Identifying and Addressing Generation Constrained Areas

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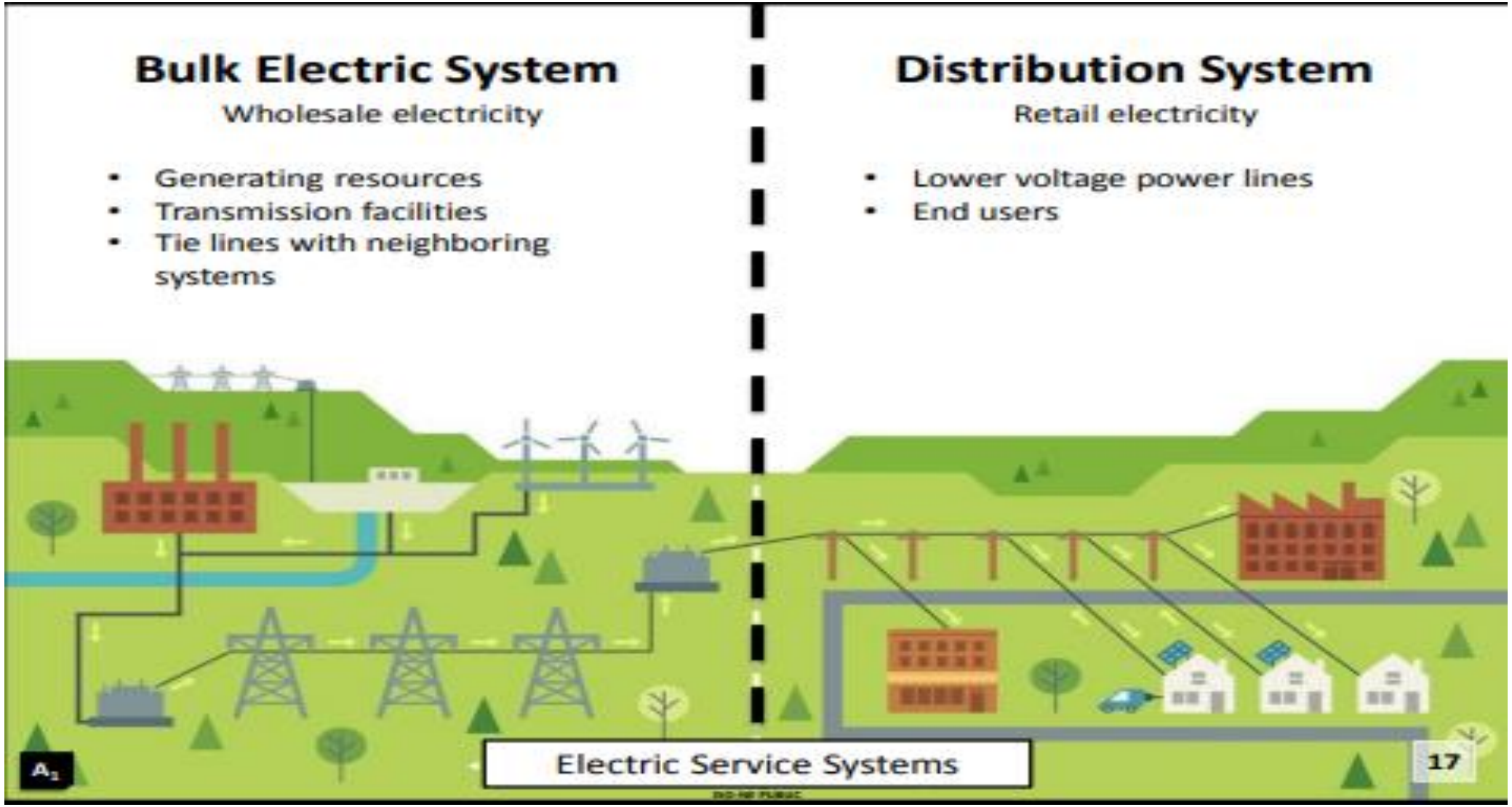
Overview

- There are physical and economic constraints that limit development of new generation in some areas of Vermont
- This is a result of growing pains associated with successful and rapid deployment of resources
- There is no silver bullet, solutions are costly
- Increased emphasis on distribution system planning and grid modernization is necessary

