Investigation of Compressed Air Energy Storage

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New York Power Authority

NYPA-EPRI Study on Advanced CAES Project

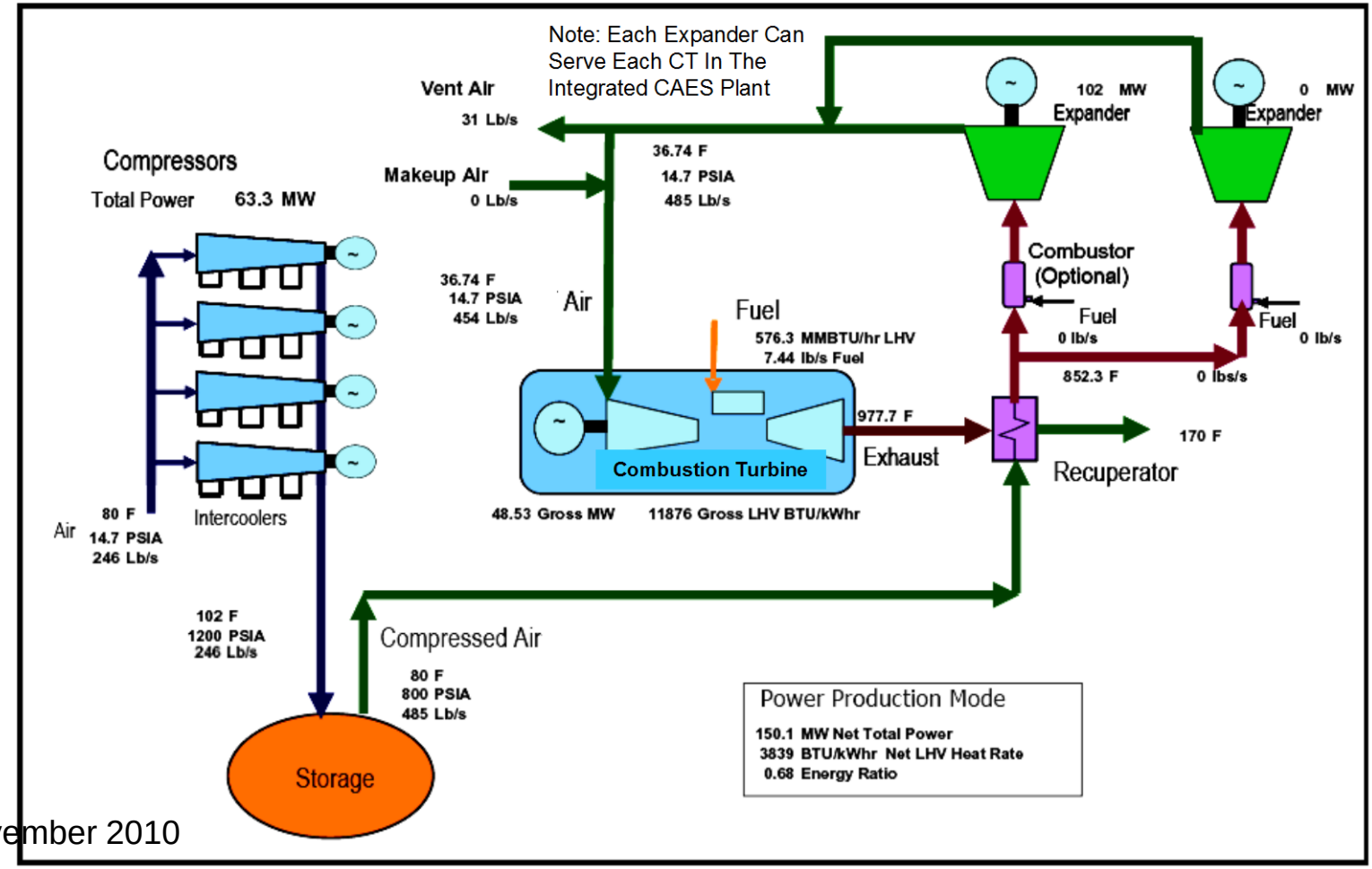
Objective:

- To evaluate the feasibility of a utility-scale underground compressed air energy storage facility in NYS (300MW gen, 215MW c, 10hours)

