CAES AND UTILITIES NEED

A PERFECT FIT

John Strom – Haddington Ventures

Haddington Ventures

- Private Equity Fund Manager
  - $330 mm under management in Haddington Energy Partners (HEP) I, II, and III
  - Specialize in mid stream energy infrastructure development – pipelines, gathering, processing, storage, and specialized refining and power – across all hydrocarbons.
- Haddington principals founded TPC Corporation in 1984, the largest independent natural gas storage developer in U.S.
  - TPC sold to PacifiCorp in 1997 for $420 mm
- Haddington principals have had extensive prior subsurface project development successes
  - Moss Bluff Gas Storage (TPC)
  - Egan Gas Storage (TPC)
  - Lodi Gas Storage (HEP)
  - Bobcat Gas Storage (HEP)

Haddington's Experience

- Power Storage Developments
  - Magnum Energy Storage
  - Norton Energy Storage
  - Texas CAES
- Project Finance and Loan Guarantee Experience
  - Lodi Gas Storage – First merchant gas storage project finance without contracts
  - Bobcat Gas Storage - $185 million Term Loan A and B Project Finance
  - Endicott Biofuels – One of the "Sweet Sixteen" first round Loan Guarantee Finalists

Energy Storage Value Drivers

- Drive toward **renewable energy** is introducing **variability** into the grid: Renewables are variable ENERGY generation assets that
  - Vary Seasonally
  - Vary Hourly
  - Provide unpredictable CAPACITY
- Utilities have ALWAYS handled variability in the grid, though only on the DEMAND side
  - Current generation assets and transmission infrastructure operate at lowerload factors, balancing load profiles and providing quick response to changes
  - As renewables enter the grid and assets retire, the marginal, flexible asset may not be on line when needed
  - In deregulated markets, the utility no longer matches assets to load, adding the need for a flexible market resource: STORAGE

Energy Storage Market Opportunity

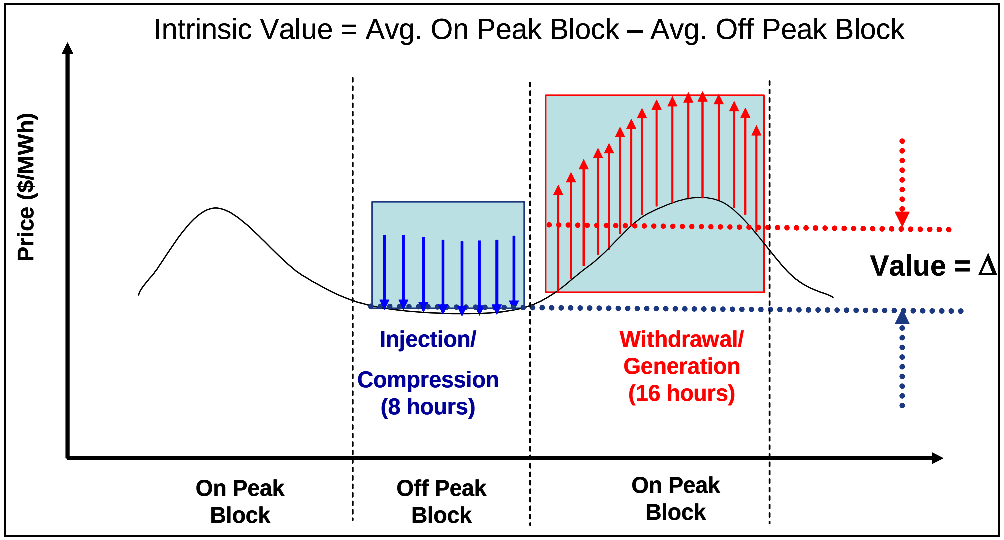
- Sources of Revenue for Energy Storage
  - Ancillary Services
  - Energy
  - Capacity
- Bulk Energy Storage technology can capture ALL available revenue streams
  - CAES and PSH technology fully compliant with regulation and spin markets
  - CAES and PSH ramping & variable costs advantaged relative to natural gas and coal units
  - Strong support for CAES and PSH within MISO/PJM, DOE, & FERC
- Bulk storage developers could sell each of these products of bundle a sale to "full requirements" customers.

