Advancing Digester Development in the Northeast

for REFOR17 “States Advance Digester Development”

October 17, 2017

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Agricultural Development Division

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Outline

1. Policy
   - Its nature
   - The options
2. The states
   - Main factors influencing development

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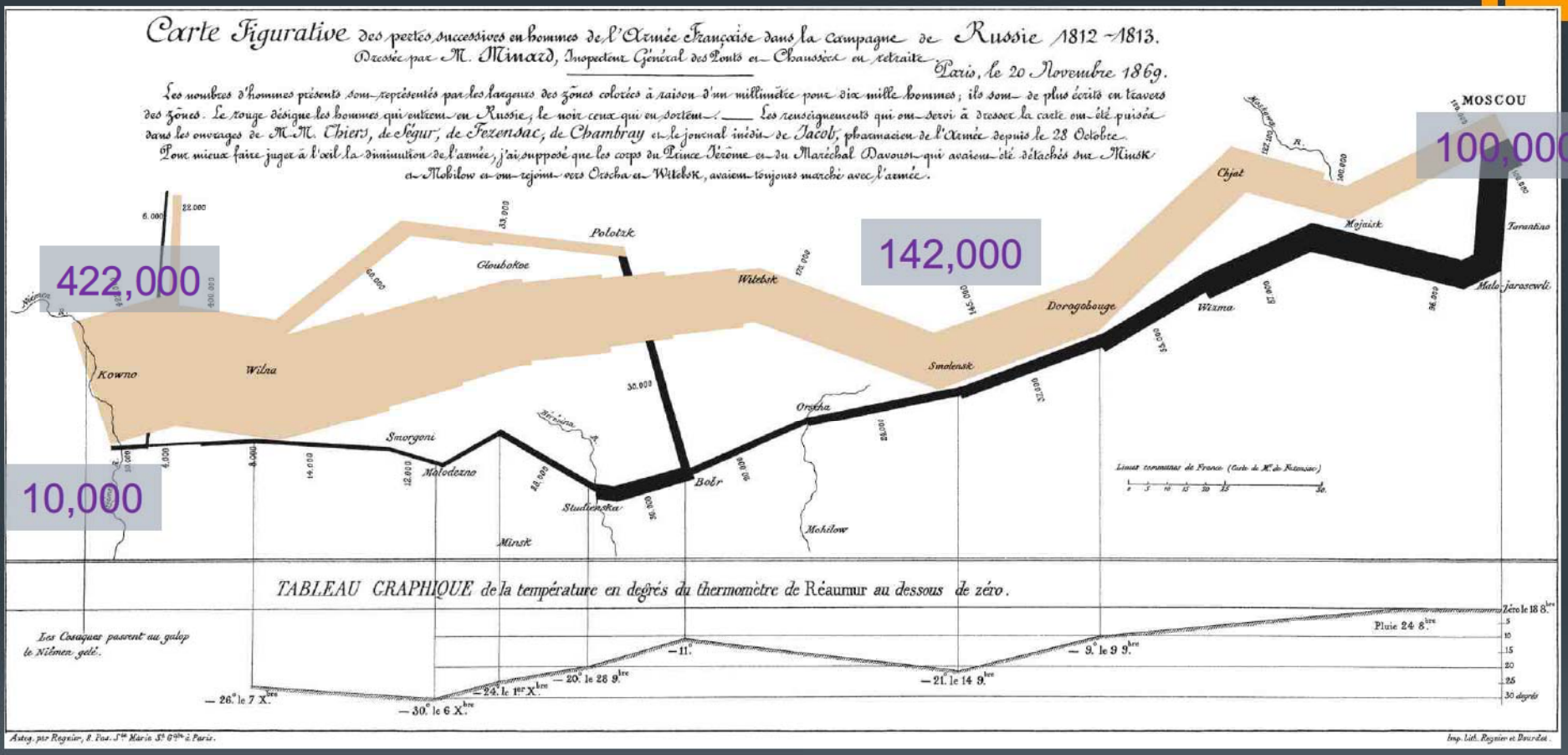

