LOCAL ENERGY GOVERNANCE IN VERMONT:
AN ANALYSIS OF ENERGY SYSTEM TRANSITION STRATEGIES AND ACTOR CAPACITY

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Overview

- **Context (slides 3-14)**
  - Energy System Change in Vermont
  - Key Literature
  - Project Goals

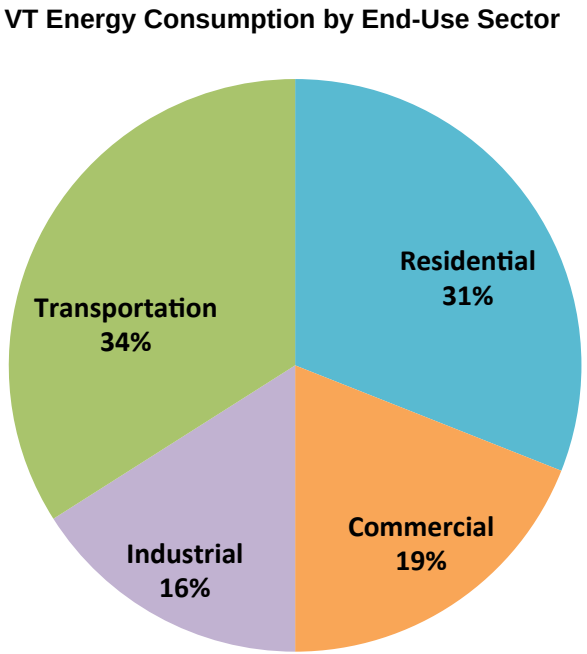
- **Energy Planning (slides 15-28)**
  - Presented at VECAN Conference Session A5: Aligning Local, Regional and State Planning to Meet Vermont's Energy Goals

- **Local Energy Organizing (slides 29-45, extras: slides 48-58)**
  - Presented at VECAN Conference Session B2: Town Energy Committees: Strategies, Stories and Tips for Success

- **Discussion (slide 46)**
  - Conclusions & Recommendations

VT Energy by the Numbers

- Total Energy Consumption Per Capita (EIA, 2011)
  - 238 million Btu
  - 11th best ranked state (least consumption)
- Electricity Generation (EIA, 2011)
  - 70% nuclear, 20% hydro, 10% renewables
  - Lowest CO2 emissions in the nation
- No. 1 in the nation for solar job creation per capita (Governor's Energy Dashboard, 2014)




Vermont Yankee

State Energy Action in VT

- Net Metering Law (1998)
- Energy Efficiency Utilities (1999)
- Clean Energy Development Fund (2005)
- Smart Grid (2009)
- Standard Offer Program (2009)
- Building Energy Standards (2011)
- Comprehensive Energy Plan (2011)
- Energy Siting Commission (2012)
- Fracking Ban (2012)
- Thermal Efficiency Task Force (2013)
- Total Energy Study (2013)

Local Energy Action in VT

- Small Business Growth
- Woodchip Heating in Schools
- Property Assessed Clean Energy
- Assessments & Planning
- Energy Education
- Electric Efficiency
- Street Lighting Campaigns
- Audits, Retrofits, & Weatherization
- Transportation Initiatives
- Group Net Metering
- Community Renewable Energy

VT Energy Actors & Initiatives

Utilities

Key Actors

Non-Profits

Businesses

Key Literature Fields

1. Sustainability Transitions
   - Multi-Level Perspective
   - Transition Management
   - Energy Transitions

   } 3 subfields

2. Energy Planning

3. Local Energy Governance

Sustainability Transitions

- Emerging field of change research
  - Systems framing
  - Socio-technical transitions
  - Actor-oriented approaches

Sustainability Transitions Research Network

- Recognizes the **long-term and multidimensional** nature of transformation **processes** which **shift our systems** to more sustainable modes of production and consumption (Markard, Raven, & Truffer, 2012)

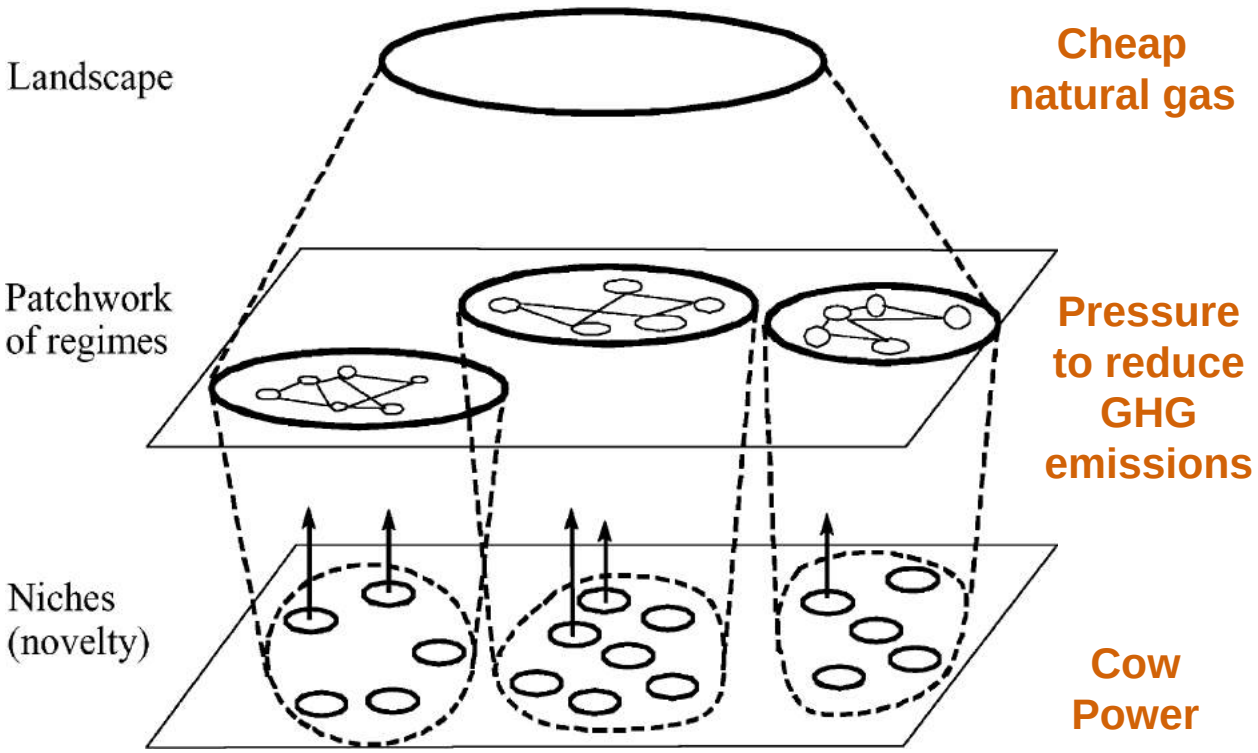
- System change can be traced to **strategic interactions of ambitious actors** (Farla, Markard, Raven, & Coenen, 2012)

Multi-Level Perspective

Macro: external factors

Meso: stability and trajectory

Micro: innovation and experimentation



The multi-level perspective nested hierarchy.
(Geels, 2002)

Transition Management Cycle

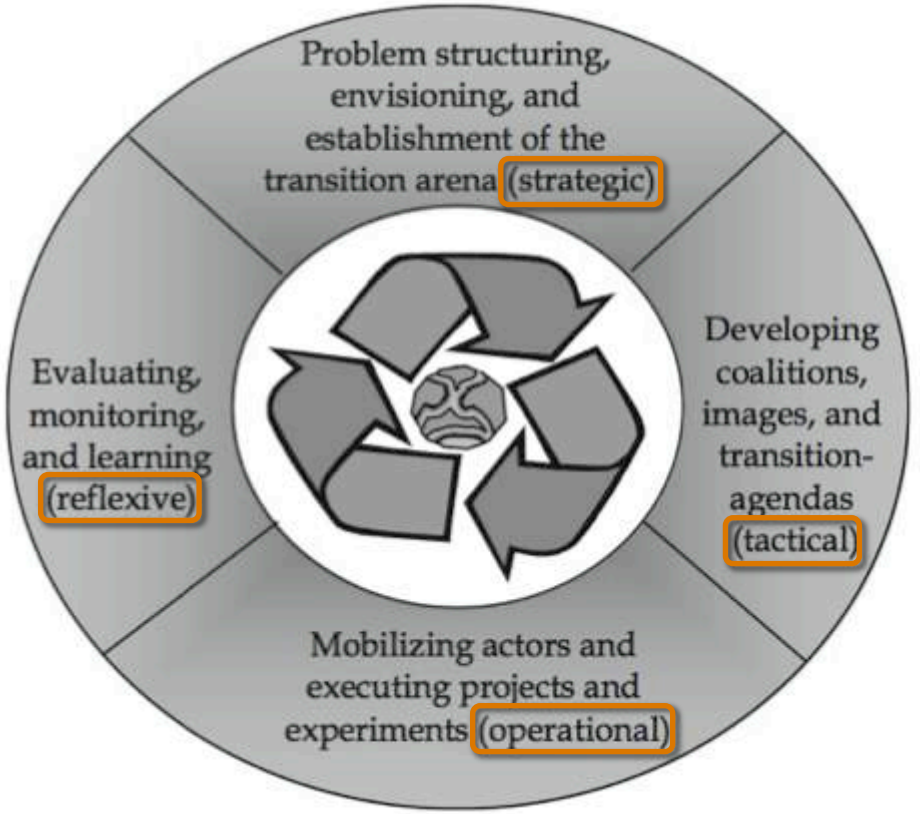
Complex systems theory and **governance**

Focus on **persistent problems**

Practice-based approach

CEP
Municipal Energy Planning

All Energy Actors



VECAN

Town Energy Committees

(Loorbach, 2010)

Energy Transitions

- Five **major challenges** (van Vuuren et al., 2012)
  - Increasing energy demand
  - Lack of energy access
  - Environmental risks
  - Energy security concerns
  - Lack of long-term policy focus

- Achievable through technological and economic terms, but faces **significant challenges of governance** (Ibid.)

- **Stakeholder engagement at multiple scales** is necessary (Sovacool, 2013)

Research Approach

Process

Inductive, applied, practical

Approach

Community Participatory Action Research

Partner

Vermont Energy and Climate Action Network

Methods

Document review, content analysis, survey, actor conversations

Johanna Miller
VECAN

Tarah Rowse
RSENR

Overarching Questions

1. What can be learned from Vermont about the **conditions for effective energy transitions**?

2. What are the **opportunities and challenges** for town energy planning and local energy organizing?

3. What are the **institutional triggers** that will facilitate a faster transition to sustainable energy systems?

4. How can **lessons learned be translated** to other states and towns?

My Studies

Identify **conditions for change**, including opportunities and challenges, within Vermont **energy system decision-making and governance at the local level**.