The Natural Gas "Analogy"

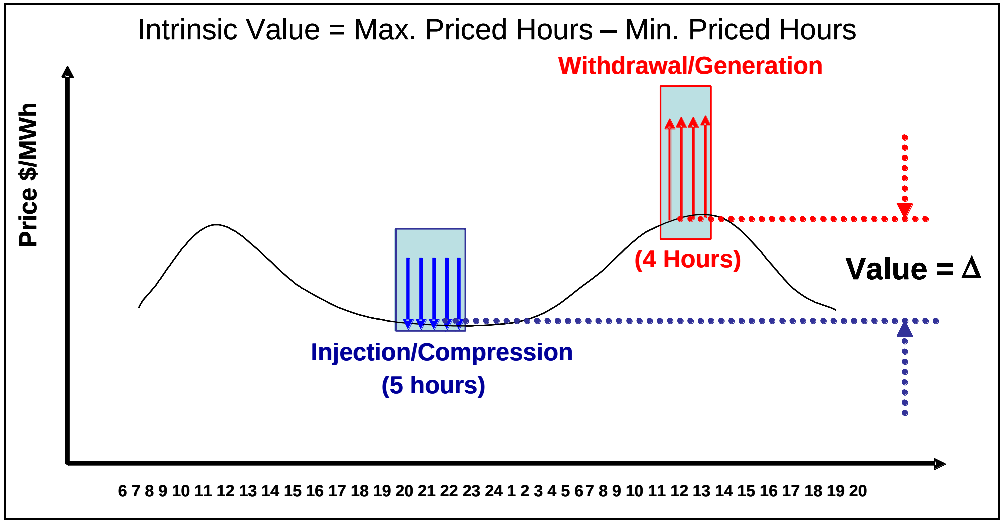
- Pre-natural-gas deregulation (1986) and FERC Order 636 (1994) very little gas storage existed
  - All Local Distribution Company (LDC) and pipeline storage facilities were in the "rate base"
  - LDCs smoothed seasonal demand and met spikes with integrated resource plans
  - the LDC controlled the system, sometimes back to the resource in the ground.
- With wellhead decontrol, unbundling of regulated services, and peakier load shape, different types and owners of natural gas storage evolved.
  - Transparency in gas volatility and price gave rise to increased option value
  - Option value drove "higher turn" storage service to meet the increased fluctuations and capitalize on price volatility.
  - Independent and merchant developers of storage identified the trends in physical and financial markets and provided the assets needed for the natural gas system stability
- Haddington expects electricity storage to follow a similar value path to natural gas storage.

Hourly Response from CAES

- Traditional pumped hydro view for intrinsic value of power storage is based on buying off peak block and selling on peak block