Description of Generation Constraints



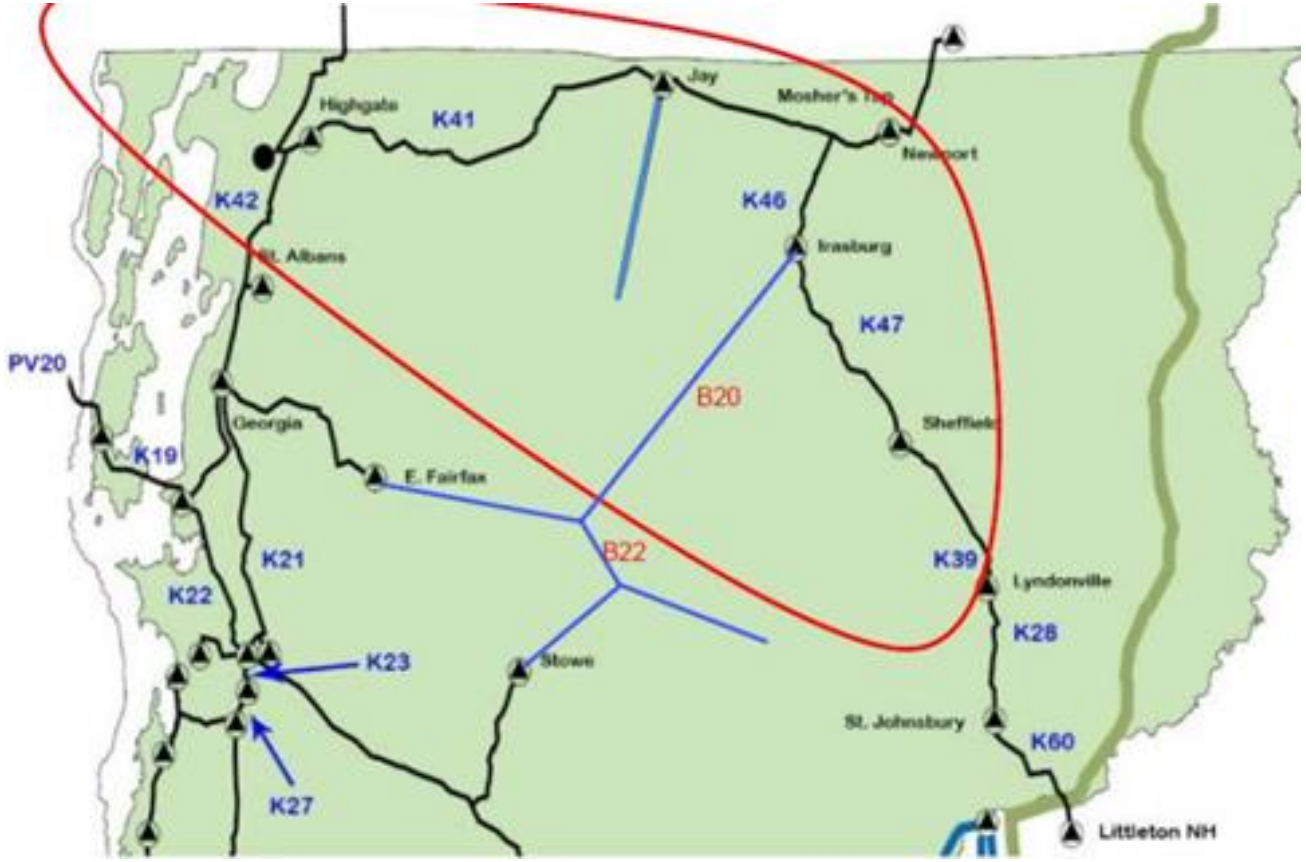
Source: ISO 101: Introduction to ISO New England, available at https://www.iso-ne.com/static-assets/documents/2018/10/2018C-ISO101-student-book-posted.pdf.