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Sankey Diagram

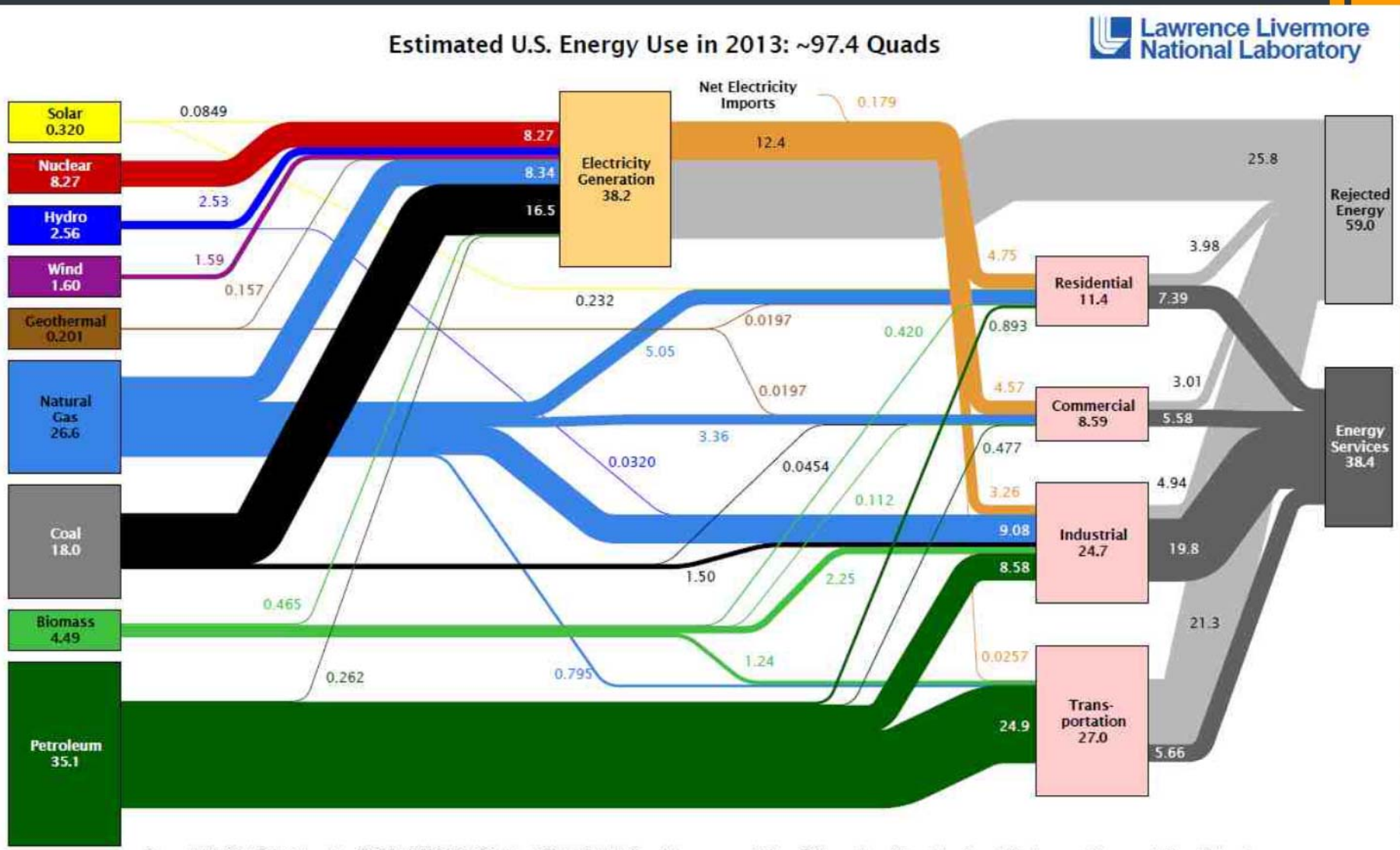
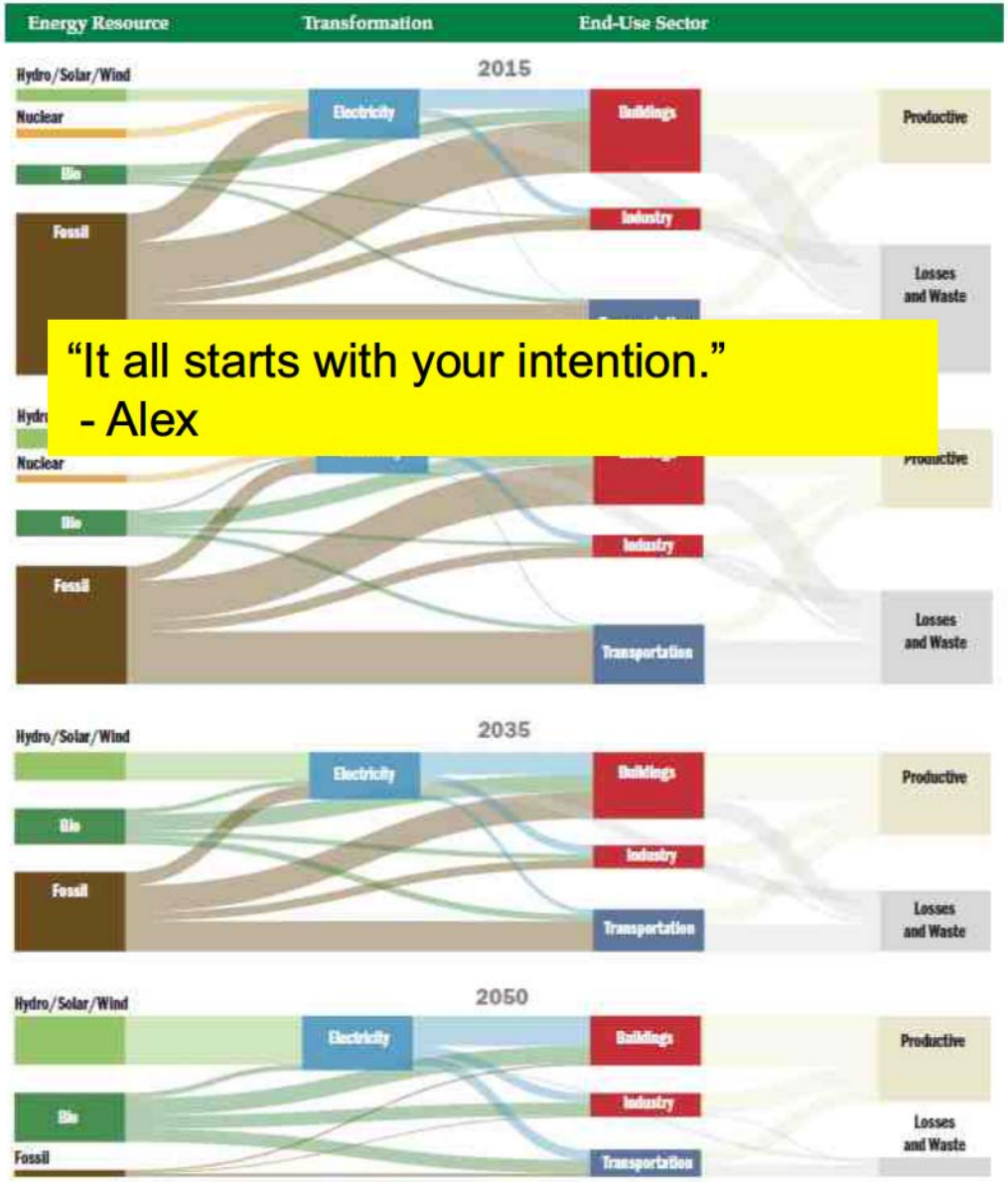


Figure ES-1

Vermont energy flows in 2015, with an illustrative path forward to 2025, 2035, and 2050.



"It all starts with your intention."
- Alex

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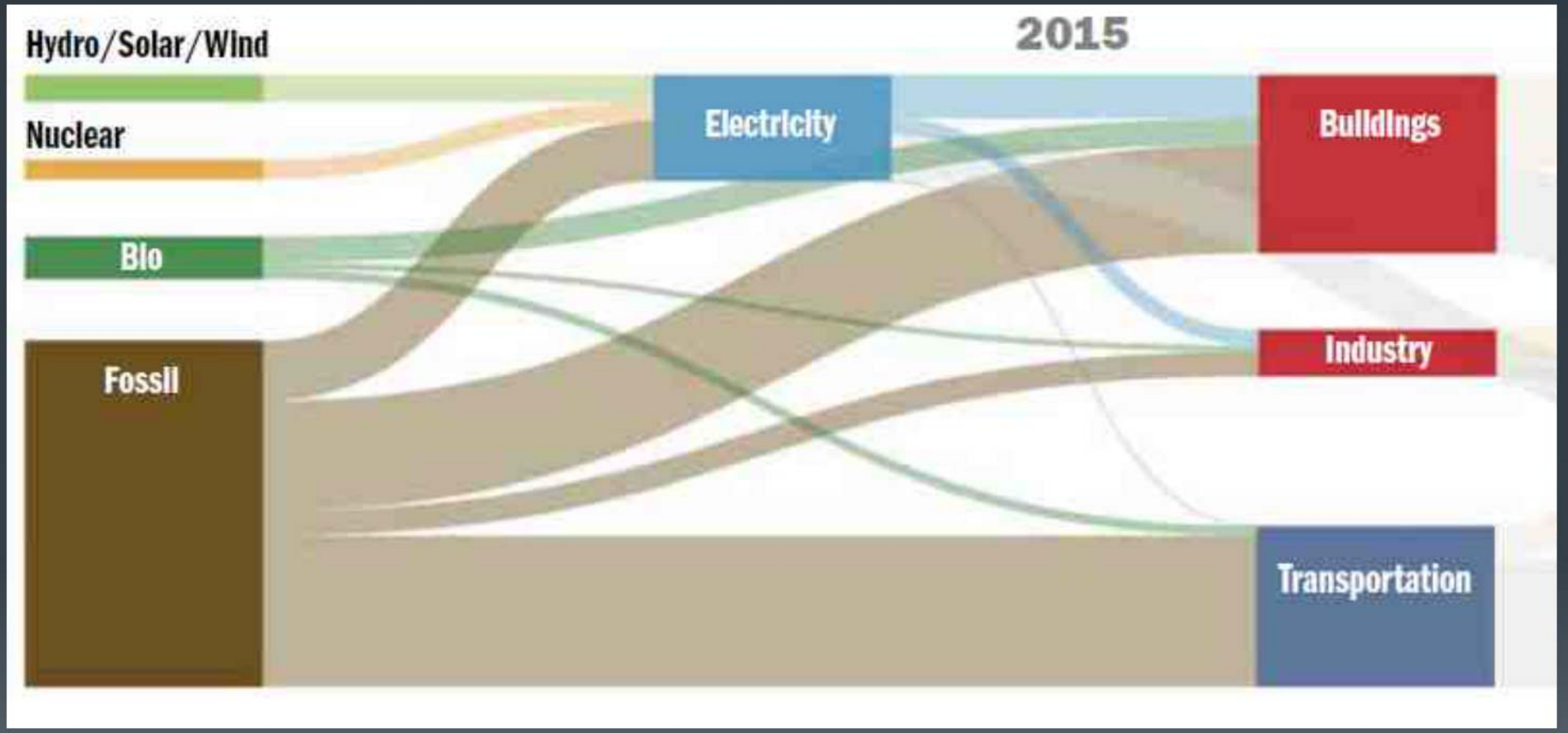
Renewable energy in Vermont