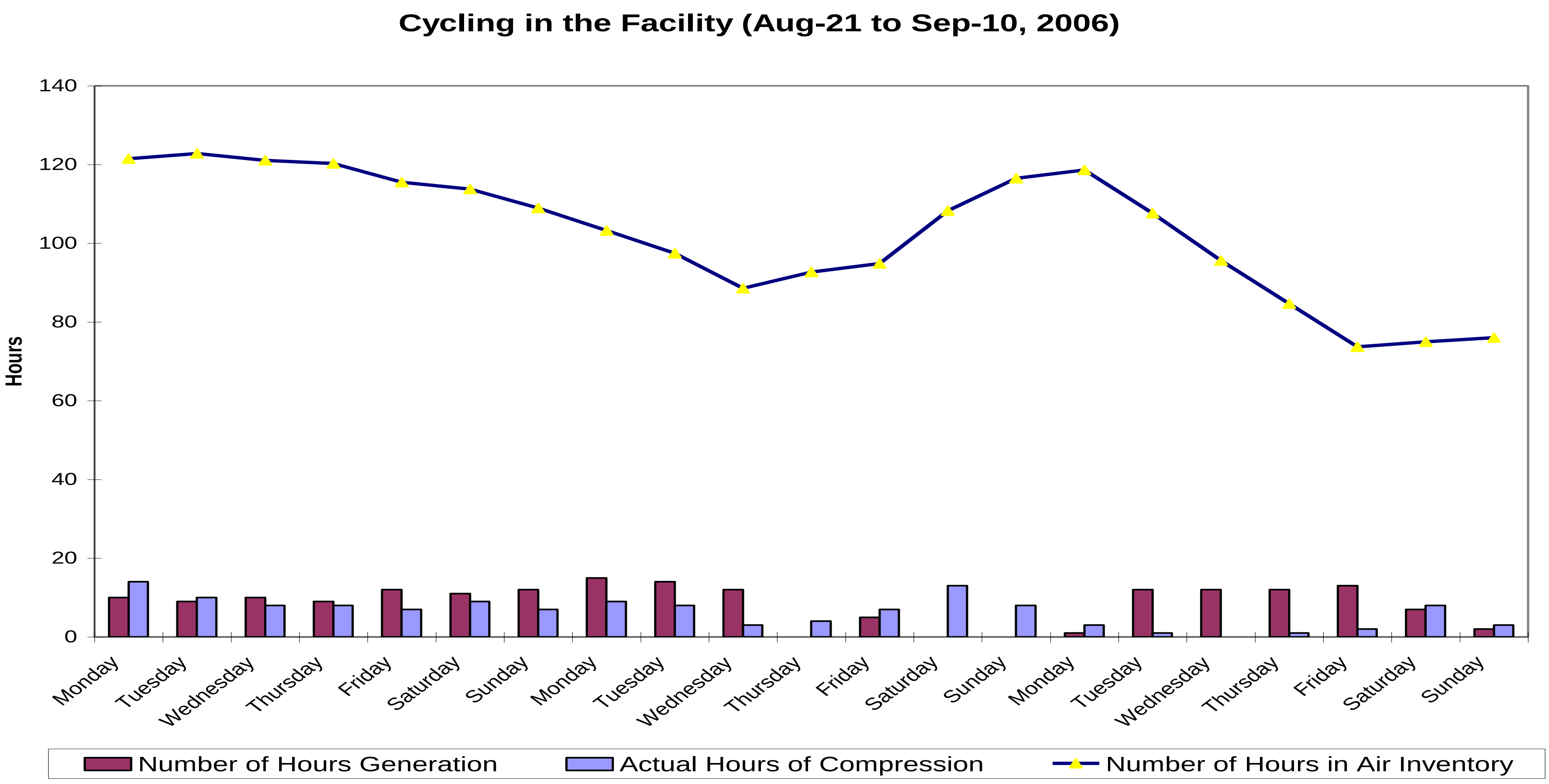


- CAES flexibility allows buying of lowest price hours and selling of highest price hours



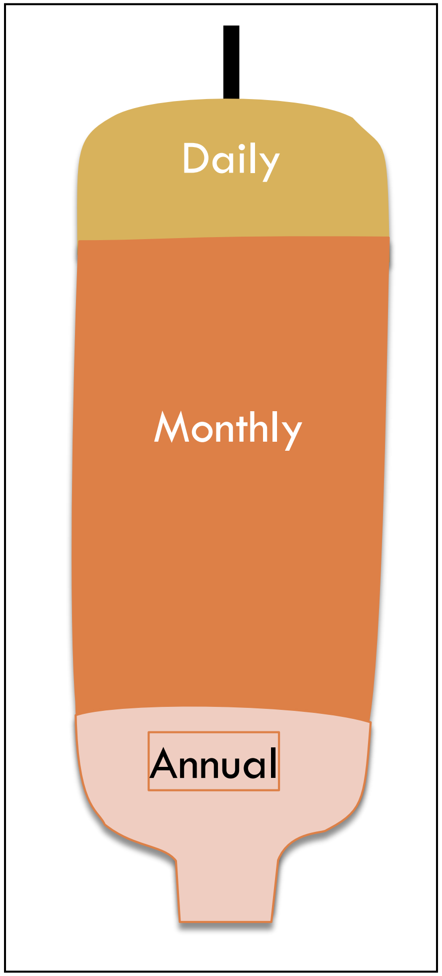
NOT On-Peak/Off-Peak Spread

- CAES has flexibility to optimize compression and generation: Example of 2 weeks simulated dispatch from hourly price data



