What follows is a Cautionary Tale

Risks aren’t always what you anticipate!
Topics

- New England Market Environment
- Vermont Regulatory Policies
- Sheffield-Highgate-Export-Interface (SHEI) Constraint
- Implications of the SHEI Experience
- Effect on power supply decisions
New England Market Environment

- Has been a tight centralized power pool for decades
  - New England Power Pool created in the 1960’s
  - Converted to ISO New England in late 1990’s

- ISO New England
  - Operates as a Regional Transmission Organization
  - Operates New England’s centralized power markets

- Markets do not include most distributed resources
  - Centralized energy and capacity markets do not include behind the meter generation
Vermont Utility Environment

- All utilities are subject to state regulation
  - Public Utility Commission (PUC) acts as judiciary
  - Department of Public Service (DPS) is consumer advocate

- Seventeen distribution utilities and one transmission company
  - One IOU (Green Mountain Power)
  - Two Cooperatives (Vermont Electric Coop, Washington Electric Coop)
  - Fourteen municipals (Twelve VPPSA members, Burlington Electric, Stowe Electric)
  - Statewide transmission company (Vermont Electric Power Company)
    - Owned by the distribution companies

- Still vertically integrated - no retail choice
  - Although state policies are setting up a framework to provide retail choice through DER

- Statewide peak load is ~1,000 MW (and dropping)
  - Utilities (on average) are 80% hedged in long term contracts
State Efficiency Policy

- Aggressive efficiency efforts started in the mid-80’s

- Centralized statewide efficiency utility (EEU) created in 1999
  - Burlington Electric allowed to maintain its own EEU function

- Responsibility for efficiency efforts shifted away from distribution utilities
  - EEU works directly with customers to reduce energy use and peak loads
  - Distribution utilities are required to share customer usage data

- Funded by an “Energy Efficiency Charge” line item on electric bills
  - Distribution utilities collect funds and turn over to the EEU

- Charges and programs are regulated by the Public Utility Commission

- Estimate Vermont annual energy need is 15% lower due to efficiency
State Feed-in Tariff Policies

- “Standard Offer” Feed-in Tariff to promote small scale (<2.2MW) renewable generation started in 2005

- Fixed quantity of capacity solicited each year until a total program capacity of 127.5MW is reached

- Winners are chosen by auction (most recent price ~$0.12/kwh)
  - Original program was by lottery with a fixed payment at $0.30/kwh
  - Location is not a factor in choosing winners

- Winners enter a contract with a state appointed administrator
  - Utilities are required by law to buy their pro rata share of generation output

- Auction is designed to allocate contracts among a variety of fuel types
  - Solar, wind, biomass, hydro, methane
State Net Metering Policies

- Program has existed for decades but was put on steroids in the past several years
- Distribution utilities are required to accept net metering projects
- Sizes allowed up to 500kW - under 15kW is permitted by registration process
- “Group Net Metering” is allowed (but only within each utility territory)
  - Large projects can be financially shared among a self-managed group of customers
  - There is no requirement for the generator to be located at a customer site
- Credits are based on the lower of utility residential rate or statewide average residential rate
  - Adders or subtractors are applied based on location (i.e. roofs, parking lots, brownfields)
  - An adder or subtractor is applied based on who gets the Renewable Energy Credits
  - Base credit is roughly $0.145/kwh - can go to $0.19/kwh with adders
Net Metering Results

Percent of Peak Load Served by Net Metering By Utility
(as of March, 2016)
Vermont Monthly Energy Use

Source: Vermont Electric Power Company (VELCO), Monthly Peak Reports.
Utilities began reacting in traditional ways

- Sought legislative fixes to mitigate the pace of development
  - Such as the Standard Offer change to an auction format

- Began modifying rates to ensure fixed cost recovery
  - Higher customer charges, TOU & Demand Rates

- Incorporated forecasts of future DER development into purchase analyses
  - Began leaving bigger open positions in the future

- Started evaluating protection on impacted distribution lines
  - Solar development has caused some circuits to back feed on sunny days

- Began offering DER lease programs as a way to increase rate base
State Renewable Energy Standard Policies

- **Tier I - All Renewables including “large” hydro**
  - Generic RECs equal to 55% of retail sales in 2017 (75% in 2032)

- **Tier II - Distributed Generation**
  - RECs from renewable generation under 5MW in size, located in Vermont, and built after 7/1/15 equal to 1% of retail sales in 2017 (10% in 2032)

- **Tier III - “Energy Transformation”**
  - Credits are associated with mmbtu of eliminated fossil fuel use
  - Converted to MWh using a heat rate formula
  - Designed to encourage utility electrification programs
    - Heat pumps, electric vehicles, motor/compressor replacement
  - Must produce credits equal to 2% of retail sales in 2017 (12% in 2032)
**SHEI Constraint**

- Location of Resources was not a consideration in state policies

- Created an export constraint in northern Vermont
  - During high generation seasons (i.e. high hydro)
  - But also just windy or sunny days

- Market prices as low as -$150/MWh are prevalent during some times of year

- ISO New England often curtails market-based generation
  - Primarily larger wind plants
SHEI area: growth in generation since 2005

Plus behind-the-meter solar

LEGEND
- Farm methane
- Hydro
- Landfill gas
- Solar
- Wind

From VELCO SHEI Presentation 12/7/17
SHEI Impacts

- Unguided development has caused state policies to compete with each other
  - Net metering and Feed In Tariff installations are undercutting utility efforts to meet RES Tier I and Tier II goals
  - Utilities experiencing economic harm are opposing proposals for new generation – even from other utilities

- Market based resources are paying a large financial penalty
  - Owners of a 60MW wind plant are now seeing losses in excess of $2 million/year due to curtailments
  - Offtakers from a 50MW wind plant are paying twice for the energy they receive

- The state’s approach to energy efficiency is being called into question
  - “regional equity” is required by regulators - but efficiency inside the SHEI area can increase curtailments

- FERC’s market based transmission policy is implicated
  - Several proposed merchant lines have been opposed for increasing the constraint

- Electrification has become viewed as the next panacea
Implications - Unexpected Results

- Our sensitivity analysis worst case ≠ THE worst case
  - Deep penetration of solar moved Vermont’s peak from 3:00pm to 6:00pm
    - The assumed value from capacity contributions has dropped 80%
    - Paying twice for contracted power is rarely an assumption

- Ownership of “free fuel” renewables actually added risk
  - Curtailment of anticipated generation is effecting the ability to meet fixed costs

- “Control” of contracted resources became important
  - Traditional contracts left control of unit bidding with developers
  - Once negative bids were allowed - developers began bidding at negative $150/MWh
  - Offtakers of a contract in the SHEI area are paying the contract rate AND in some hours paying the ISO the negative price to allow the power onto the grid
What Does This Mean For Power Supply Management?

- The old real estate rule - Location! Location! Location! - is becoming equally true for us
  - efficiency value needs to be evaluated by location - not all efficiency is equal
  - Electrification programs should consider benefits for existing generation
    - Some programs are better than others
  - Interconnection of DER needs to consider impacts on existing generation
    - Many small units in the wrong place can have dramatic consequences
  - Retail rates need to work in tandem with locational wholesale price signals
    - Special appliance rates may be beneficial in addition to traditional demand response

- Visibility and control are becoming increasingly important
  - Traditional DER needs to look, feel, and operate more like utility generation

- Decision making needs to be holistic in approach but granular in scope
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