Very little of Vermont's usage comes from renewable energy generated here.

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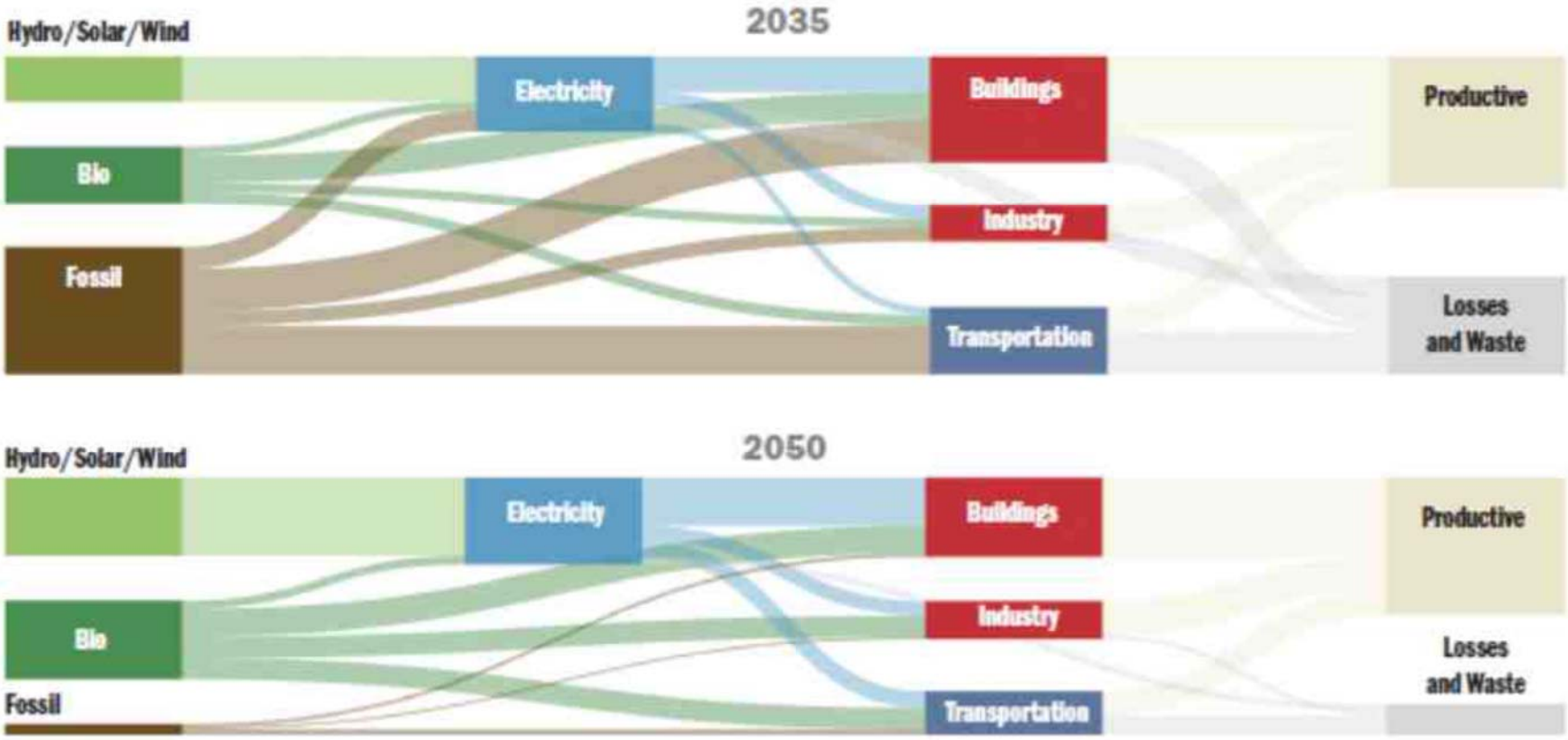

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The Nature of Policy

- Goals (intention!)
- Inquiring of a policy ("tests")
  - Maybe not score or rank policies … at least ask the question!
- Types

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Policy Goals

- Renewable standards (energy or "portfolio" requirements)
  - Develop own industries?
  - Reduce pollution? Which form?
  - Save ratepayers money?
  - Rely on own sources of energy?
  - Others?
  - *Note: having fewer goals tends to make them more achievable.*

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Another example

- Food-waste ban
  - Avoid landfill siting
  - Less expensive solid waste disposal
  - Recover nutrients, (re)build soil
  - Reduce GHG (LFG emissions, hauling)
  - Renewable energy (see previous slide…)
  - Other goals??

