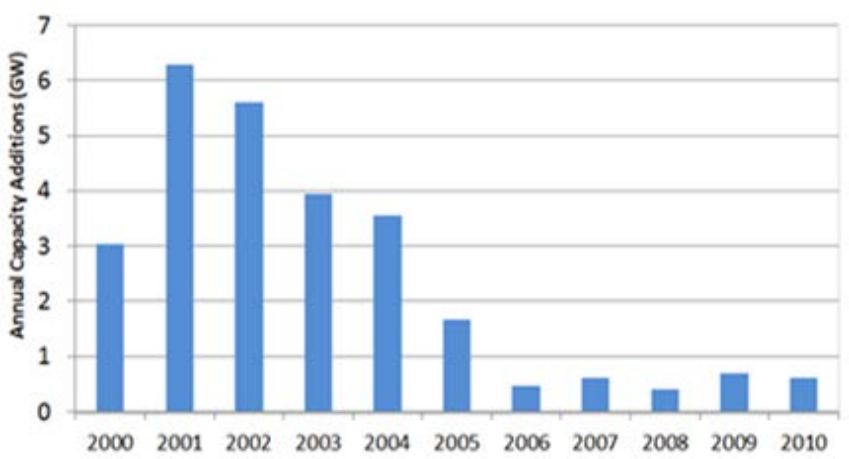


Source: EIA

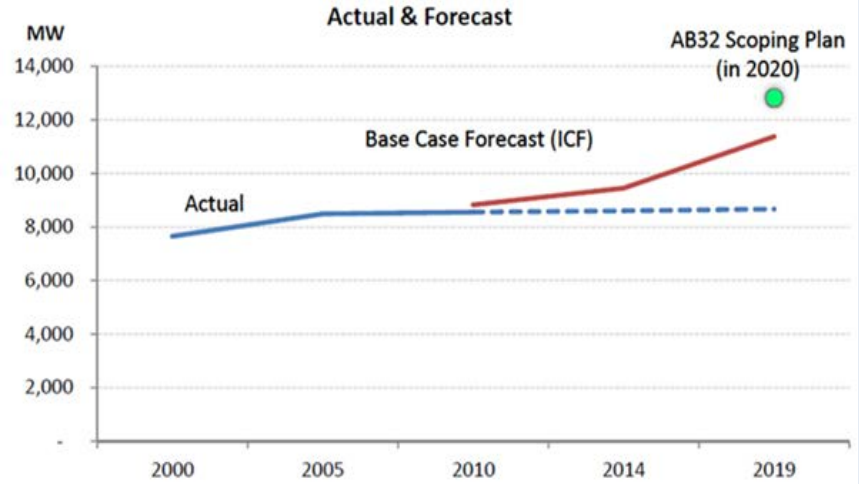
CHP Market Trends

- Relatively slow CHP capacity growth in the U.S./CA over the past several years
- National: 82 GW over the last 5 years = 500 MW/year (CAGR = 3%)
- CA: 8.5 GW over the last 5 years = 40 MW/year (CAGR = 7%)
- CA new CHP capacity technical potential through 2030: 16 GW (ICF)

U.S. CHP Capacity Additions



CA CHP Installed Capacity



Source: ICF Consulting

The Electric/Combination Utility

- Electric utilities are concerned about steep growth curve of solar PV:
  - Growing number of interconnection points creates issues with grid stability, voltage regulation, safety
  - Utility incentives often impact rates of remaining customers
  - Utilities would like for CHP capacity to be flexible and dispatchable
- Increasing awareness of rate impact to support key policy goals:
  - EE/DR
  - RPS
  - Energy Storage
  - Is CHP next?
- Electric utilities currently have little incentive to promote CHP
- Business as usual → modest growth
- CHP growth can reach growth targets with active engagement from electric utilities

Electric Utility CHP Concerns / Issues

Issue	Description	Impact	Future Considerations
California Departing Load Charges (DLC)	DLC pays for EE, RD&D and stranded assets.	DLC equates to fee of ~$0.016/kwh paid only to CA electric utilities	Exemption could require ratepayer subsidy
Standby Charges	Standby charges pay for backup utility infrastructure	Could be in the range of $x - $y/kW/month	Exemption could require ratepayer subsidy.
Net Metering	Customer pays for net electricity use on annual basis	Significant benefit to customers	Enablement could be ratepayer subsidy
Interconnection	Each micro-CHP device would be connected to grid, similar to solar PV	System not built to move power in both directions; safety issues with outages and islanding	Smarter grid could mitigate this issue
Feed In Tariff/Export of Electricity to Grid	Customers pays set price for electricity exported to the grid based on marginal cost (+ externalities?)	Depends on pricing	Could be a ratepayer subsidy if export price is above market; energy storage could help
Other Technical Challenges	Proper system design, sizing and operation	Ensures reduction in GHG emissions and criteria pollutants	Could help justify incentives/subsidy

Keys to Accelerating Adoption of Micro-CHP

- Develop more cost-effective technologies which meet strict emission standards (e.g., CARB-2007).
- Minimize net electricity exports.
- Enable net metering, eliminate DLC.
- Consider funding for incentives and subsidies by gas ratepayers (instead of electric ratepayers)
- Ensure that CHP is included in the definition of ZNE.
- Encourage active engagement by electric utilities.
- Implement a regulatory framework for utilities to participate in investment opportunities.