Seasonal and Diurnal Characteristics

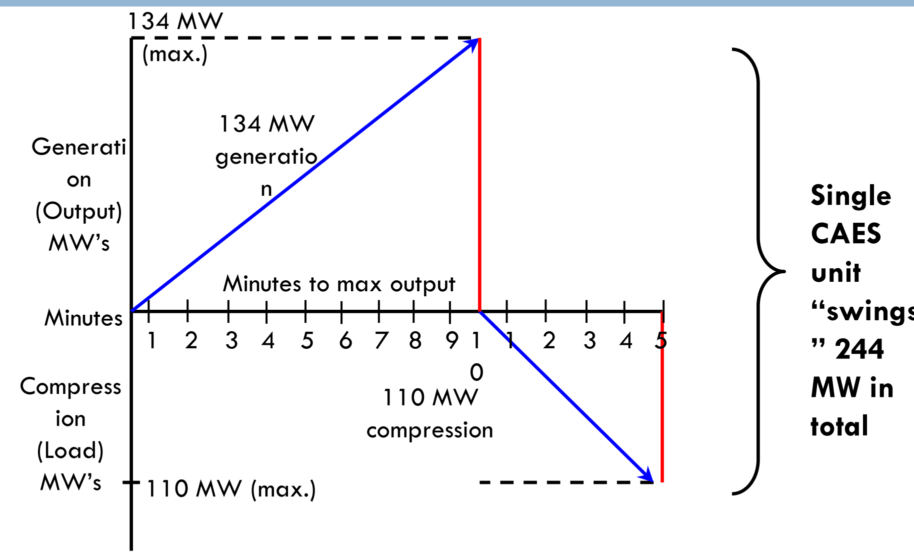
- Seasonal services from salt cavern gas storage
  - 10 BCF facility with "6 turns"
    - 30 days to inject and withdraw
    - Facility is empty in 30 days at full load
  - Customers pay for seasonal, monthly and daily
    - Storage is the RIGHT but NOT THE OBLIGATION to withdraw a commodity
    - There is NO REASON a CAES facility could not capture seasonal arbitrage – it will only fail to do so if the value of daily arbitrage is higher
  - Customer Mix: High, Medium, Low turn
- Application in Air Storage
  - A typical size salt cavern matched with 270 MW of CAES can store 10,000 MWh seasonally at full load or 13,000 Mwh on partial load.
  - More likely: weekly cycle averaging half full
  - Once operators get comfortable with the dispatch of CAES assets in markets with financial products, we expect similar "extrinsic" monetization as gas storage



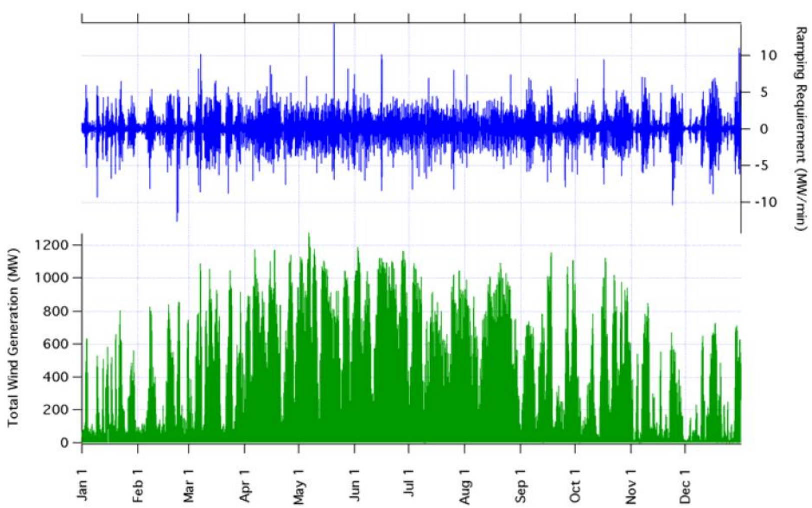
Typical Gas Storage Inventory Mix

Variability Support

- The improvements to Dresser Rand's McIntosh configuration provide unmatched response
- Unlike traditional ramping plants, CAES can continue to ramp down using compression



Estimated Wind Ramping Req in California - 2002



Shiu, et al. http://www.energy.ca.gov/2006publications/

- 1,200 MW of wind can add up to 20 mw/min ramping requirement
- Given duration of potential events, this could be 600 MW of required NEW ramping for each 1,200 MW of wind

Value in Reference to a Load Serving Entity

- CAES facility is a valuable partner to a Load Serving Entity ("LSE")
- An LSE with the commitment to supply full-requirements to a load is exposed to price and load deviating from "normal"
  - This risk can be mitigated in other ways, using a fleet of generation. The LSE example is only illustrative of the inherent value in the plant
- The value is incremental to the economics of the dispatch of the plant
  - The value is incremental as compared to a single, static predicted price scenario (deterministic analysis)
  - Adding variability using scenario analysis (probabilistic analysis) could "double count" the volatility used to calculate the option premium.