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Inquiring of Policy

- Is it an efficient use of public and/or ratepayer money?
- Is it adequately fair?
- Philosophy of action and intention
  - What is your theory of market behavior, including consumer behavior?
  - You are undertaking a social missionf

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Effectiveness

- Will it work??
  - Installations
  - Measurable goals achieved
  - Reasonable cost
  - Fair

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Types of policy

- What a creative world we live in!!
- Planning (SWDs, energy)
- Allowable business structures and market access rules
  - Retail choice
  - Net metering
  - Interconnection (electric and gas)

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Types of policy, 2

- Product definitions or performance standards
  - Compost or biosolids or digestate or RNG…
  - Energy usage of a device
  - Voluntary or penalties or compulsory
    - P fertilizer sales ban versus tax on P
    - EnergySTAR versus energy building code

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Types of policy, 3

- Market mechanisms
  - Feed-in tariff
  - Renewable portfolio standard or RFS or similar
    - Sometimes with carve-out and categories
  - Cap and trade
  - Taxes (carbon)

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Types of policy, 4

- Subsidies
  - NOT feed-in tariff or net metering or RPS or…
    - "incentives"? Yes… "subsidies"? No.
  - Grants, interest rate reductions, favorable taxes
    - Steven Chu story

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Policy summary

- Planning
- Allowable business structures and market access rules
- Definitions or standards
- Market-based mechanisms
- Subsidies
- …is there something else??

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Policy for biogas in the Northeast

- …New England
- Minor drivers
  - Planning
  - Subsidies (it depends how big)
- Major
  - RPS -- a starting point or prerequisite
  - Feed-in tariff
  - Food-waste landfill ban or strong food-waste supply

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	RPS	Feed-in tariff	Food-waste ban
Maine	Yes	No	No
NH	Yes	No	?
Vermont	Yes	Yes	Yes (100% by 2020)
Massachusetts	Yes	Yes, for solar	Yes
Connecticut	Yes	No	Yes
Rhode Island	Yes	Yes	Yes

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Compared to what?
(How many MW needed?)

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Food waste resource

- Quantity that will require a new home (and per capita, and how dispersed)
- Tipping fee (~ cost of collection)
- Policy notes:
  - An inverse *Field of Dreams*? Provide the baseballs, bats, and umpires, and someone will build the field.
  - Mostly, akin to an RPS.
    - Requirement increases over time.

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Food waste bans

- "Organics Disposal Bans and Processing Infrastructure," Biocycle, September 2017; Carol Jones. CT, MA, RI, VT.
- Requirement on ICI or all (VT is 100% ban)
- Population density (68, 739, 873, 1022) and income ($60,000 - $73,000) and ICI versus residential amounts.
- Tipping fees $55 – $90 (VT, MA).

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Looking for a home

CT	MA	RI	VT
500,000	900,000	200,000	40,000

- Other pathways
  - Animals (poultry, swine)
  - Composting
  - Non-compliance?
  - Source reduction?

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Parting thoughts

- Federal policy questions
  - Climate, agriculture, water quality
- Policy gets more complicated as the project gets more complicated.
  - food-waste bans
    - composting and animal feeding rules
  - digestate standards
  - nutrient extraction
  - …or simple farm-based digester
  - Consider the complexity of the deal(s).

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Plato and justice

- Think about what you're doing.
- Do what you came to the planet to do.
- Plato's Republic – what is justice?

  "There will be no end to the troubles of states until philosophers become rulers in this world, or until rulers become philosophers."
- Suggestions, fellow philosphers.

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Supplementary material

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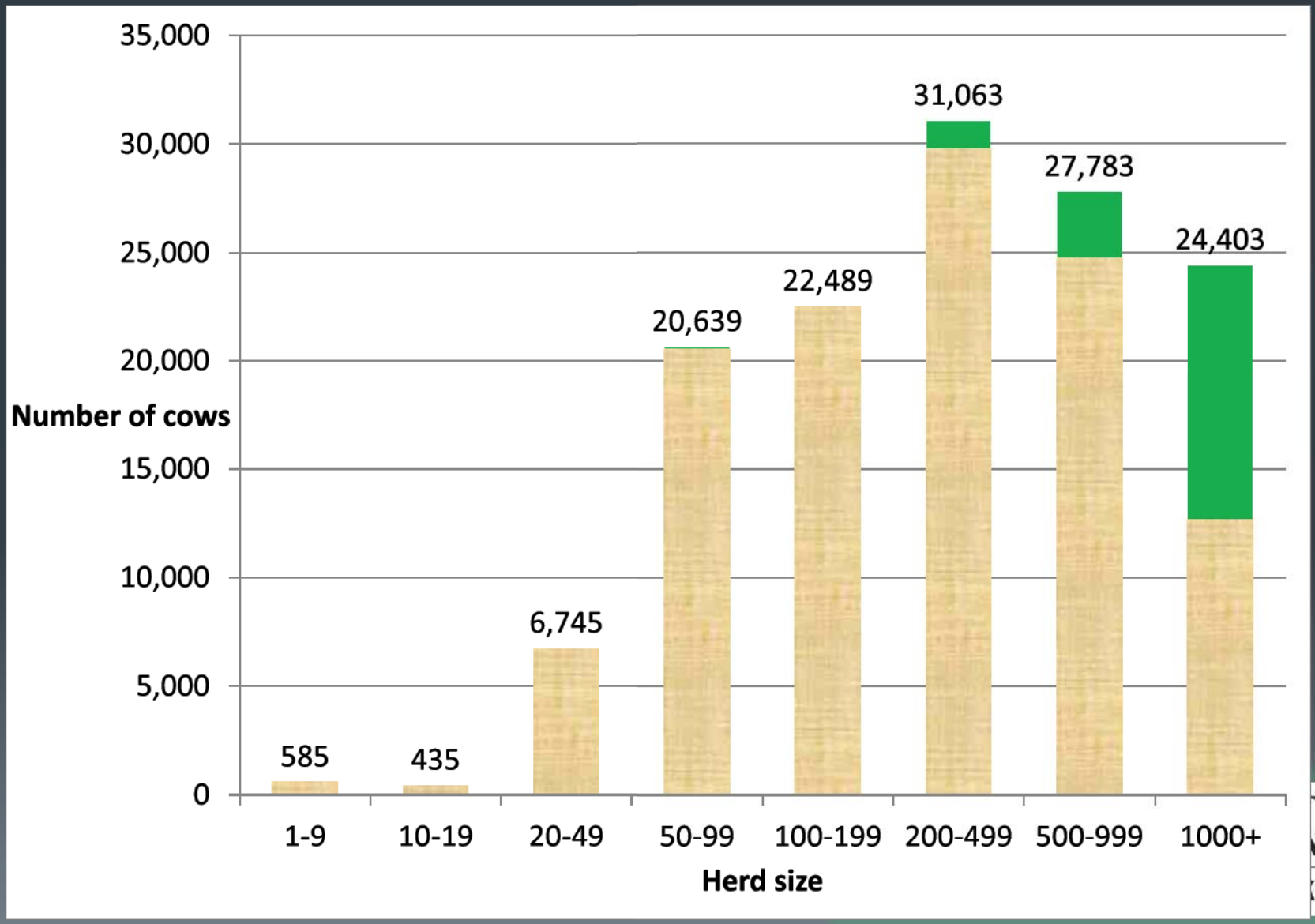
Vermont: dairy herd size (134,000) and digested manure