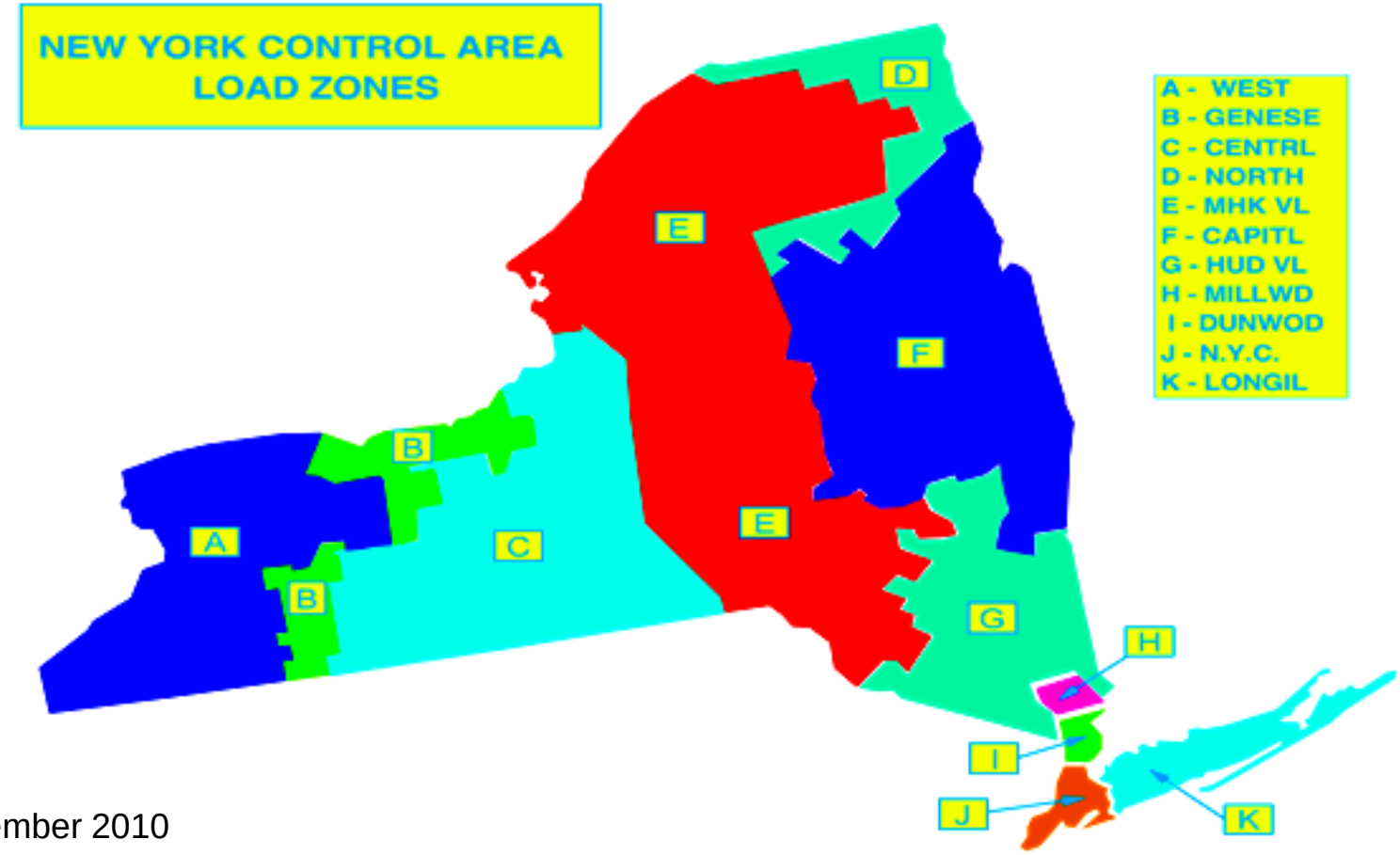
Scope of Work:

- Engineering Evaluation
- Economic Benefit / Cost Analysis
- Geologic Siting Opportunities

Advanced CAES Plant – Chiller Option



NYS Regions Chosen for Study: NYC (Zone J), Central (zone C) & Dunwoodie (zone I)