Integrated Resource Planning

Variable Load Profiles

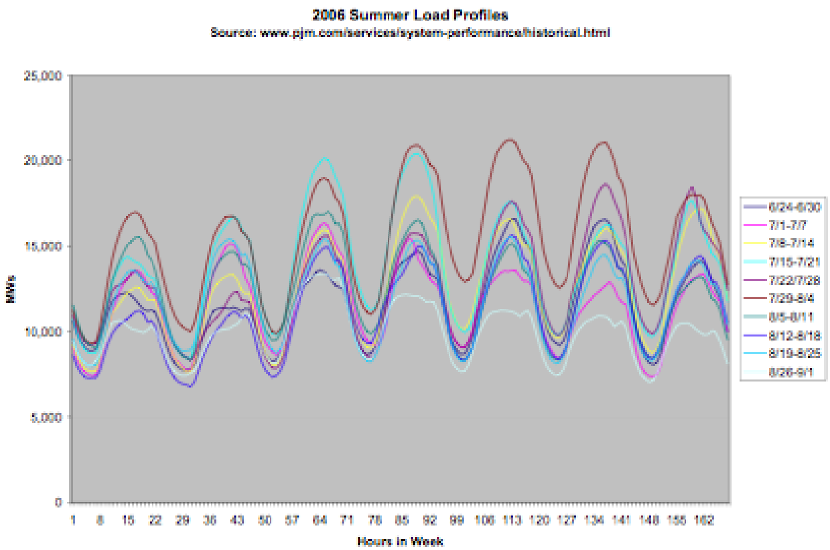


Figure 2: 2006 Summer Load Profiles. A typical summer load profile has tremendous peak demand times that require sufficient electricity capacity to meet this demand.