Physical Constraints

- All electric systems are constrained to some extent
- Generation in an area cannot exceed the ratings of infrastructure (lines/transformers/switches)
- When the amount of generation exceeds load, the power needs to be exported
- Tends to occur in rural areas with limited load

Sheffield Highgate Export Interface

- 450 MW of generation, 35 MW of load on average
- To ensure transmission system is not overloaded, ISO-NE curtails projects participating in wholesale electricity markets
- Increased generation, and decreased load, increases the amount of curtailment



Vermont’s Renewable and GHG Policies, Goals, Requirements

Vermont’s Energy Policy – 30 V.S.A. § 202a

It is the general policy of the State of Vermont:

(1) To assure, to the greatest extent practicable, that Vermont can meet its energy service needs in a manner that is adequate, **reliable**, secure, and **sustainable**; that **assures affordability** and encourages the State's economic vitality, the efficient use of energy resources, and cost-effective demand-side management; and that is environmentally sound.

(2) To identify and evaluate, on an ongoing basis, resources that will meet Vermont's energy service needs in accordance with the **principles of least-cost integrated planning**; including efficiency, conservation, and load management alternatives, wise use of renewable resources, and environmentally sound energy supply

Renewable Requirements

Renewable Energy Standard (enacted in 2015)

- Started 2017, requirements increase until 2032

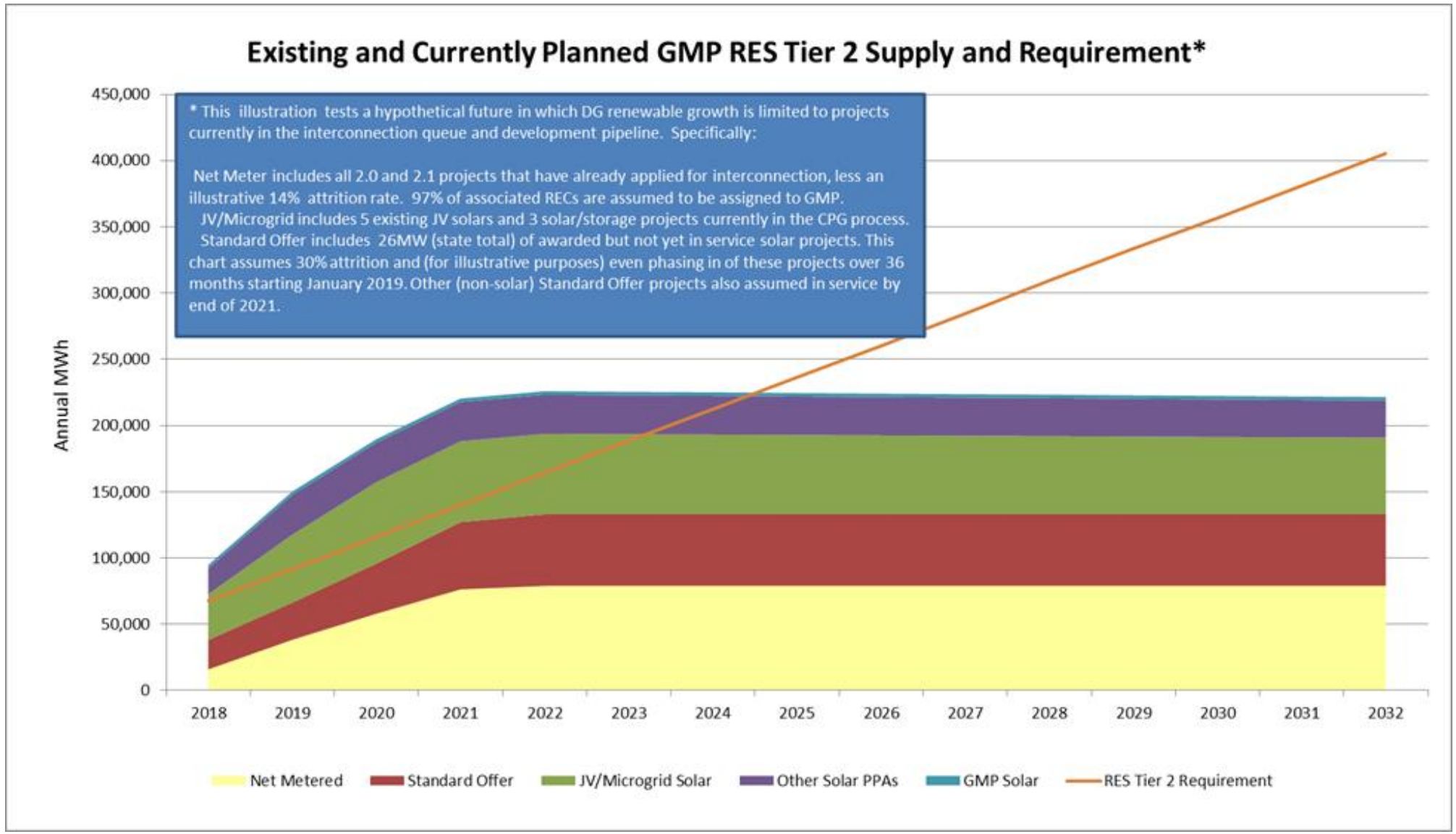
Tier 1: 55% - 75% renewable (2017 – 2032)