Vermont

- 18 systems – per capita and per cowpita leader?
  - 1 heat only (Jasper Hill)
  - 6 (including Jasper Hill) on farms with fewer than 500 cows
- A few problems – 24-7 enterprise; complex system
- "Manure digesters tend to enable practices that can improve water quality."
- Highest electricity payments in the US?
- Spurred by Green Mountain Power customers' voluntary payments

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VTC digester
Complete-mix with hydrolysis pre-treatment tank

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Water quality

- Sources of phosphorus
- TMDL
- Agricultural practices

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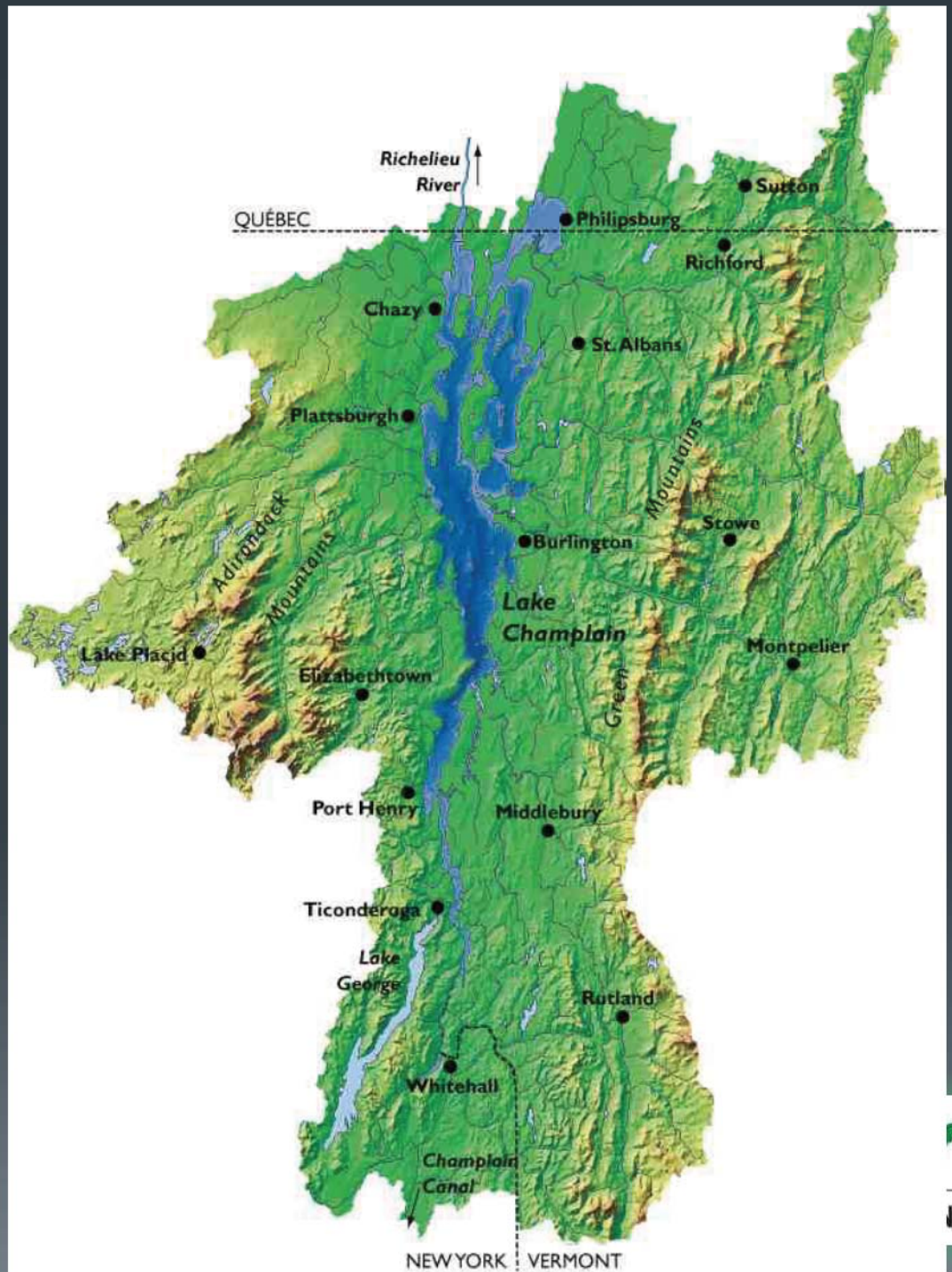

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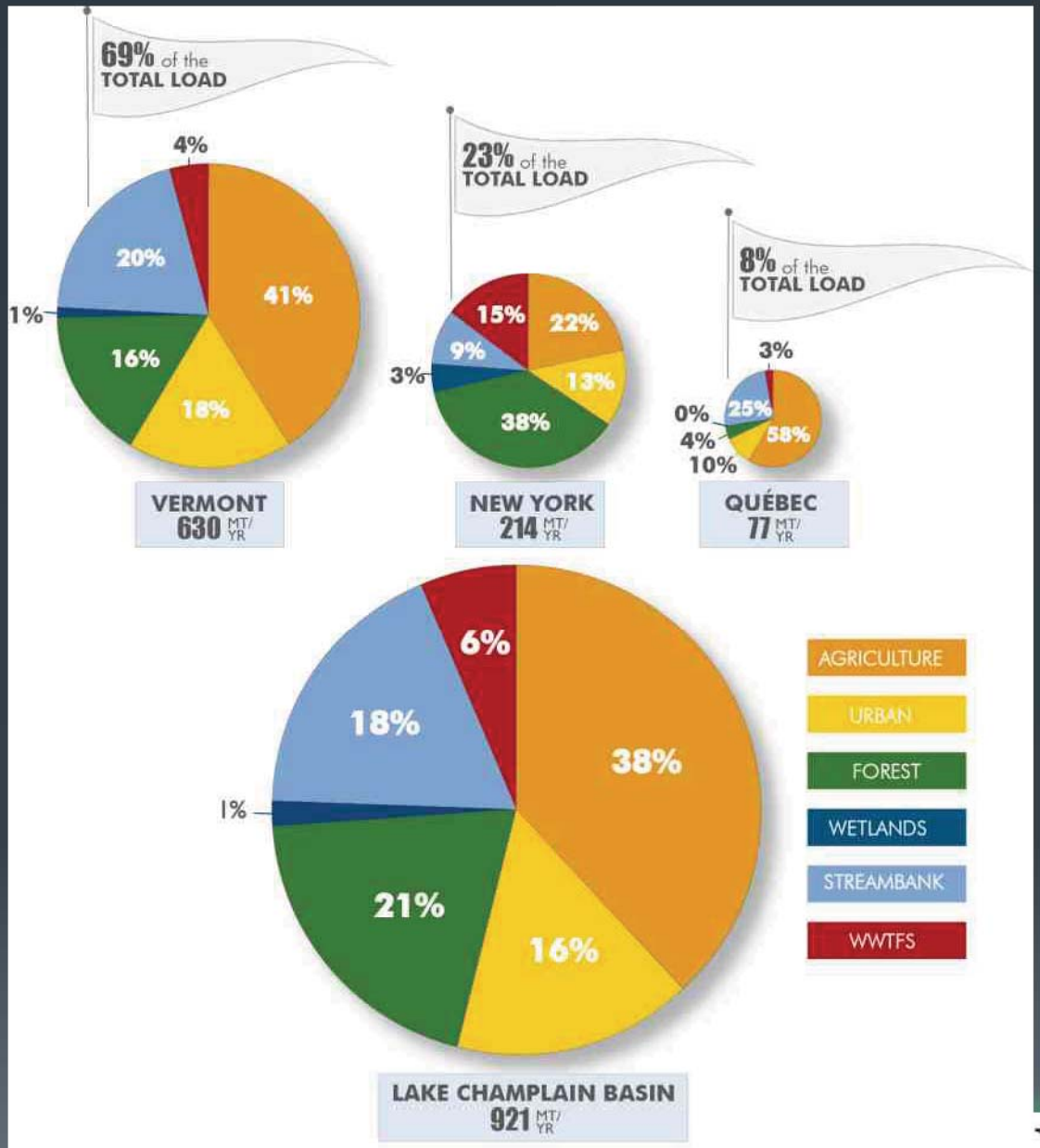