Study 1: Energy Planning

- Municipal energy plans
- Alignment with state energy planning

Study 2: Local Energy Organizing

- Town energy committees and coordinators
- Energy activity and actor capacity

STUDY 1: ENERGY PLANNING

Acceptable alignment? An assessment of Vermont state and municipal energy planning strategy agreement

Energy Planning Literature

Key need for energy planning:

- Energy planning by **local authorities** can **deliver energy savings and carbon reductions** (Comodi et al., 2012; Fudge & Peters, 2009)
- **Long-term vision** and **collective expectations** (Farla et al., 2012)
- Strategic and **coordinated planning** (Sperling et al., 2010)

- European focus
  - Sweden, Italy, Denmark, United Kingdom
- Recent U.S. research
  - ACEEE, California, American Indian tribes

Vermont's Energy Vision and Planning Alignment

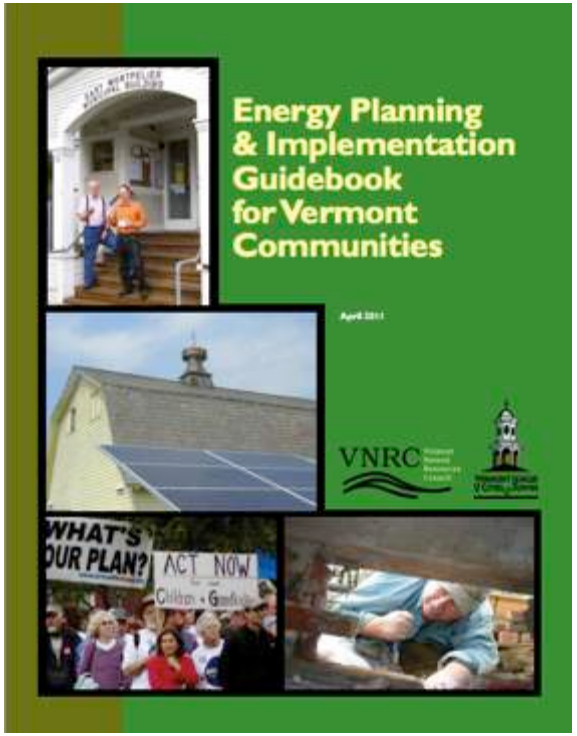
Comprehensive Energy Plan (CEP)

- Led by Planning and Energy Resources Division
  - Public Service Department
- CEP released in December 2011
  - Volume 1: Vermont's Energy Future
  - Volume 2: Facts, Analysis and Recommendations
  - Volume 3: Appendices
- Goal: 90% renewable energy by 2050
  - 23% renewable energy in 2011
- The State cannot do it alone
  - "Meaningful, robust energy plans"
  - "Best practices for town energy committees"

Leverage Points

Municipal Energy Planning in VT

- Municipal planning is on a 5 year cycle
  - Energy chapters required
- Developed by planning commissions
  - Selectboard adoption
- Energy planning resources and support
  - Vermont Energy and Climate Action Network
  - Regional Planning Commissions



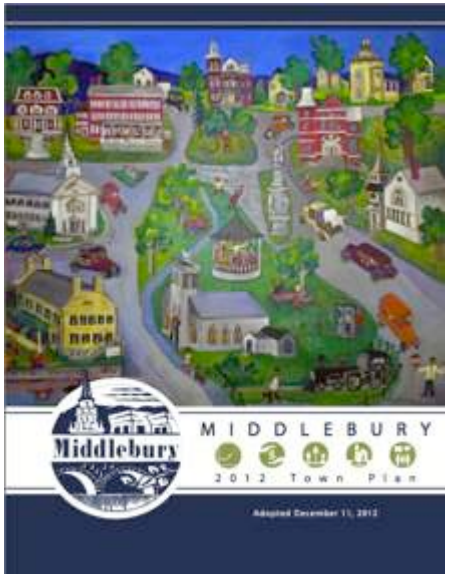
Rutland Regional Planning Commission

SWCRPC
SOUTHERN WINDSOR COUNTY
REGIONAL PLANNING COMMISSION

CHITTENDEN
COUNTY
RPC

Research Questions

- What are the high-level state strategies of Vermont's **CEP**?
- What are the strategies found in **municipal energy plans**?
- How are the municipal energy plans **aligned** with state strategy?



Methods

- Reviewed the CEP (Volume 1) to identify high-level strategies
  - Develop strategy table
- Collected municipal plans adopted between mid-2012 to mid-2013
  - Town Plan adoption database (Agency of Commerce)
- Evaluated energy chapters using coding software (HyperRESEARCH)
  - Code book mirrored the CEP strategy table
- Coded motivations and renewable energy sources

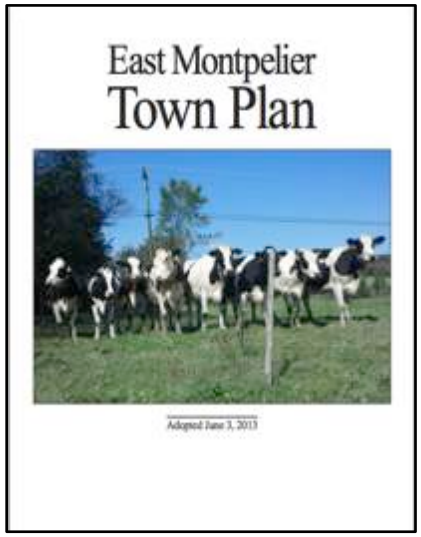
CEP Strategy Table
Goal: 90% renewable energy by 2050
Intent: "sustainable, affordable renewable energy future"

EFFICIENCY	ELECTRICITY & RENEWABLE ENERGY	THERMAL ENERGY	TRANSPORTATION & LAND USE	LEVERAGE POINTS
"efficiency first" and "a whole-building approach to all-fuels efficiency"	"continue our progress on renewable electricity" and "transition to electricity to the maximum extent possible"	"shift towards renewable sources and renewable-blended fuels for heating"	"change our transportation technology and infrastructure" and "support the growth of compact, sustainable communities"	"a systematic approach addressing all leverage points is required"
Conservation energy savings, energy reductions, behaviors **Efficiency** electric efficiency, thermal efficiency, efficient technologies **Buildings** audits, retrofits, weatherization, Energy Star, net-zero energy construction, passive design	**Smart grid** **Transmission** planning **Renewables** promote renewable energy sources **Small-scale RE** distributed small-scale generation **Community energy** district heating **Agriculture** on-farm biodiesel, solar, biodigesters, wind **Commercial** consider large projects	**Fuel-switching** displace fossil fuels, biomass deployment **Natural gas** expansion **Combined heat and power (CHP)** **Sustainable forest management**	**Vehicle programs** low and zero emission, low carbon fuels, electric vehicles, clean vehicle infrastructure **SOV alternatives** rideshare, transit, walking, biking **Rail** **Energy siting** thoughtful and responsible energy siting **Smart growth** compact development, sustainable communities, town centers	**Outreach and education** **Finance and funding** **Innovation and expertise** **Regulatory policy and structures** --- **Partnerships and coordination** 

Researcher-developed strategy table (CEP Volume 1 review)

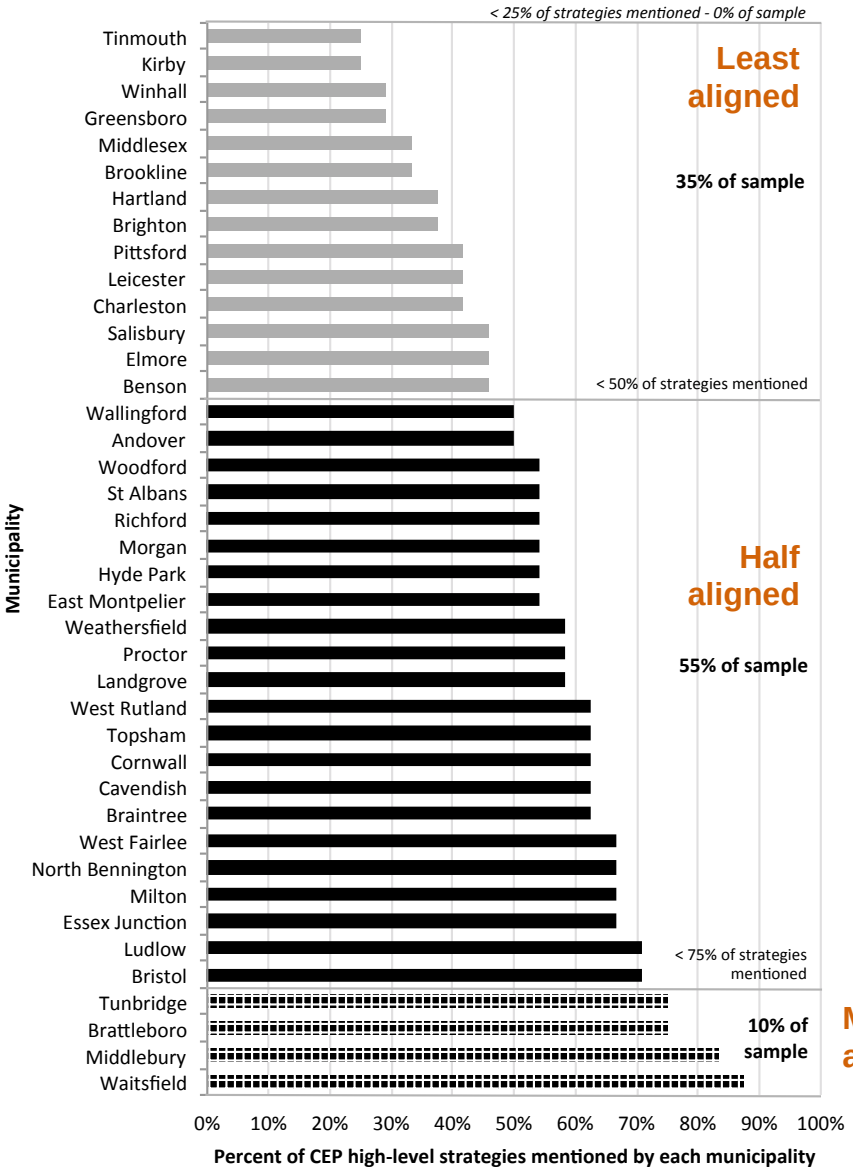
Municipalities & Energy Chapters

- 40 municipalities
- Mean population: 2,475
  - 205 (Landgrove) to 12,031 (Brattleboro)
- Mean household income: $53,515
  - $27,321(Brighton) to $78,241 (Cornwall)
- Energy chapters ranged from a few paragraphs to 20 pages