Tier 2: 1% - 10% **distributed generation within Vermont** (2017 – 2032)

- Both utilize Renewable Energy Credits

Tier 3: 2% - 12% energy transformation projects (2017 – 2032)

- Requires measures that reduce fossil fuel reductions (including EVs and heat pumps)


Existing and Currently Planned GMP RES Tier 2 Supply and Requirement*
* This illustration tests a hypothetical future in which DG renewable growth is limited to projects currently in the interconnection queue and development pipeline. Specifically:
Net Meter includes all 2.0 and 2.1 projects that have already applied for interconnection, less an illustrative 14% attrition rate. 97% of associated RECs are assumed to be assigned to GMP.
JV/Microgrid includes 5 existing JV solars and 3 solar/storage projects currently in the CPG process.
Standard Offer includes 26MW (state total) of awarded but not yet in service solar projects. This chart assumes 30% attrition and (for illustrative purposes) even phasing in of these projects over 36 months starting January 2019. Other (non-solar) Standard Offer projects also assumed in service by end of 2021.
Annual MWh
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
Net Metered
Standard Offer
JV/Microgrid Solar
Other Solar PPAs
GMP Solar
RES Tier 2 Requirement

Renewable Energy Credits

- One MWh of renewable generation = one REC
- Renewable attributes are separated from underlying generation
  - Creates fungible commodity that can be traded
  - Creates uniform system for ensuring that there is no double counting
- Different Tier/Class eligibility means different values
  - Tier 1 REC has less significantly less value than Tier 2
  - Excess Tier 2 RECs likely to be sold out of state
- RECs are used throughout U.S. to determine renewability

Comprehensive Energy Plan

- Implements the policy of 30 V.S.A. §202a
- 90% renewable by 2050 – all sectors
  - Electric Sector - 67% renewable by 2025 (consistent with RES; was 63% in 2017)
    - “Power supply questions now revolve around the most cost-effective way to meet the RES requirements, not around how much renewable energy to acquire.“ CEP at 277.
  - Thermal Sector – 30% renewable by 2025
  - Transportation Sector – 10% renewable by 2025

RES Tier 2 sets requirement for in-state generations

- By 2032, Vermont would have 1150 MW of installed renewable generation
  - 300 MW of existing distributed solar
  - An additional 400 MW of new Tier 2-eligible distributed solar (and one 20 MW solar)
  - 200 MW of hydroelectric
  - 160 MW of wind
  - 70 MW of biomass
  - 11 MW of landfill gas
  - 5 MW of farm methane