NOTE: Grass/Shrub was included in the analysis but excluded from this graphic due to the comparatively low percentage of phosphorus.
DATA SOURCE: Tetra Tech, 2015.

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TMDL

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Transport reduction

- Field practices
- NRCS payments (or not)
- RAPs (required agricultural practices – Act 64)
- The problem of attribution
  - Edge-of-field monitoring
  - Lots of modeling

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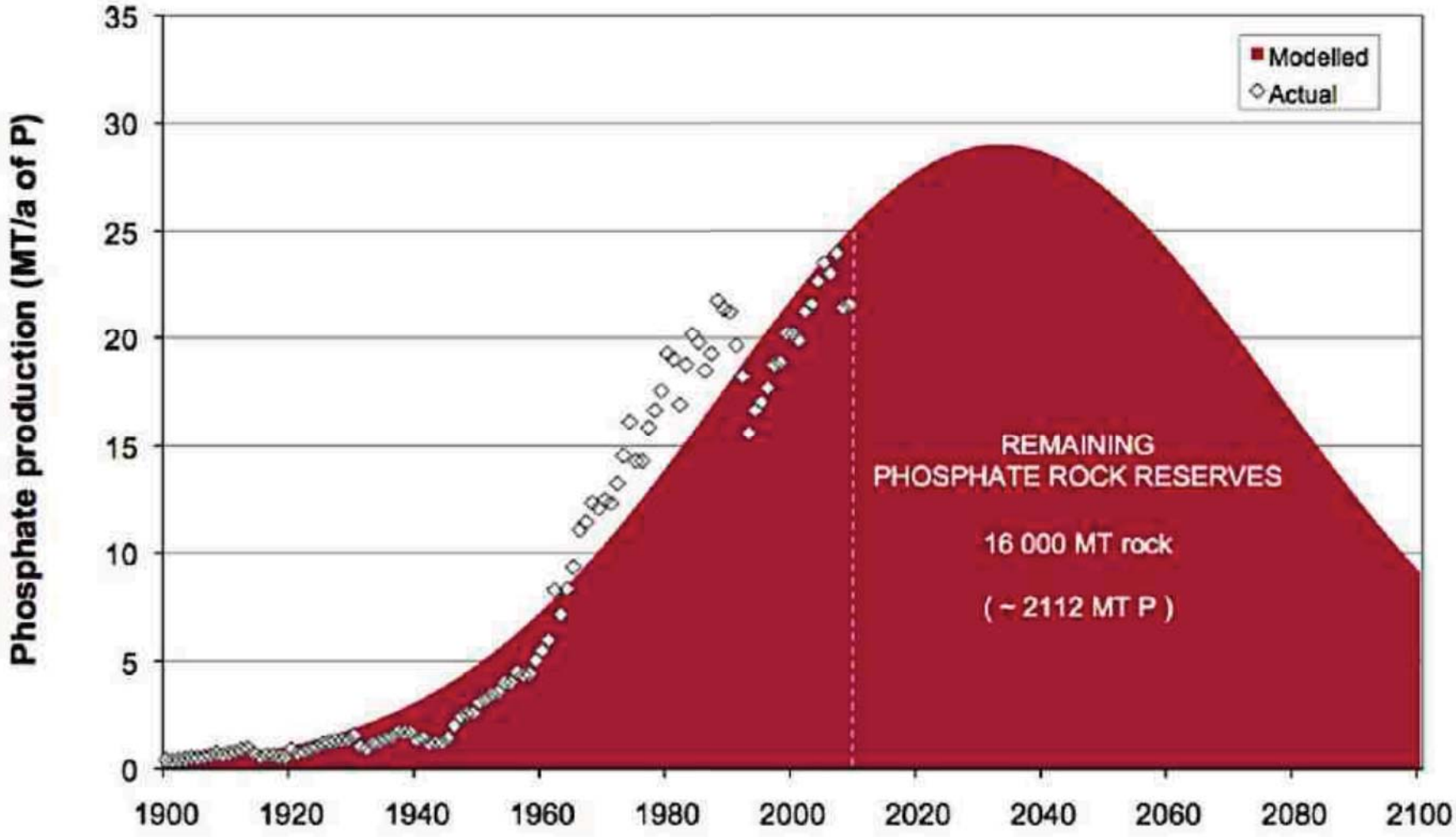

Figure 4. Graphical representation of peak phosphorus (Cordell and White, 2011).

Phosphorus extraction from manure (or other liquids)

- P clings to solids
- Extract solids from manure
  - Manure is 7-10% solids
  - Coarse solids via solids separator
- Dissolved air flotation (DAF)
- Centrifuge
- Filter-belt
- …all with or without chemicals