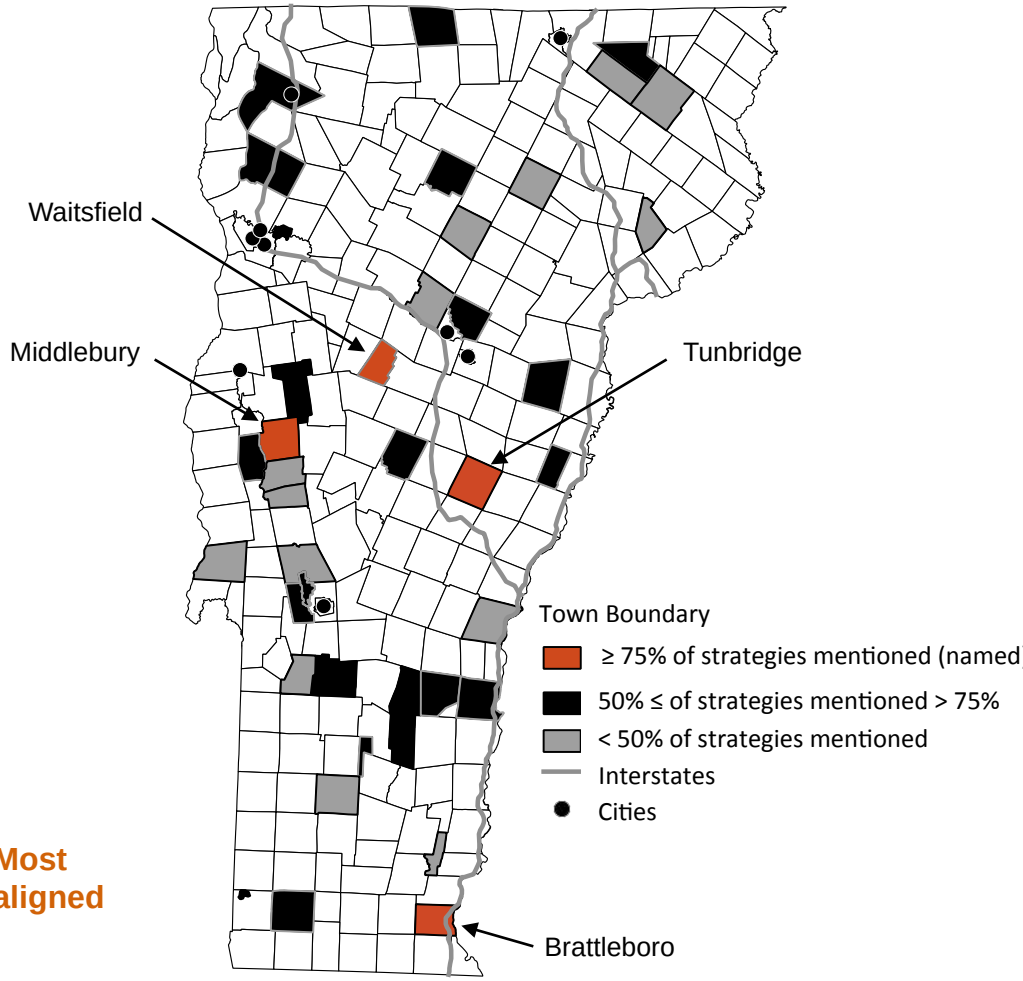


Andover
Benson
Braintree
Brattleboro
Brighton
Bristol
Brookline
Cavendish
Charleston
Cornwall
East Montpelier
Elmore
Essex Junction
Greensboro
Hartland
Hyde Park
Kirby
Landgrove
Leicester
Ludlow
Middlebury
Middlesex
Milton
Morgan
North Bennington
Pittsford
Proctor
Richford
Salisbury
St Albans
Tinmouth
Topsham
Tunbridge
Waitsfield
Wallingford
Weathersfield
West Fairlee
West Rutland
Winhall
Woodford

Overall Alignment



Mean Alignment = 54%



Alignment by Sector

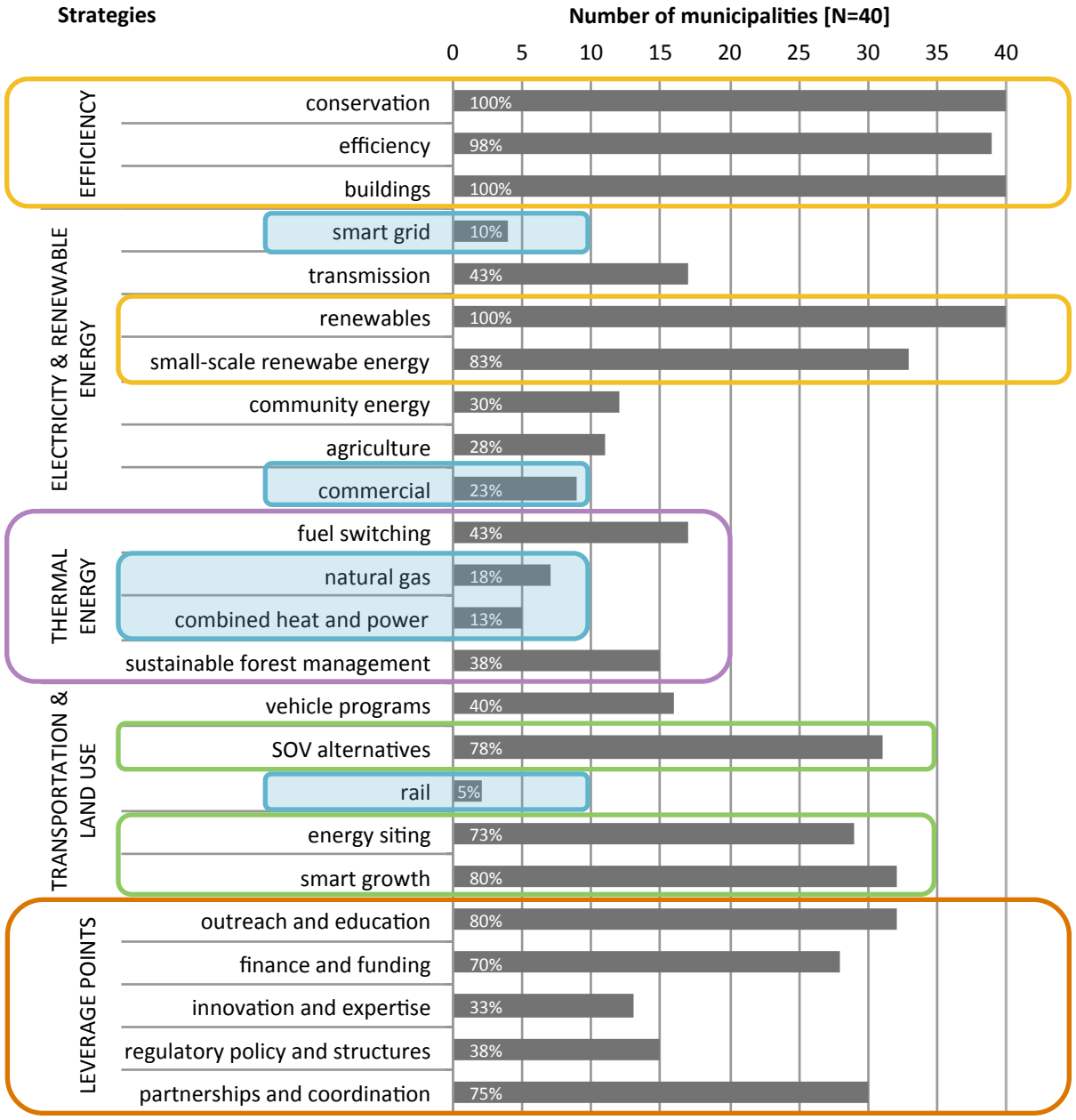
Complete alignment:
efficiency, conservation, renewables

Strong alignment:
SOV alternatives, smart growth, and siting

Weak alignment:
thermal energy sector

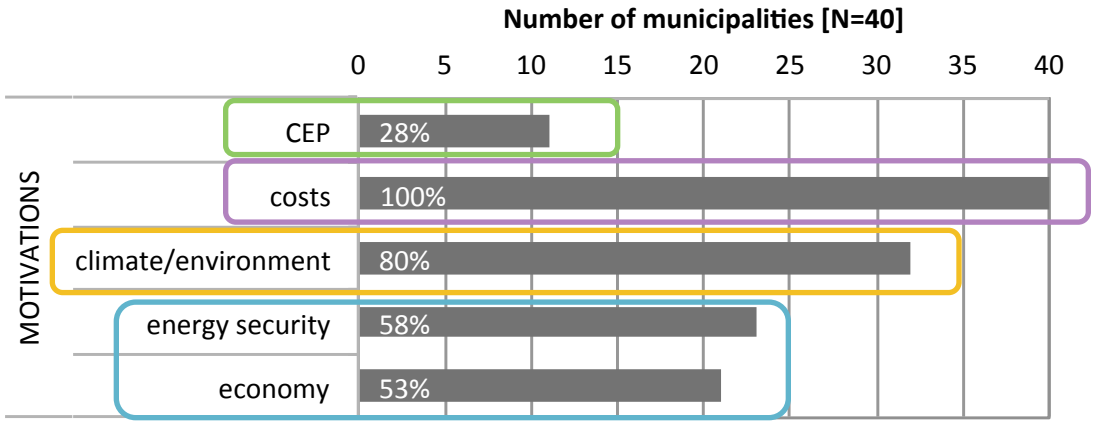
Gaps in alignment:
smart grid, commercial RE, rail services

Leverage points
EE education, PACE, committee formation, local ordinances



Motivations

*"The goal of the Vermont **CEP** is... East Montpelier shares this goal and has proposed specific actions to support it."*



Only a quarter noted the **CEP**

Decreasing **costs** and saving money are principal

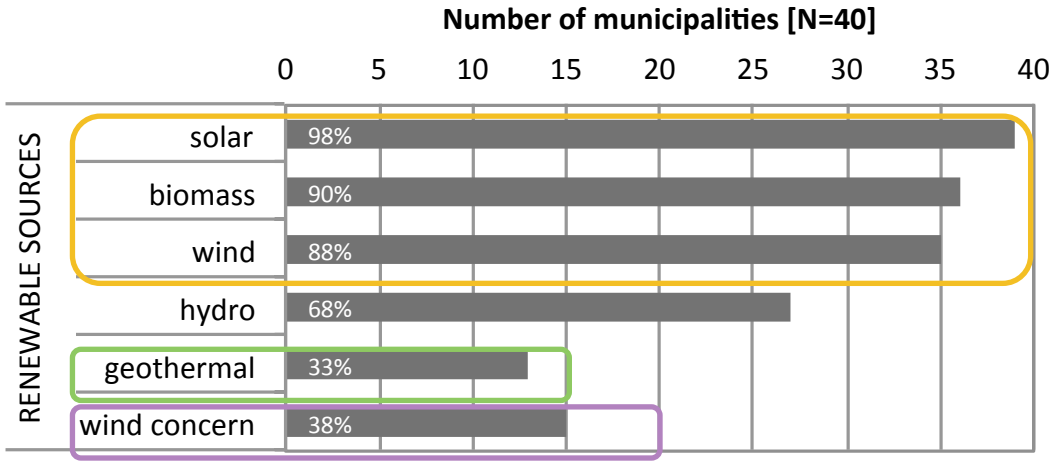
Climate/environment also central

Energy independence and **job creation** still significant

Renewable Sources

Solar, biomass, and wind most frequently considered

Low acknowledgement of **geothermal**



Commercial **wind development concern**

Apprehension to prohibition

Scenic viewsheds

Community standards

Recommendations: Multi-Level Perspective

Maintain stability in key areas at the regime level

1. Continue efficiency efforts, with more thermal
2. Alternative transportation and smart growth

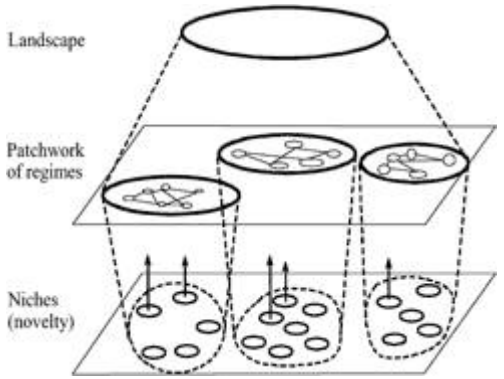
Foster increased innovation at the niche level

3. Community energy pilot program
   - Clustered experimentation
4. Electric vehicle infrastructure incentives
   - Process models and local build-out
5. Technology specific policy and incentives for less commonly considered sources
   - CHP, geothermal

State Triggers ---------- **Local Innovation**

enable

shift



Multi-Level Hierarchy

Leverage Points

Recommendations: Transition Management

Strategic

1. Targeted CEP workshops for towns: State and RPCs

Tactical

2. Siting review, policy, and conflict resolution: State

Operational

3. Residential smart meter education: Utilities and EVT
   - Community Based Social Marketing
4. Full implementation of PACE: State and EVT

Reflexive

5. Evaluation, learning, feedback between actors
   - VECAN

Transition Management Cycle

Leverage Points

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STUDY 2: LOCAL ENERGY ORGANIZING