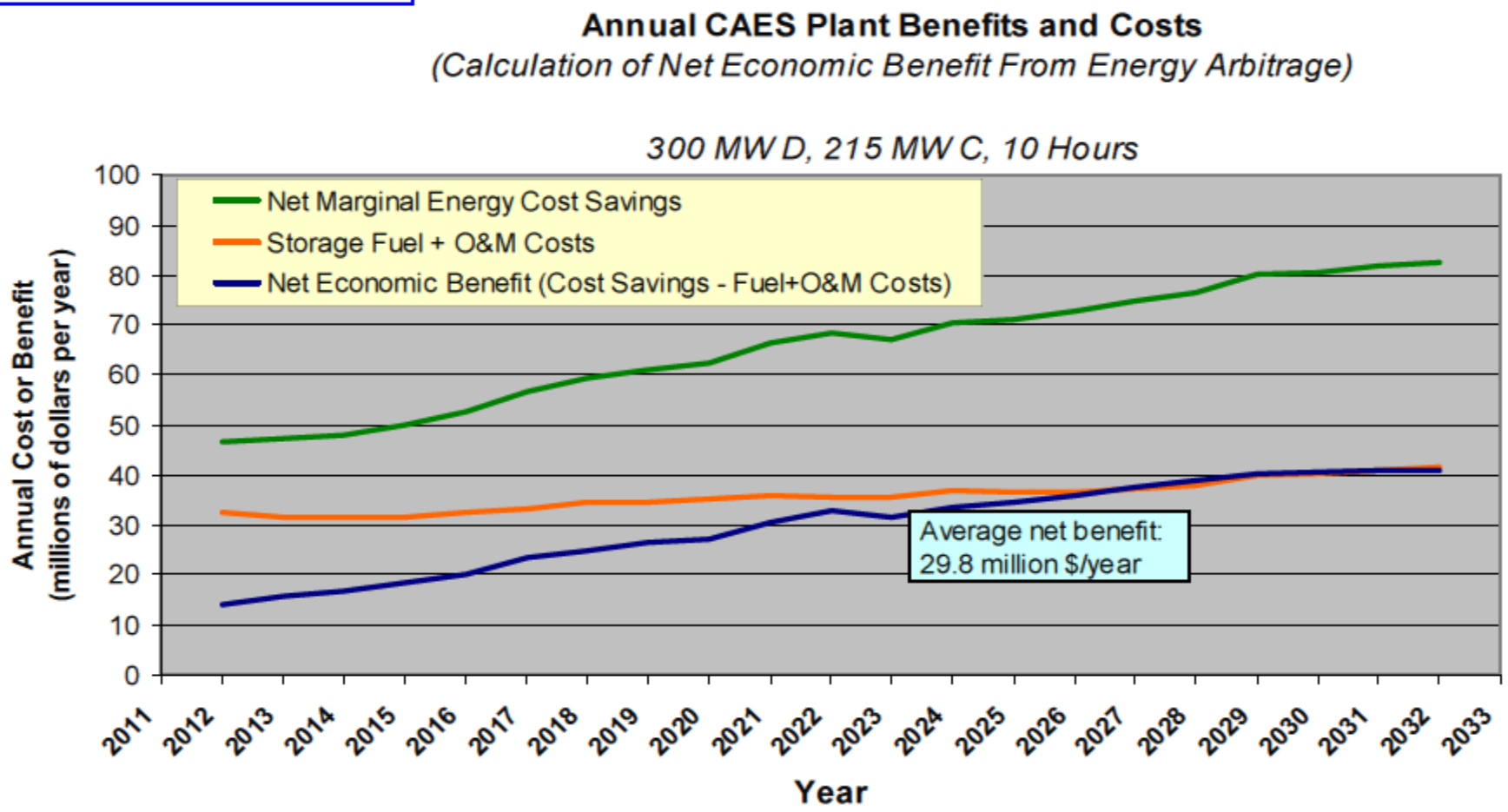
Economic Analysis Assumptions

Parameter	Nominal Case
Generation Capacity (MW)	300
Compression Capacity (MW)	215
Generation Period, Max (Hours)	10
Compression Period, Max (Hours)	10
Generation Heat Rate (Btu-In/kWh)	4229
Energy Ratio (kWh–In / kWh-out)	0.70
Variable O&M ($/MWh)	3.5
Fixed O&M ($/MW-Yr)	5
Planning Horizon	2012 - 2032
Capital Cost of the plant ($/kwh)	700
NYPA Fixed Charge Rate (FCR)	13%

With forecasted electric prices, natural gas prices and load profiles

Annual CAES Plant Benefits and Costs

NYC - Region J



Summary of Net Benefits from Arbitrage only

NYC (zone J)	$29.8 million/year
Dunwoodie (zone I)	$22 million/year
Central (zone C)	$7 million/year