Load Duration Curves

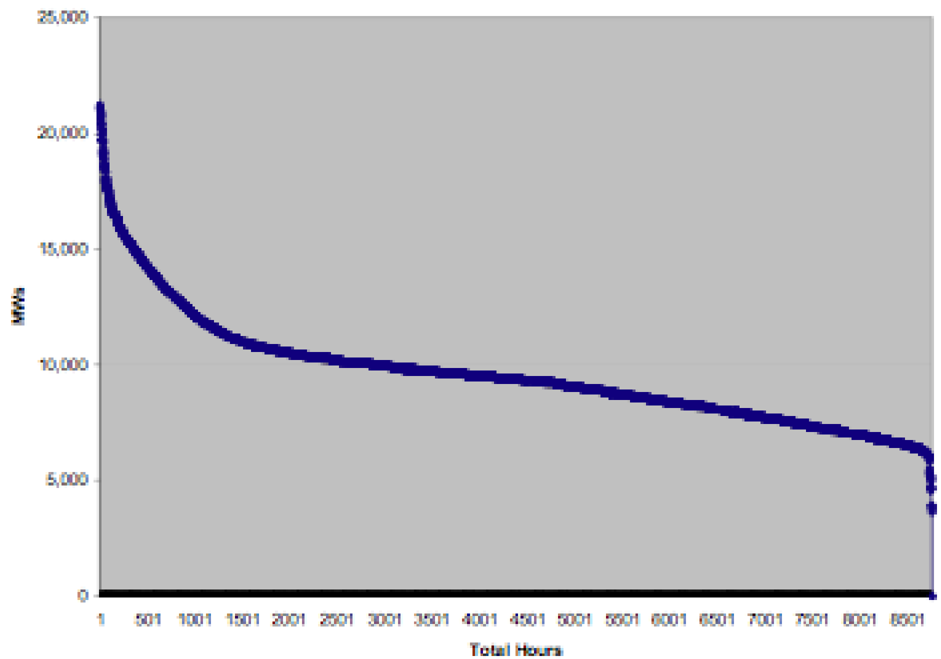


Figure 3: 2006 Load Duration Curve

Reliability and the Shoulder Months

Coal runs all the time

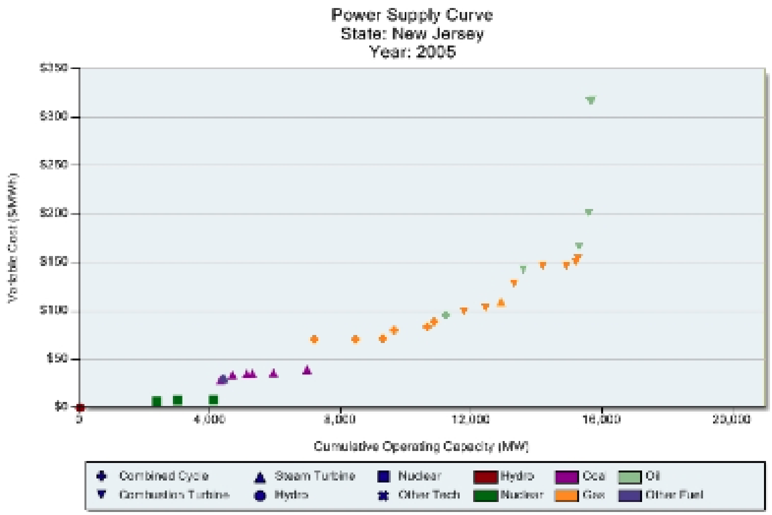


Figure 7: 2005 Power Supply for New Jersey. The plants with the highest operating costs (oil and natural gas) set the price of electricity that all plants receive.

Coal Plants are OLD

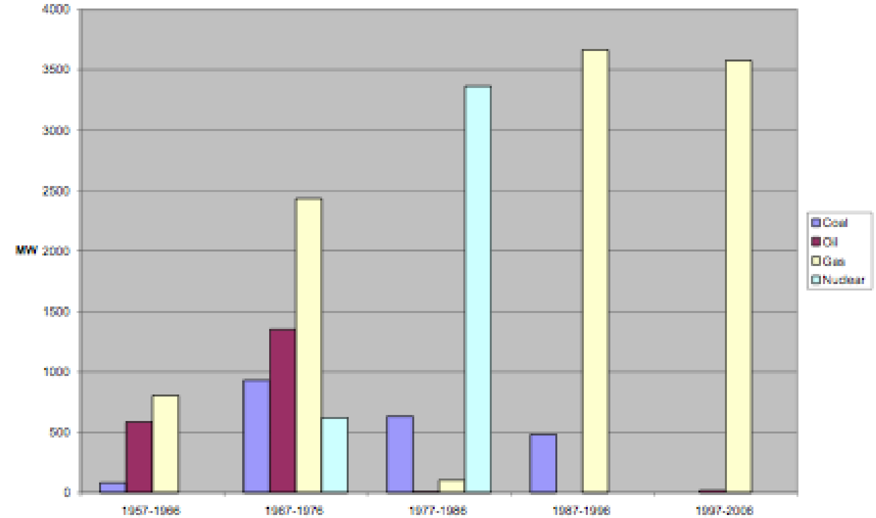


Figure 9: Electricity Generation Capacity in New Jersey, by Fuel Type and In-Service Date.[24]

RESOURCE COMPARISON CAES / GAS /COAL

Attribute	CAES	Gas-fired peaker (OCGT)	Combined-cycle gas turbine (CCGT)	Coal-fired (PC)
5-minute ramp rate	100% turbine production + 100% compressor load	100% turbine production	<100% gas turbine production + <10% of steam turbine production	<15% production
Variable cost*	$45/MWh	$79/MWh	$58/MWh	$41/MWh
Cost to stand ready	Zero	High	Medium	Low cost to run/ Medium lost opportunity margin

* Based on $7/MMBtu natural gas, $15/MWh offpeak power, $60/ton eastern coal; O&M at $2/MWh for CAES/OCGT, $6 for CCGT, and $8 for coal

Source: Dresser-Rand

CAES in The Future

Haddington seeks dialog with developers and utilities as we look to develop CAES assets in other markets.

We would be interested in working on a toll or development partnership.

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