Local energy action in Vermont:
a structural analysis of local energy actor capacity and activity

Local Energy Governance Literature

Key role of local approaches:

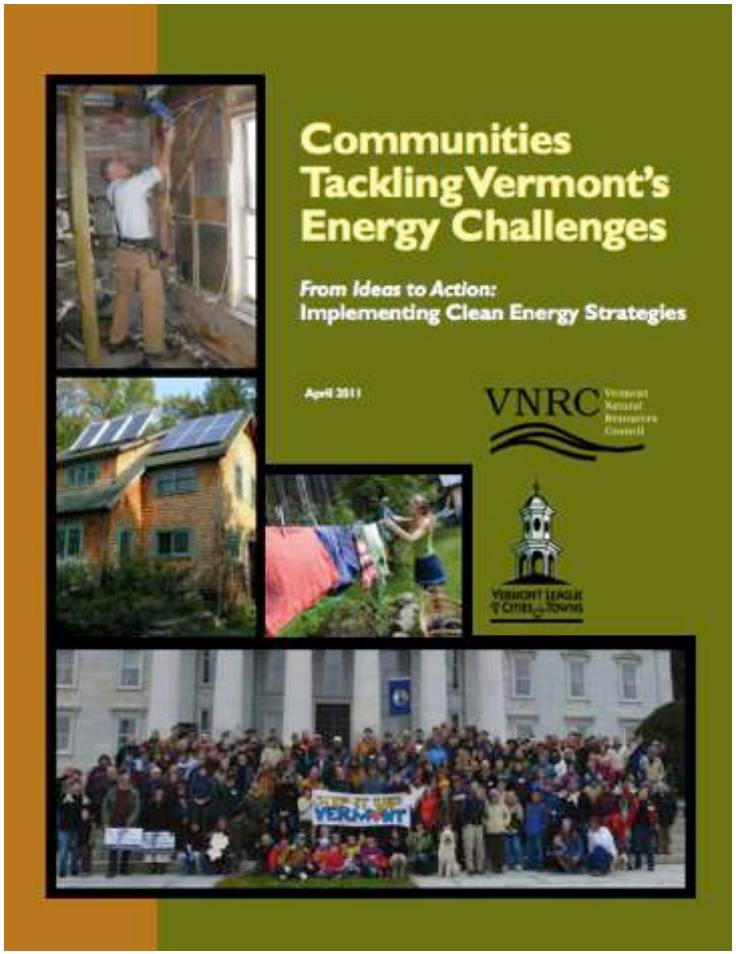
- More **resilient energy systems** (O'Brien & Hope, 2010)
- **Practical route** to addressing individual and **community energy change** (Fudge & Peters, 2009; Jefferson, 2008)
- Local involvement can build trust and understanding creating a **positive social context for energy transitions** (Walker et al., 2010)

- Research has focused on structure and impact, not capacity

- Examining capacity in relation to performance is useful for understanding systematic effectiveness (Meyer et al., 2012)

Vermont's Local Energy Activity and Capacity

Local Energy Actors

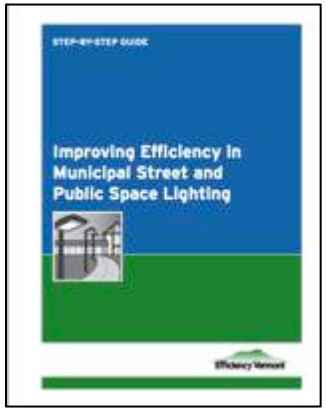


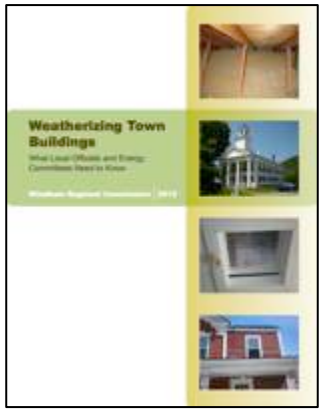
Town Energy Committees (TECs)

- Committees and coordinators
- Grassroots approach

VECAN

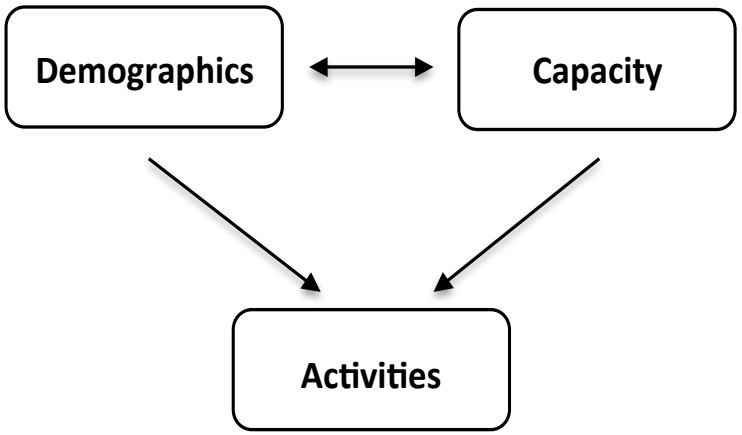
- Technical assistance and resources
- Networking and annual conference





Research Questions

- How are the **structures, processes, activities, and outcomes** of local energy actors contributing to an energy system transition in Vermont?
- What **patterns** highlight the key **opportunities and challenges** for town level energy change?
- What are the relationships between **demographics, capacity, and activities**?



Methods

- Survey of all currently active local energy actors
  - Sent from VECAN
- Descriptive statistics and analyses
- Structural analysis using chi-square testing (SPSS)
  - Dependent variables
    - Activity: existence, aggregate, and categorical
  - Independent variables
    - Demographics: income and population
    - Capacity: structure, resources, planning

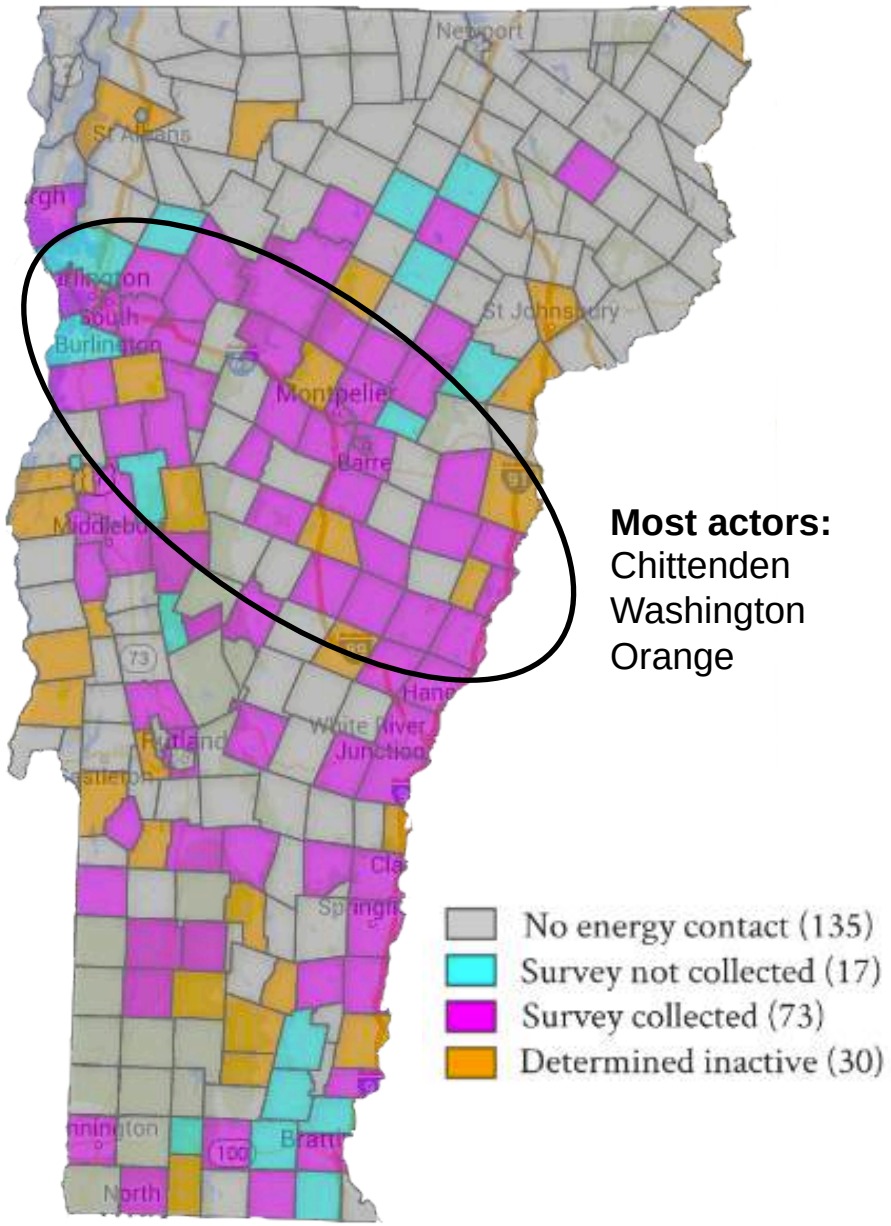
Survey Areas

History
Structure
Processes
Networks
Resources
Planning
Priorities
Activities
Outcomes
Funding
Evaluation
Strengths
Challenges
Needs

Survey Population

*I use “town” and “municipalities” interchangeably.

- 255 municipalities in Vermont
- 120 towns identified as having actors
  - 25% determined inactive
  - 80% survey response rate
- 35% of VT towns have currently active energy actors

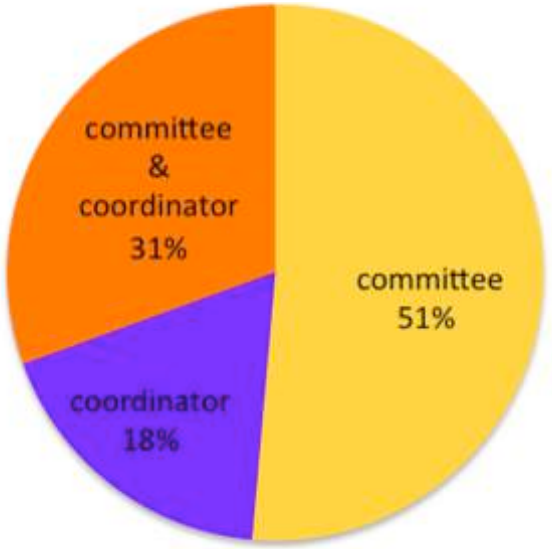


Most actors:
Chittenden
Washington
Orange

Local Energy Actors

- 66% of committees are municipal
- Volunteer-based and unpaid
- No budget (75%) or very small (25%)
  - Ranged from $50 to $8,000
- Commit only a few hours a month