Greenhouse Gas Reduction Goals – 10 V.S.A. § 578

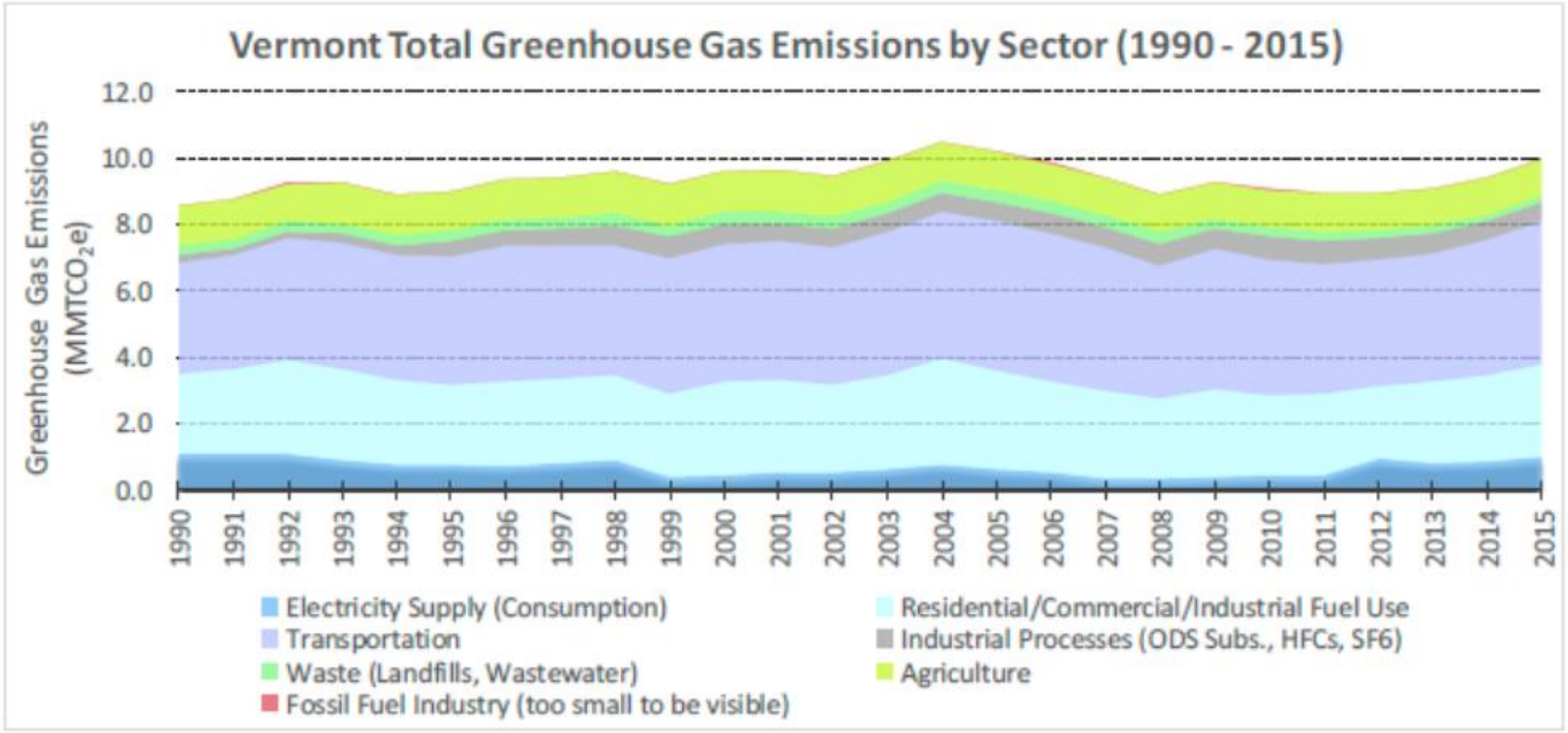
Reductions from a 1990 baseline of 8.1 million tons:

(1) 25 percent by January 1, 2012;

(2) 50 percent by January 1, 2028;

(3) If practicable using reasonable efforts, 75% percent by January 1, 2050

Vermont GHG Emissions by Sector



GHG Emissions Reduction Strategies

- Electric sector contributes less GHG than each of thermal, transportation, and agricultural sectors
- RES creates mandatory pathway for future reductions in electric sector
- Imposing mandates on electric utilities is relatively easy but not necessarily the most cost-effective policy for GHG reductions
- Cost of electricity is a significant factor in determining cost-effectiveness of electric vehicles and heat pumps

Costs associated with Generation Constraints

Identification of Costs

- No environmental costs – renewable generation can be obtained outside constrained areas
- Economic development costs
- RES Tier 2 compliance costs could increase as the areas impacted by generation constraints increases
- Constraints in SHEI causes increased costs for Vermont customers due to curtailment and congestion

Allocation of Costs

- Constrained areas can be addressed by investing in transmission and/or distribution infrastructure
- Cost Causers Pay Methodology = Whoever imposes costs on system must pay those costs
- Generation constrained areas are those where the costs of upgrading infrastructure to accommodate new generation are greater than the economic benefit

Strategies for encouraging deployment of renewable generation while minimizing curtailment

Strategies

- Grouping infrastructure upgrade costs among developers
- Controlled load building – choreographing flexible load (such as EVs) with production of intermittent generation
- Modifying policy to provide locational value for generation, flexible loads, and energy efficiency
- Energy storage – if charged and discharged properly
- Curtailments – generally should be minimized but may be most cost-effective solution in some cases