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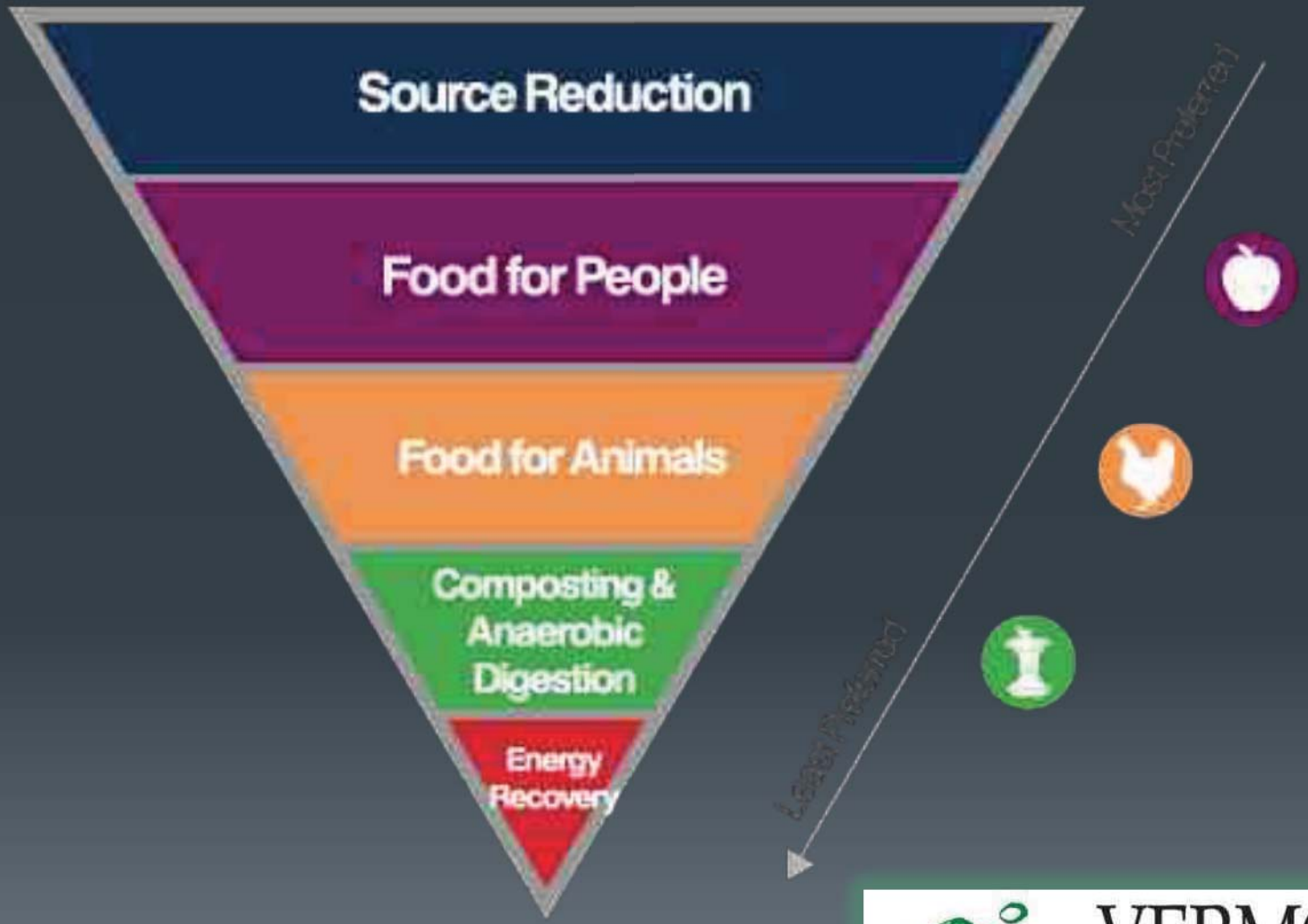
Vermont Food Recovery Hierarchy