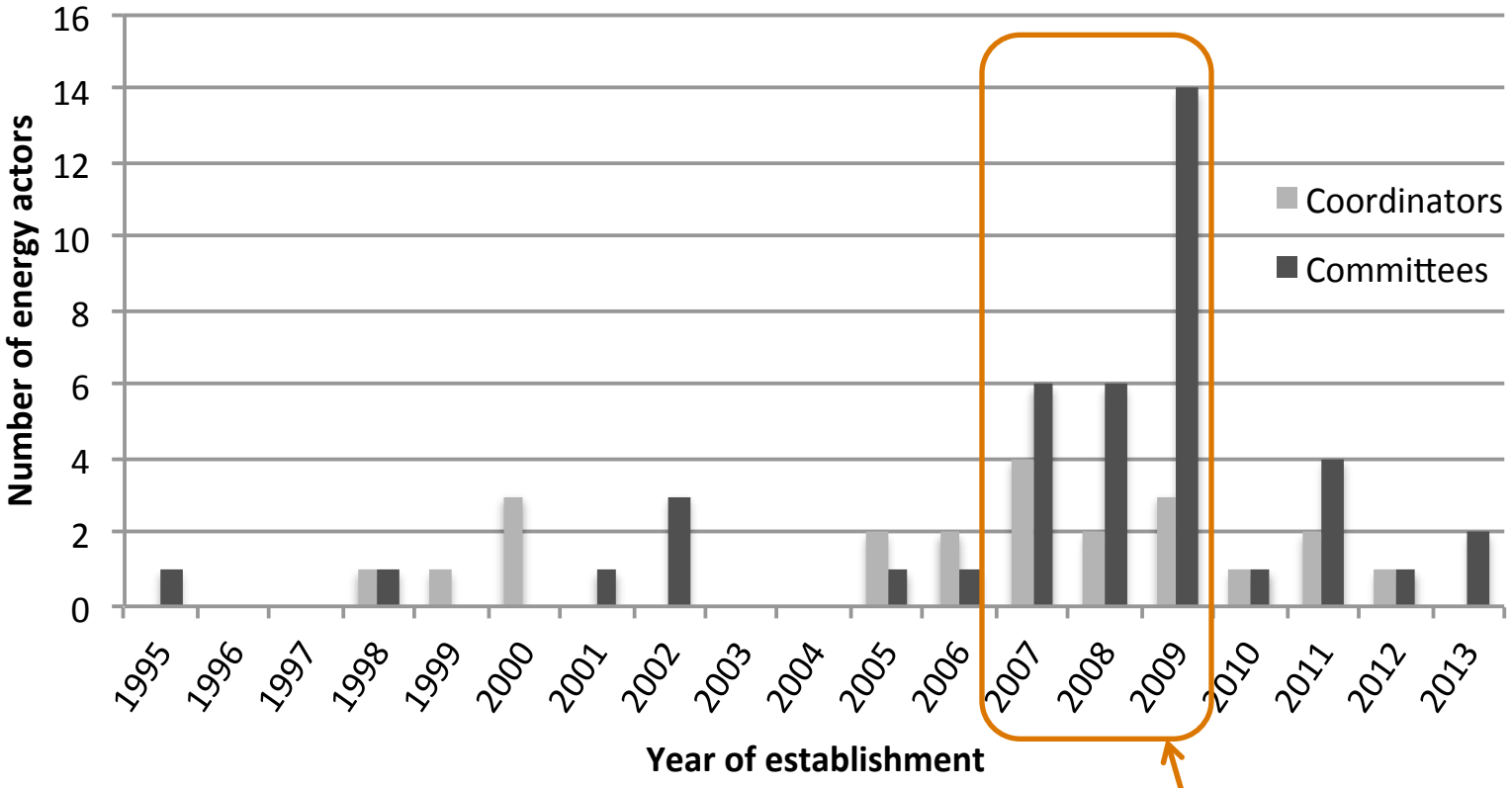
Energy Actor Set-up



Londonderry and Peru Energy Committees

Actor Establishment

VECAN established in 2005
Economic recession in 2008

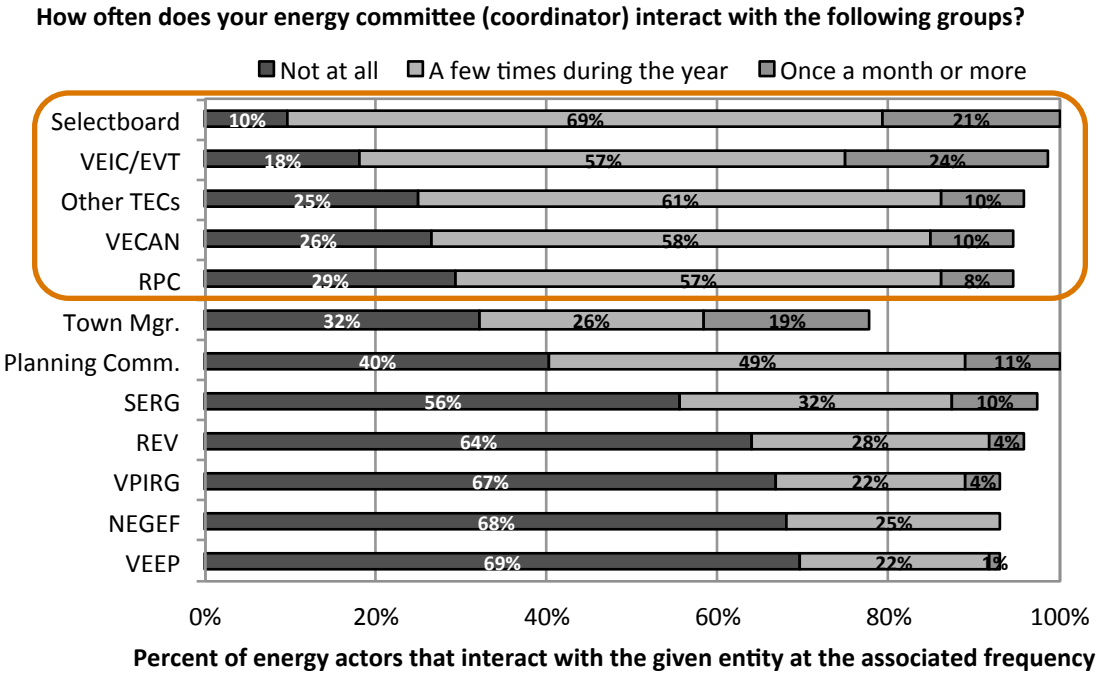


Greatest period of growth: 2007-2009
26 committees and 9 coordinators

Characteristics

- Energy interested towns
- Energy knowledgeable
- Versatile communicators
- Low volunteer engagement
- Moderate network interactions

Interactions



Planning

Survey Responses

Planning Element	Yes	No
Baseline energy assessment	58%	42%
Energy section (in municipal plan)	84%	16%
Energy plan (separate from municipal plan)	14%	86%
Specific energy reduction goals	32%	68%
Specific carbon neutrality goals	11%	89%
Evaluation	34%	66%

Goals

Cavendish: Replace all municipal street lights

Brattleboro: Increase local renewable electric generation to 10% of total electric consumption by 2030

Montpelier: First carbon neutral state capital

Waterbury: Greenest town in Vermont by 2020

Strengths

Aptitude (58%)
- Knowledge, skills, abilities

Commitment (47%)
- Passion and dedication

Relationships (30%)
- Cooperative connections

Challenges

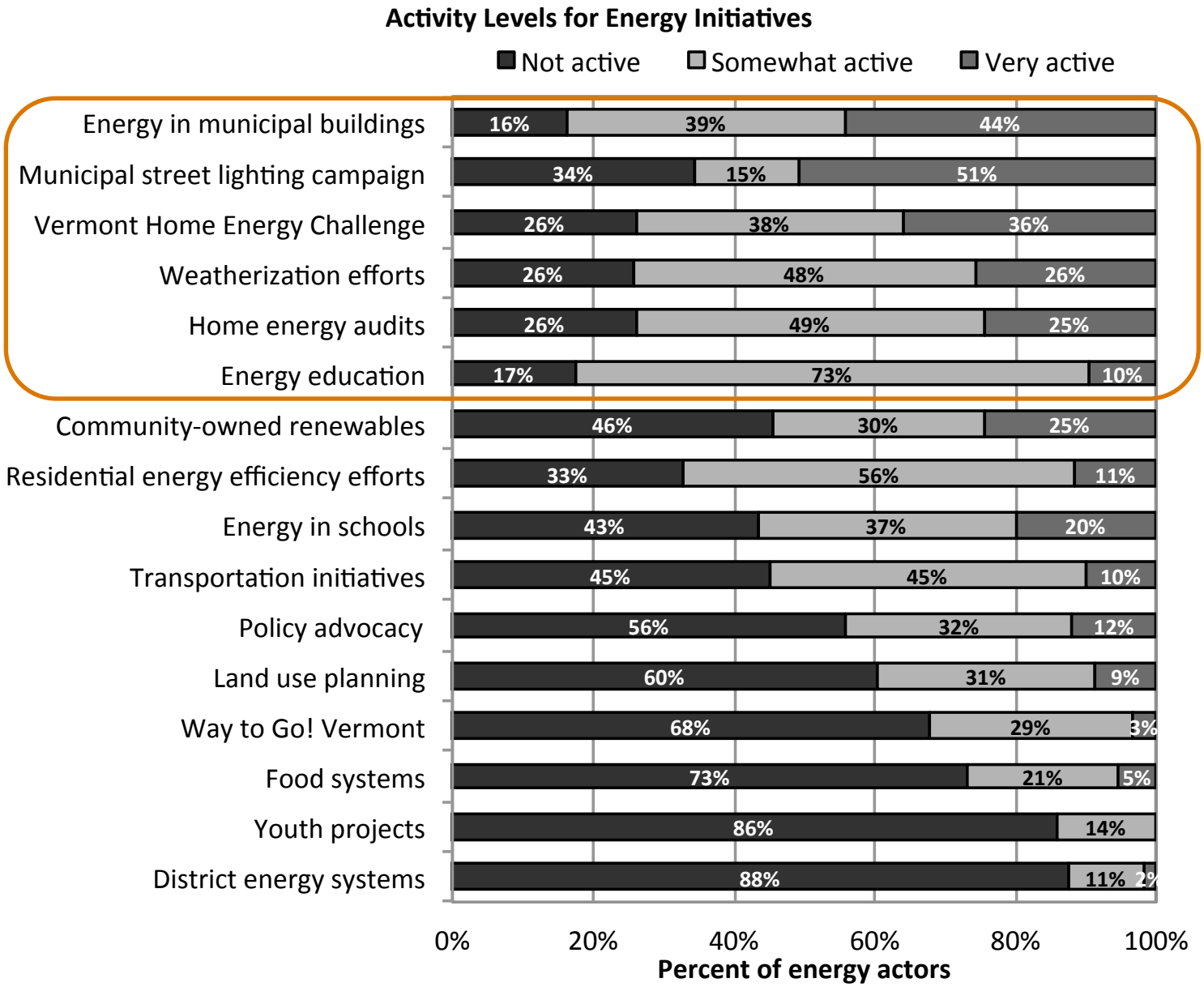
Time (41%)
- People-hours

Money (31%)
- Funding, budget, incentives

Apathy (27%)
- Community indifference

Support (14%)
- Town or citizen

Activity


Activity Levels for Energy Initiatives
Not active
Somewhat active
Very active
Energy in municipal buildings
16%
39%
44%
Municipal street lighting campaign
34%
15%
51%
Vermont Home Energy Challenge
26%
38%
36%
Weatherization efforts
26%
48%
26%
Home energy audits
26%
49%
25%
Energy education
17%
73%
10%
Community-owned renewables
46%
30%
25%
Residential energy efficiency efforts
33%
56%
11%
Energy in schools
43%
37%
20%
Transportation initiatives
45%
45%
10%
Policy advocacy
56%
32%
12%
Land use planning
60%
31%
9%
Way to Go! Vermont
68%
29%
3%
Food systems
73%
21%
5%
Youth projects
86%
14%
District energy systems
88%
11%
2%
0%
20%
40%
60%
80%
100%
Percent of energy actors