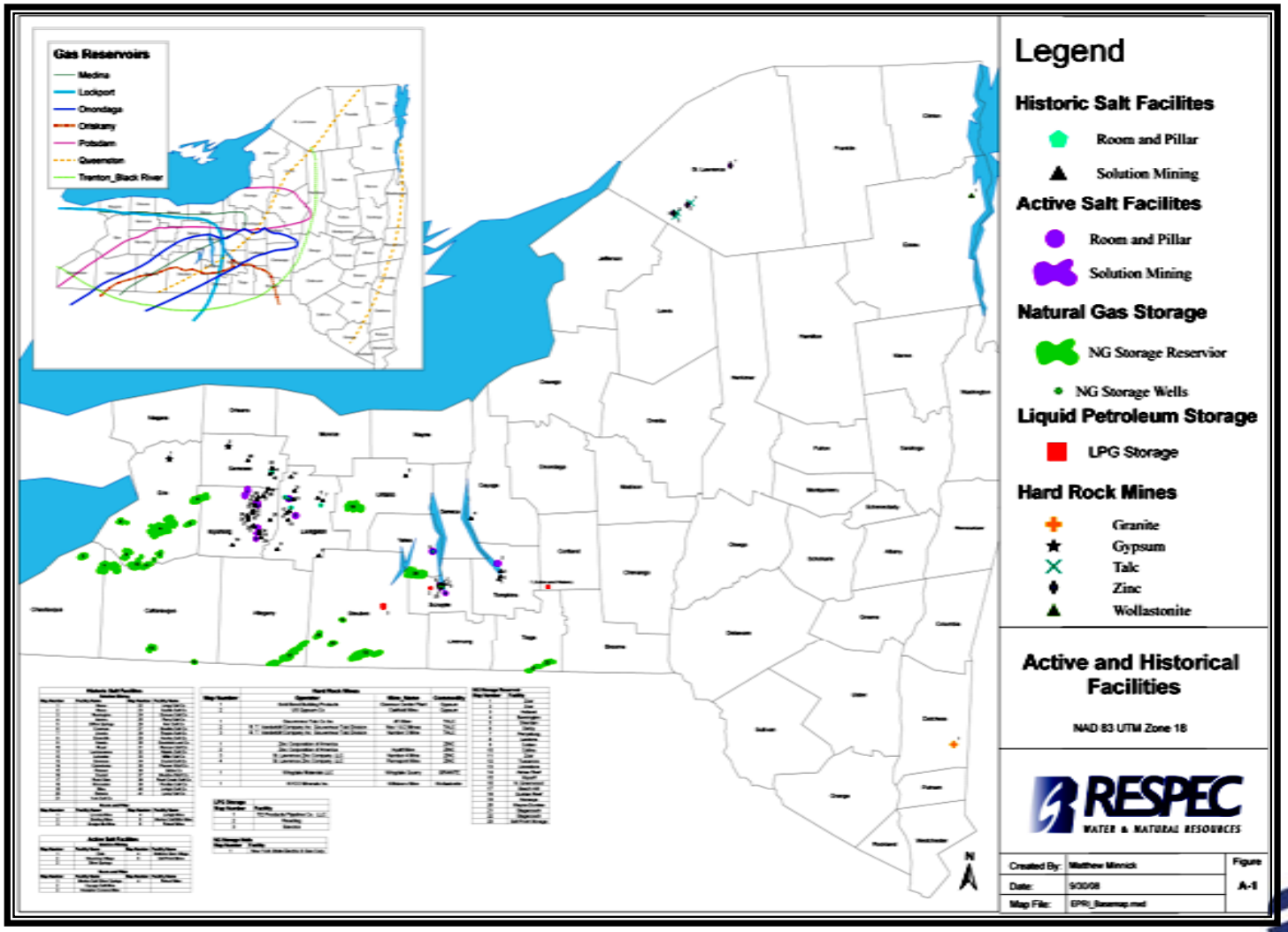
Beyond Arbitrage – Capacity and Ancillary Services

- √ Capacity Credits
- √ Spinning Reserve
- √ Regulation Service
- Ramping
- VAR
- Renewable Credits
- CO2 Credits

Potential Economic Benefits ($/kW-Yr) for Three New York State Regions

	New York	Dunwoodie	Central
Capacity Credit High Estimate	84	84	37
Capacity Credit Average	68	68	20
Capacity Credit Low Estimate	23	23	9
10 Minute Sync Reserve High Estimate	82	92	68
10 Minute Sync Reserve Average	8	9	7
10 Minute Sync Reserve Low Estimate	0	0	0
Regulation High Estimate	123	138	127
Regulation Average	80	90	83
Regulation Low Estimate	38	42	39
Arbitrage Benefits High Estimate	123	90	28
Arbitrage Benefits Average	94	68	18
Arbitrage Benefits Low Estimate	85	62	16
Total Benefits High Estimate	412	404	260
Total Benefits Average	250	235	128
Total Benefits Low Estimate	146	127	64
Annualized Capital Cost FCR = 13	93	93	93
Net Plant Benefits High Estimate	319	311	167
Net Plant Benefits Average	157	142	35
Net Plant Benefits Low Estimate	53	34	-29

CAES Siting Potential in New York State



NYS Sites:

- Solution Mined Salt Caverns
- Depleted Gas Reservoirs
- Abandoned Mines

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Next Steps

- Perform more detailed geologic studies at sites in pre-determined regions
- Select a site based on these subsequent geologic analyses
- Update the economic benefits/cost and business case analyses for selected site
- Update/optimize the plant specifications to match the geological conditions of the selected storage sites