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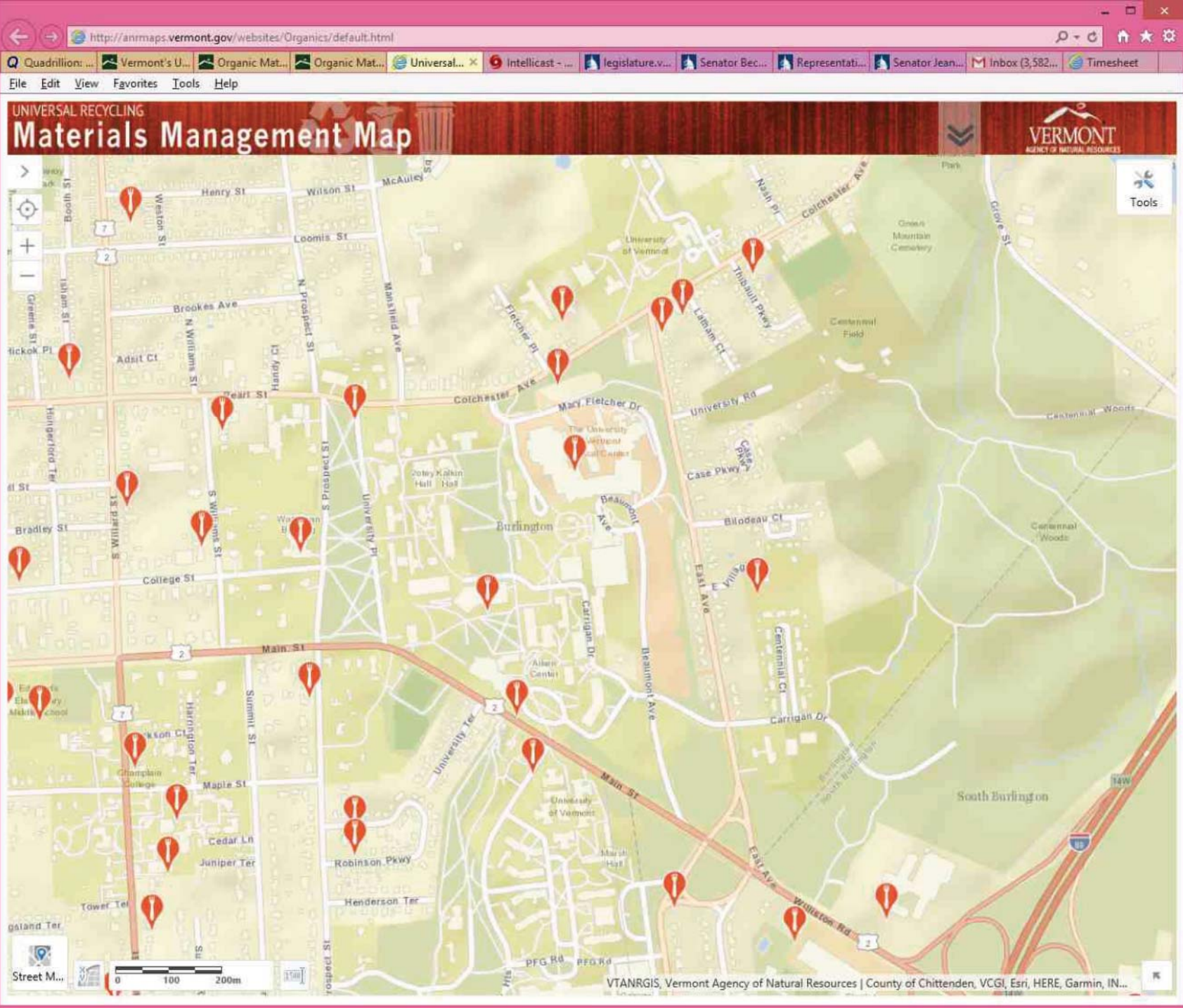
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UNIVERSAL RECYCLING
Materials Management Map
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Tools
Henry St
Wilson St
Loomis St
Brookes Ave
Adsit Ct
Pearl St
Colchester Ave
Mary Fletcher Dr
University Rd
Case Pkwy
Bilodeau Ct
Centennial Woods
Centennial Field
Green Mountain Cemetery
Bradley St
College St
Main St
Maple St
Cedar Ln
Juniper Ter
Robinson Pkwy
Henderson Ter
Carrigan Dr
Beaumont Ave
East Ave
Williston Rd
Burlington
South Burlington
University of Vermont
Champlain College
Street M...
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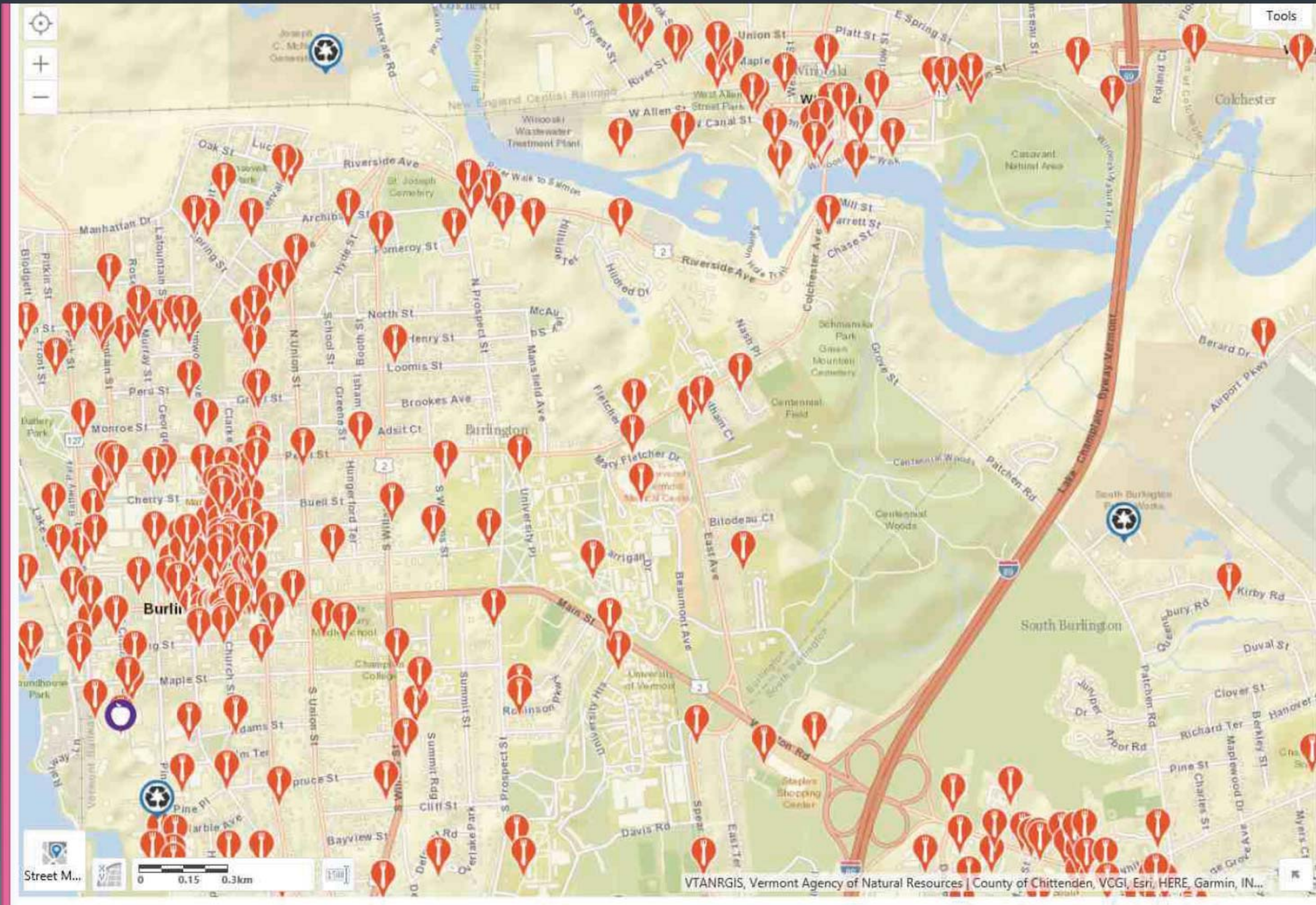
VTANRGIS, Vermont Agency of Natural Resources | County of Chittenden, VCGI, Esri, HERE, Garmin, IN...


Tools
Union St
Platt St
E Spring St
W Allen St
W Canal St
Riverside Ave
Oak St
Manhattan Dr
Archibald St
Pomeroy St
Riverside Ave
Colchester Ave
Chase St
Mill St
Colchester
Casavant Natural Area
Winooski Wastewater Treatment Plant
New England Central Railroad
St Joseph Cemetery
North St
Henry St
Loomis St
Brookes Ave
Adsit Ct
Burlington
N Prospect St
Mansfield Ave
N Union St
School St
Booth St
Hyde St
Peru St
Monroe St
Pearl St
Cherry St
Buell St
Hungerford Ter
University Pl
Mary Fletcher Dr
Bilodeau Ct
East Ave
Beaumont Ave
Patchen Rd
Berard Dr
Airport Pkwy
Kirby Rd
Duval St
Clover St
Richard Ter
Arbor Rd
Pine St
Maple St
Adams St
Spruce St
Pine Pl
Bayview St
Cliff St
Summit St
Summit Rdg
S Union St
S Prospect St
Main St
Davis Rd
Champlain College
Staples Shopping Center
Centennial Field
Centennial Woods
South Burlington
Battery Park
Street M...
0 0.15 0.3km
VTANRGIS, Vermont Agency of Natural Resources | County of Chittenden, VCGI, Esri, HERE, Garmin, IN...

Food waste

- 20,000 – 40,000 tpy will be looking for a home
- Digesters could handle it all at 10% of total existing volume.

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Digesters and Food Waste

- 18 farm digesters in Vermont
  - Low usage of pre-consumer waste ("food processing residuals") from beverage and food industry production.
  - 8 digesters use 4% of their digester capacity processing FPR.
  - 1 – 9% at individual digesters, except VTC, which is 13% from off the farm, about half of which is brewery waste and half is grease-trap waste.
  - As a percentage of capacity of the 15 digesters, the FPR is about 2%.

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Food waste going to digesters

- Two trial projects to grind solid food waste
  - Grow Compost + Vermont Technical College
  - Casella + Blue Spruce Farm
- VTC has a solid waste permit
  - Glycerin and grease-trap waste
  - Others contemplated
- Permit path will be clear and straightforward for processed (slurried) food waste going to a farm.

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Suggestions

- Good food waste brokers
  - Composters/haulers
  - Deliver qualified, tested material to digesters.
- Good solid-waste rules (duck test)
- P trading within agriculture only.
- Phosphorus removal plus drag lining, even fertigation
  - Show the farmer 70% nitrogen and 30-40% P
- Act 64 Clean Water Fund

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- Palimpsest

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