Structural Analysis

Demographic Associations

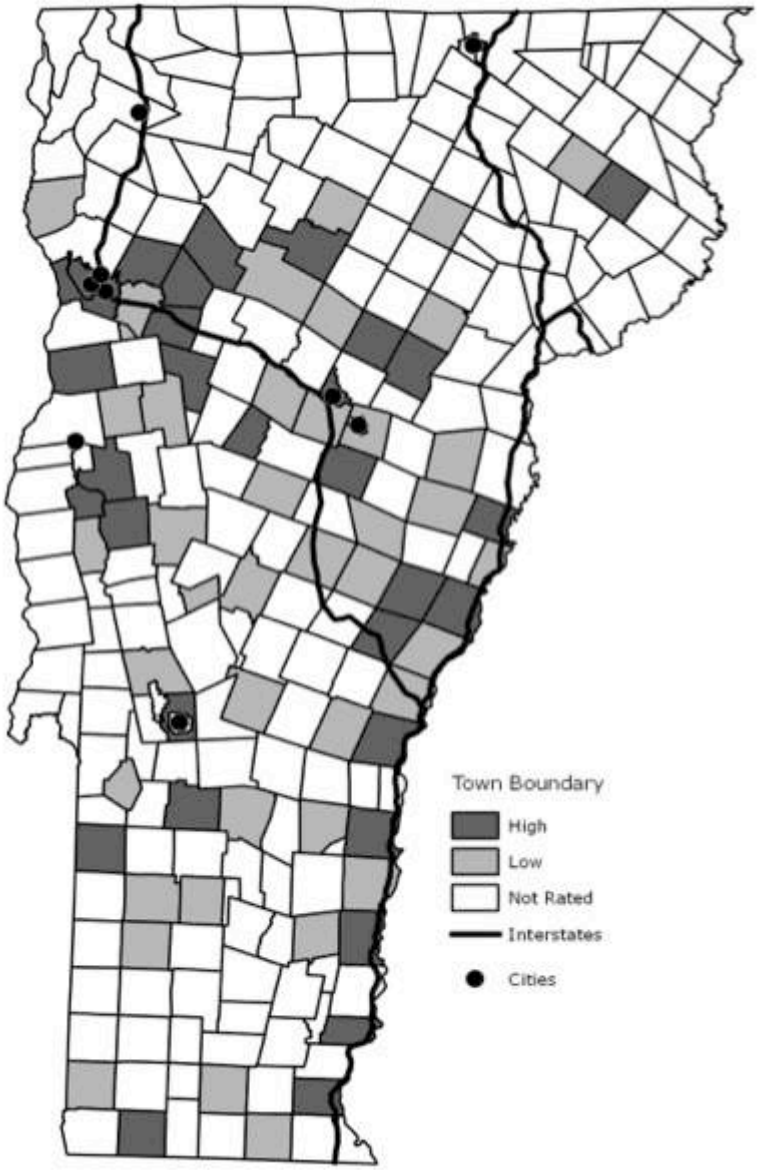
Actor presence aligns with population centers

Higher population and income towns are more likely to have actors

Higher population towns show higher aggregate activity

Higher income towns more likely to undertake weatherization

Low and high activity energy actors



Structural Analysis

Aggregate Activity Associations

1. **Actor Set-up**
   - Cmte & Coord
2. **Organization**
   - Municipal
3. **Budget**
   - Having one!
4. **Volunteers**
   - More

P-values for Pearson chi-square testing of variable pairs. Significant results (p-values ≤ .05) are shaded.

			Activity (categorical)															
		Activity (aggregate)	Education	Street lighting	VHEC	Efficiency	Weatherization	Audits	Municipal buildings	Schools	Policy	Way to Go!	Transportation	Community renewables	District energy	Food	Youth	Land use
Demographic	Income	0.20	0.55	0.85	0.09	0.94	0.02	0.26	0.32	0.88	0.96	0.34	0.14	0.87	0.19	0.64	0.38	0.70
	Population	0.01	0.70	0.07	0.51	0.53	0.56	0.94	0.60	0.77	0.06	0.06	0.11	0.37	0.16	0.98	0.83	0.96
Structure	Actor Set-up	0.01	0.06	0.44	0.03	0.15	0.00	0.00	0.96	0.90	0.48	0.09	0.34	0.25	0.88	0.98	0.26	0.76
	Organization*	0.03	0.89	0.20	0.35	0.34	0.66	0.69	0.03	0.06	0.49	0.21	0.25	0.46	0.92	0.69	0.05	0.87
	Local Officials*	0.75	0.90	0.61	0.24	0.63	0.91	0.86	0.96	0.75	0.82	0.82	0.92	0.18	0.92	0.48	0.58	0.11
Resources	Budget	0.00	0.21	0.12	0.90	0.22	0.16	0.19	0.05	0.20	0.15	0.17	0.04	0.04	0.19	0.29	0.90	0.59
	Time*	0.22	0.83	0.51	0.48	0.33	0.07	0.32	0.78	0.38	0.27	0.91	0.38	0.12	0.41	0.06	0.73	0.96
	Interest	0.18	0.77	0.10	0.82	0.03	0.34	0.11	0.16	0.97	0.18	0.74	0.10	0.05	0.12	0.73	0.90	0.33
	Knowledge	0.08	0.17	0.20	0.02	0.04	0.29	0.02	0.12	0.35	0.01	0.36	0.01	0.03	0.37	0.63	0.15	0.46
	Volunteers	0.01	0.38	0.77	0.19	0.34	0.17	0.09	0.28	0.69	0.07	0.73	0.09	0.22	0.26	0.47	0.20	0.43
	Network	0.66	0.64	0.28	0.76	0.95	0.38	0.36	0.75	0.62	0.34	0.89	0.77	0.53	0.04	0.82	0.91	0.86
Planning	Baseline	0.57	0.31	0.21	0.29	0.11	0.81	0.77	0.32	0.11	0.03	0.58	0.26	0.27	0.15	0.60	0.77	0.02
	Plan	0.91	0.82	0.40	0.77	0.84	0.65	0.62	0.55	0.82	0.01	0.10	0.30	0.13	0.00	0.63	0.46	0.98
	Goals	0.13	0.62	0.14	0.44	0.89	0.05	0.54	0.47	0.11	0.00	0.01	0.00	0.17	0.37	0.03	0.55	0.10
	Evaluation	0.93	0.05	0.40	0.27	0.09	0.10	0.27	0.88	0.35	0.49	0.22	0.19	0.19	0.70	0.12	0.04	0.39

Structural Analysis

Categorical Activity Associations

Knowledge

- Technical, complex, broader

Planning

- Strategic, long-term, comprehensive

P-values for Pearson chi-square testing of variable pairs. Significant results (p-values ≤ .05) are shaded.

		Activity (aggregate)	Activity (categorical): Education	Street lighting	VHEC	Efficiency	Weatherization	Audits	Municipal buildings	Schools	Policy	Way to Go!	Transportation	Community renewables	District energy	Food	Youth	Land use
Demographic	Income	0.20	0.55	0.85	0.09	0.94	0.02	0.26	0.32	0.88	0.96	0.34	0.14	0.87	0.19	0.64	0.38	0.70
	Population	0.01	0.70	0.07	0.51	0.53	0.56	0.94	0.60	0.77	0.06	0.06	0.11	0.37	0.16	0.98	0.83	0.96
Structure	Actor Set-up	0.01	0.06	0.44	0.03	0.15	0.00	0.00	0.96	0.90	0.48	0.09	0.34	0.25	0.88	0.98	0.26	0.76
	Organization*	0.03	0.89	0.20	0.35	0.34	0.66	0.69	0.03	0.06	0.49	0.21	0.25	0.46	0.92	0.69	0.05	0.87
	Local Officials*	0.75	0.90	0.61	0.24	0.63	0.91	0.86	0.96	0.75	0.82	0.82	0.92	0.18	0.92	0.48	0.58	0.11
Resources	Budget	0.00	0.21	0.12	0.90	0.22	0.16	0.19	0.05	0.20	0.15	0.17	0.04	0.04	0.19	0.29	0.90	0.59
	Time*	0.22	0.83	0.51	0.48	0.33	0.07	0.32	0.78	0.38	0.27	0.91	0.38	0.12	0.41	0.06	0.73	0.96
	Interest	0.18	0.77	0.10	0.82	0.03	0.34	0.11	0.16	0.97	0.18	0.74	0.10	0.05	0.12	0.73	0.90	0.33
	Knowledge	0.08	0.17	0.20	0.02	0.04	0.29	0.02	0.12	0.35	0.01	0.36	0.01	0.03	0.37	0.63	0.15	0.46
	Volunteers	0.01	0.38	0.77	0.19	0.34	0.17	0.09	0.28	0.69	0.07	0.73	0.09	0.22	0.26	0.47	0.20	0.43
	Network	0.66	0.64	0.28	0.76	0.95	0.38	0.36	0.75	0.62	0.34	0.89	0.77	0.53	0.04	0.82	0.91	0.86
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	Plan	0.91	0.82	0.40	0.77	0.84	0.65	0.62	0.55	0.82	0.01	0.10	0.30	0.13	0.00	0.63	0.46	0.98
	Goals	0.13	0.62	0.14	0.44	0.89	0.05	0.54	0.47	0.11	0.00	0.01	0.00	0.17	0.37	0.03	0.55	0.10
	Evaluation	0.93	0.05	0.40	0.27	0.09	0.10	0.27	0.88	0.35	0.49	0.22	0.19	0.19	0.70	0.12	0.04	0.39

Key Conclusions & Recommendations

Dedicated actors, limited capacity

- Lack of time and money
- 25% of energy actors inactive
- How are energy actors sustained?

1. Formalize energy coordination

- Committee and coordinator set-ups
- Innovative non-profit arrangements
- Dedicated staff and secure funds

2. Increase robustness of network

- Formal membership arrangements (fees)
- Concrete commitments and milestones
- Assistance, resources, and monitoring

Johanna Miller and Keil Corey, VECAN

Conclusions & Recommendations

Multi-Level Perspectives

- State planning and policy provides scaffolding for local work
- Foster niche experimentation
  - Policy triggers and financial incentives in strategic areas
  - Stronger links and learning between actors and projects

Community Engagement

- Enhance broader citizen participation through approach
  - Increase the focus on symbolic resources and public values (over costs)
  - Emphasize synergistic goals, multiple objectives, co-benefits

Capacity

- Formalize energy coordination and network
- Prioritize activities
  - Energy sustainability indicators and monitoring tools

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Thank you Quinn.

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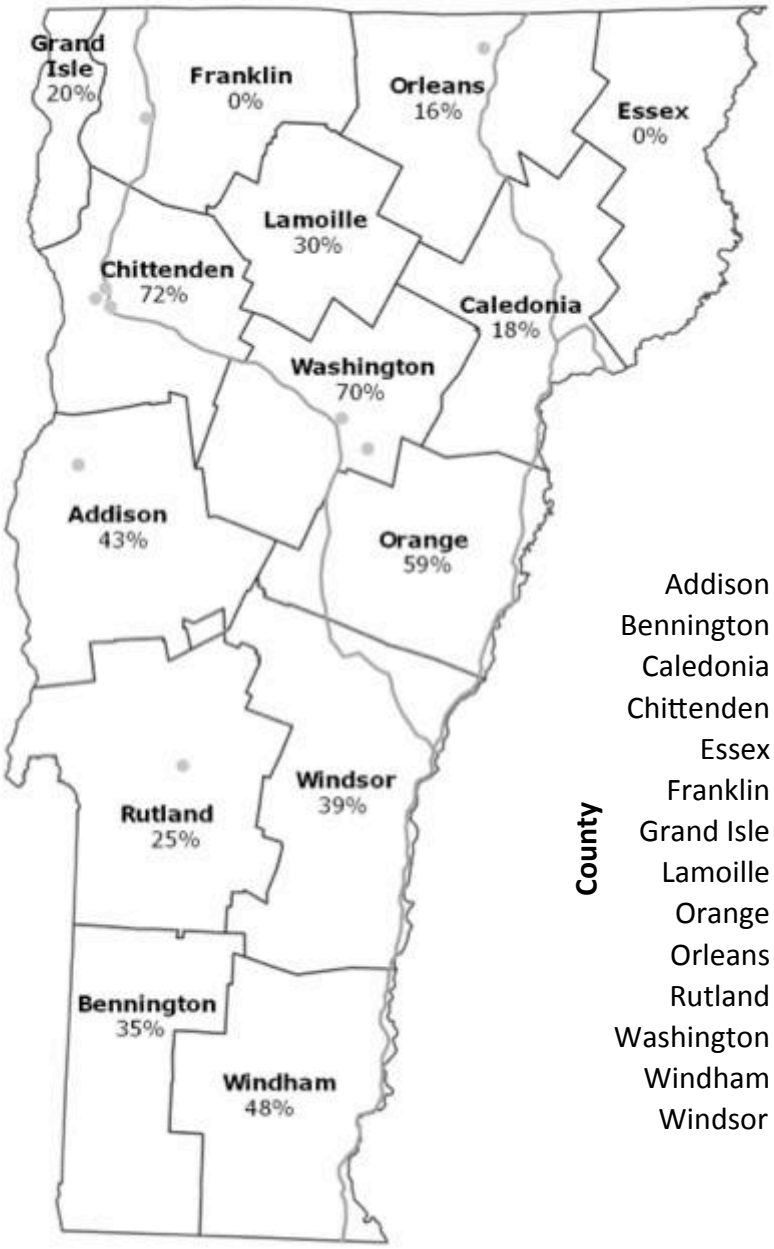
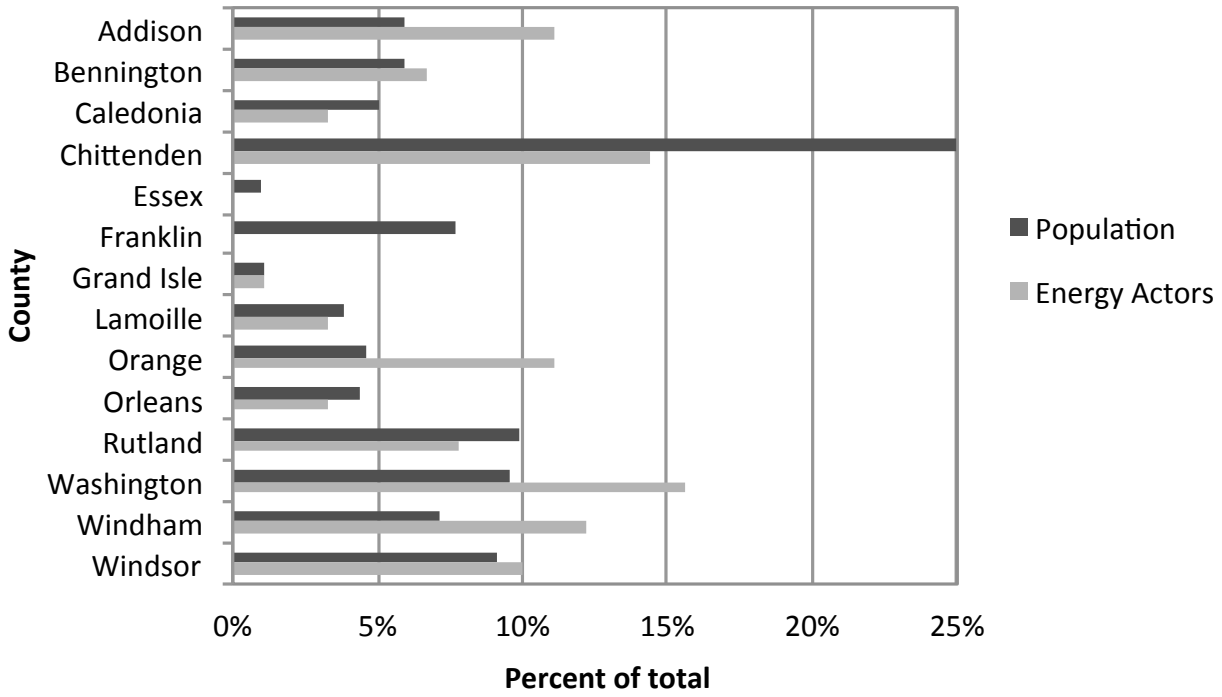
- Johanna Miller, Keil Corey, and VECAN
- Stephanie Kaza (Advisor)
- Cecilia Danks, Chris Koliba, and Richard Watts (Doctoral Committee)
- Gioia Thompson and the Office of Sustainability
- My partner, family and friends

Energy Actors by County

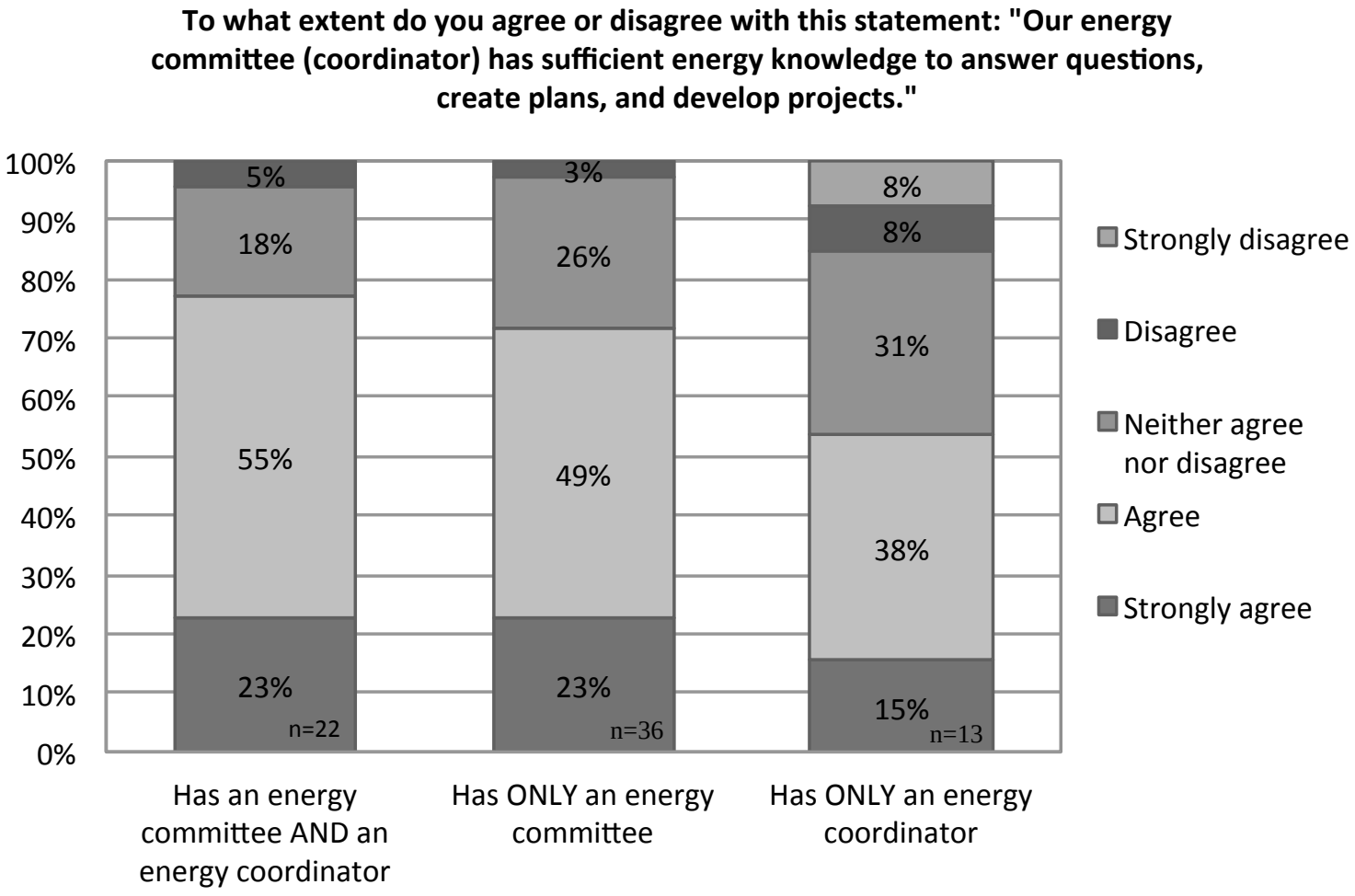


Percent of towns with energy actors

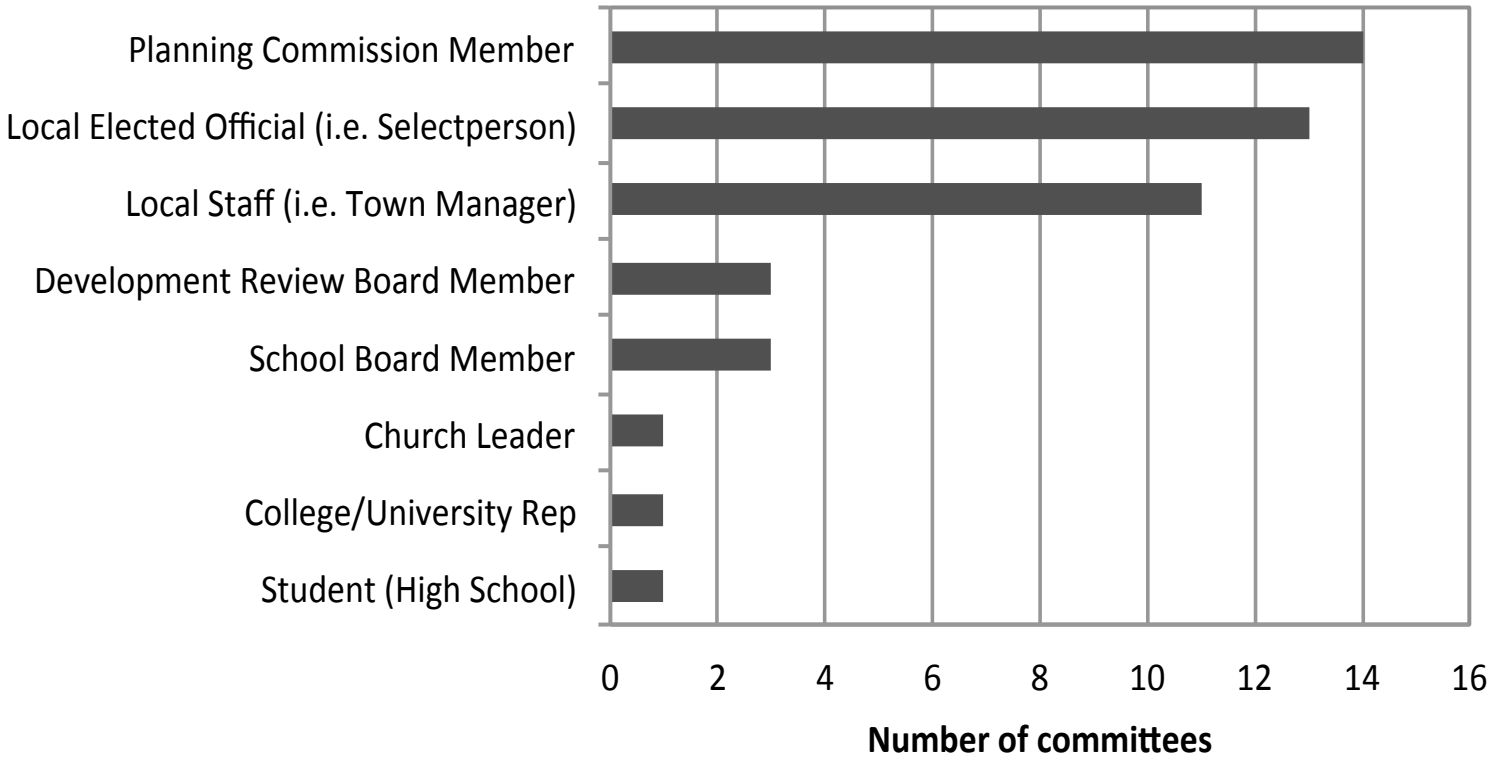
Comparison of regional distribution (by county) of population and local energy actors in Vermont



Energy Knowledge

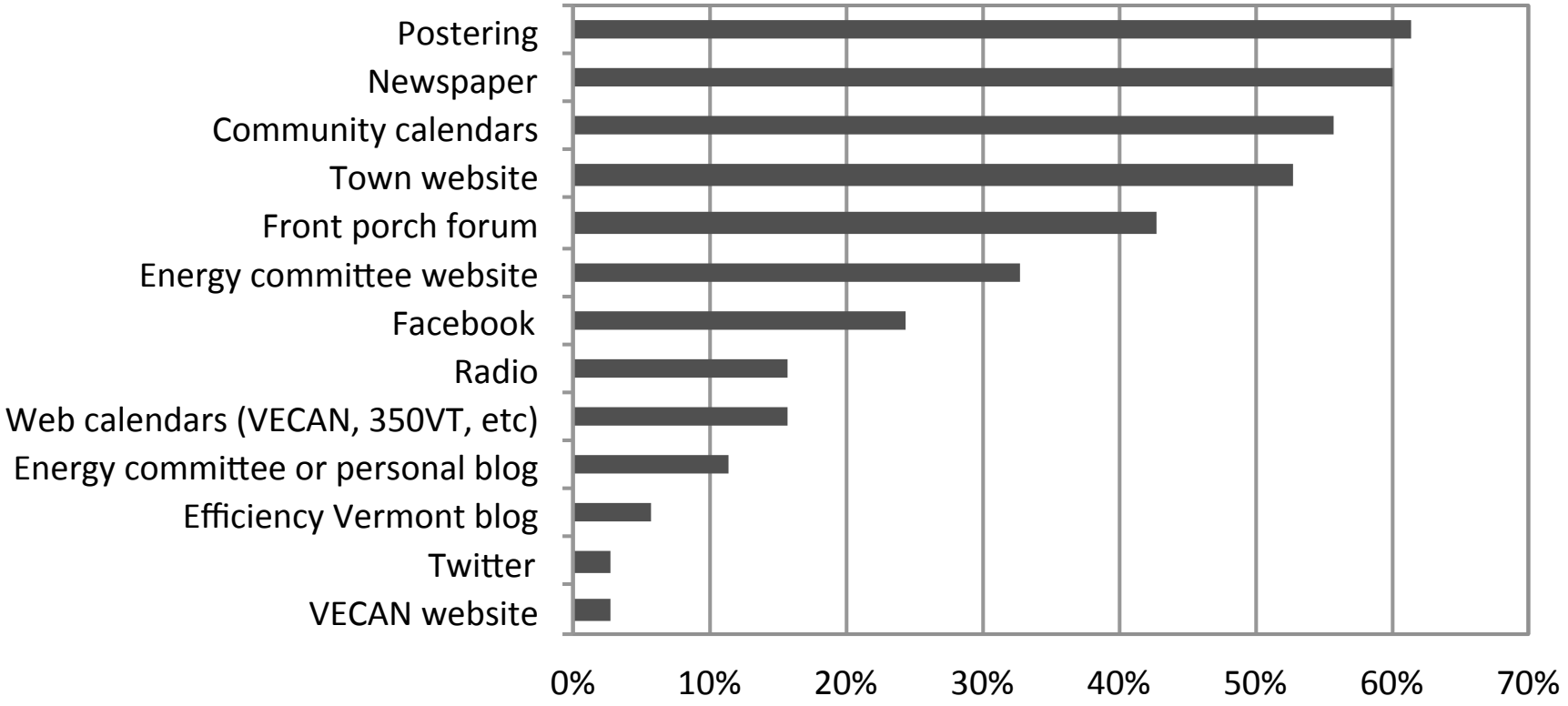


Public Officials



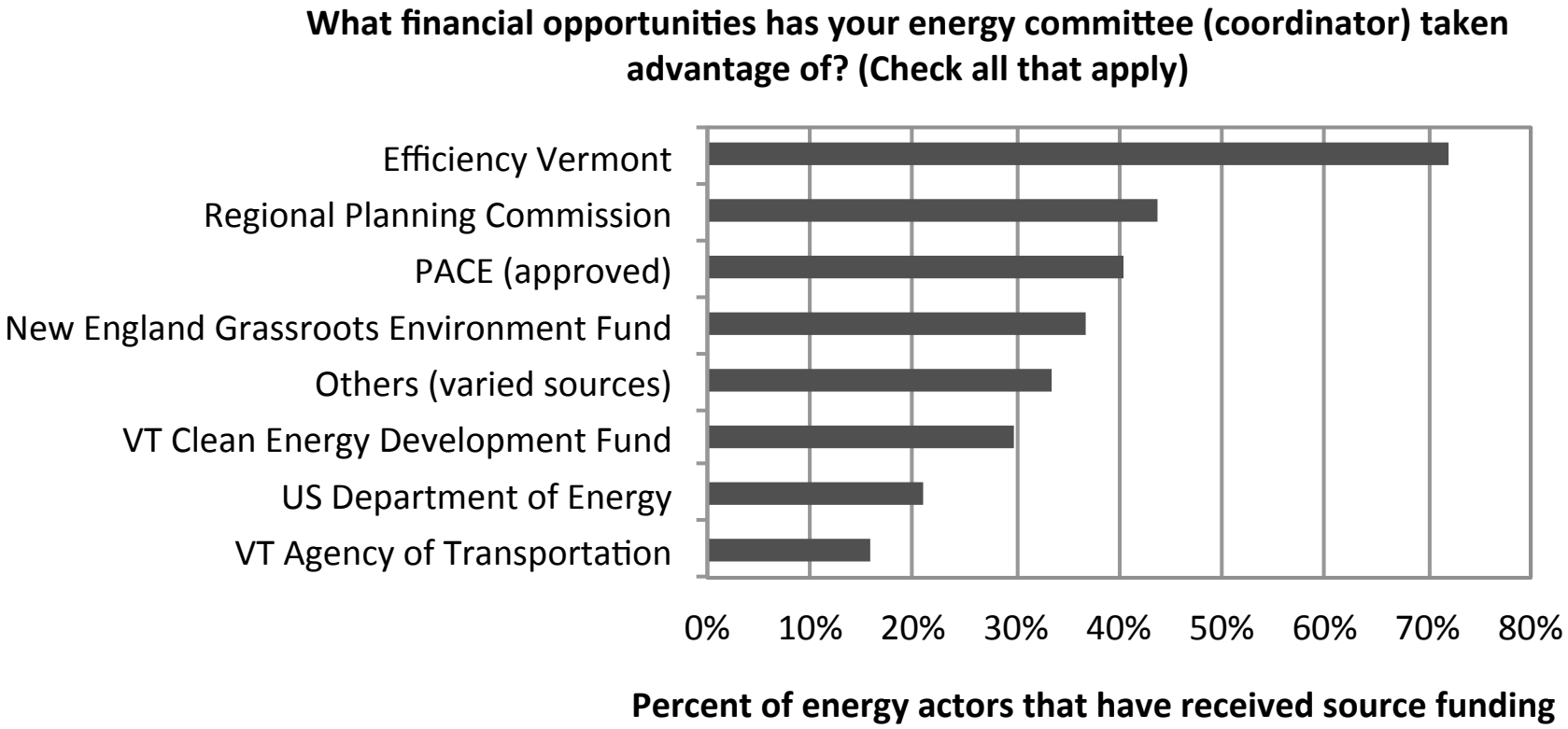
Communication Methods

Over the past two years, has your energy committee (coordinator) used the following methods to communicate about your activities and events?



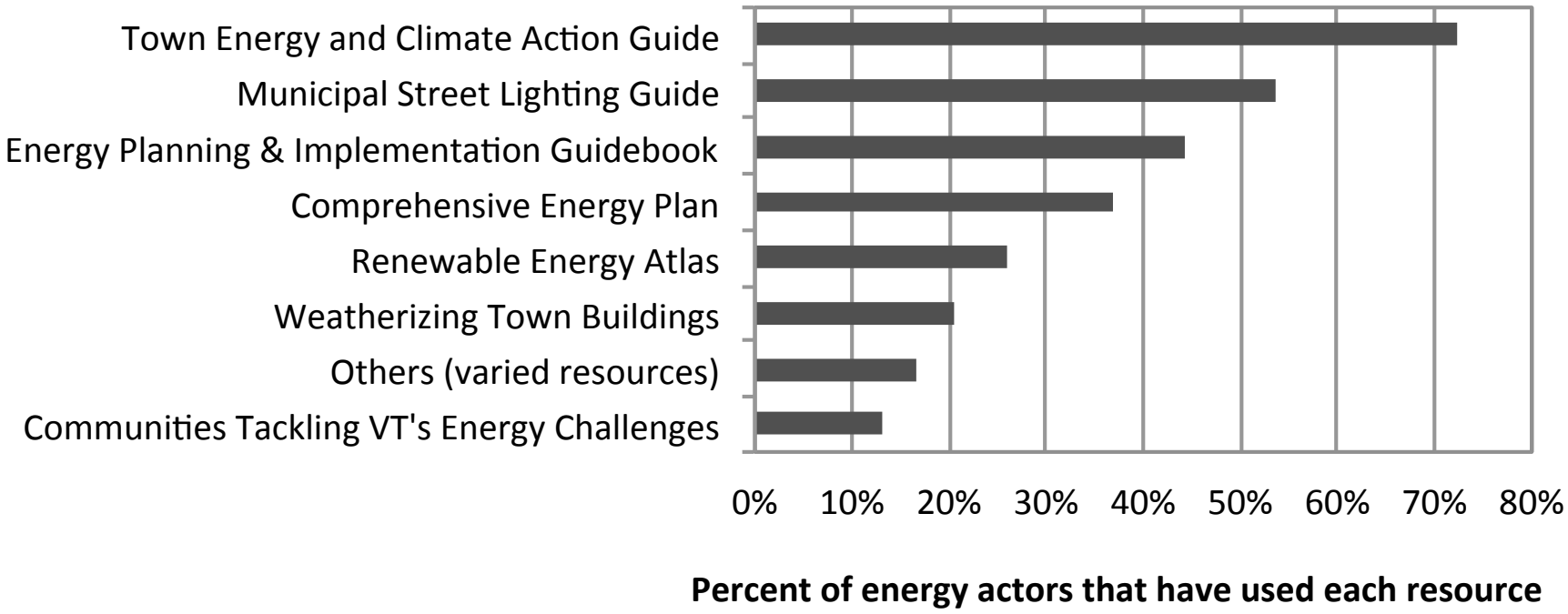
Percent of energy actors that used the communication method

Financial Opportunities



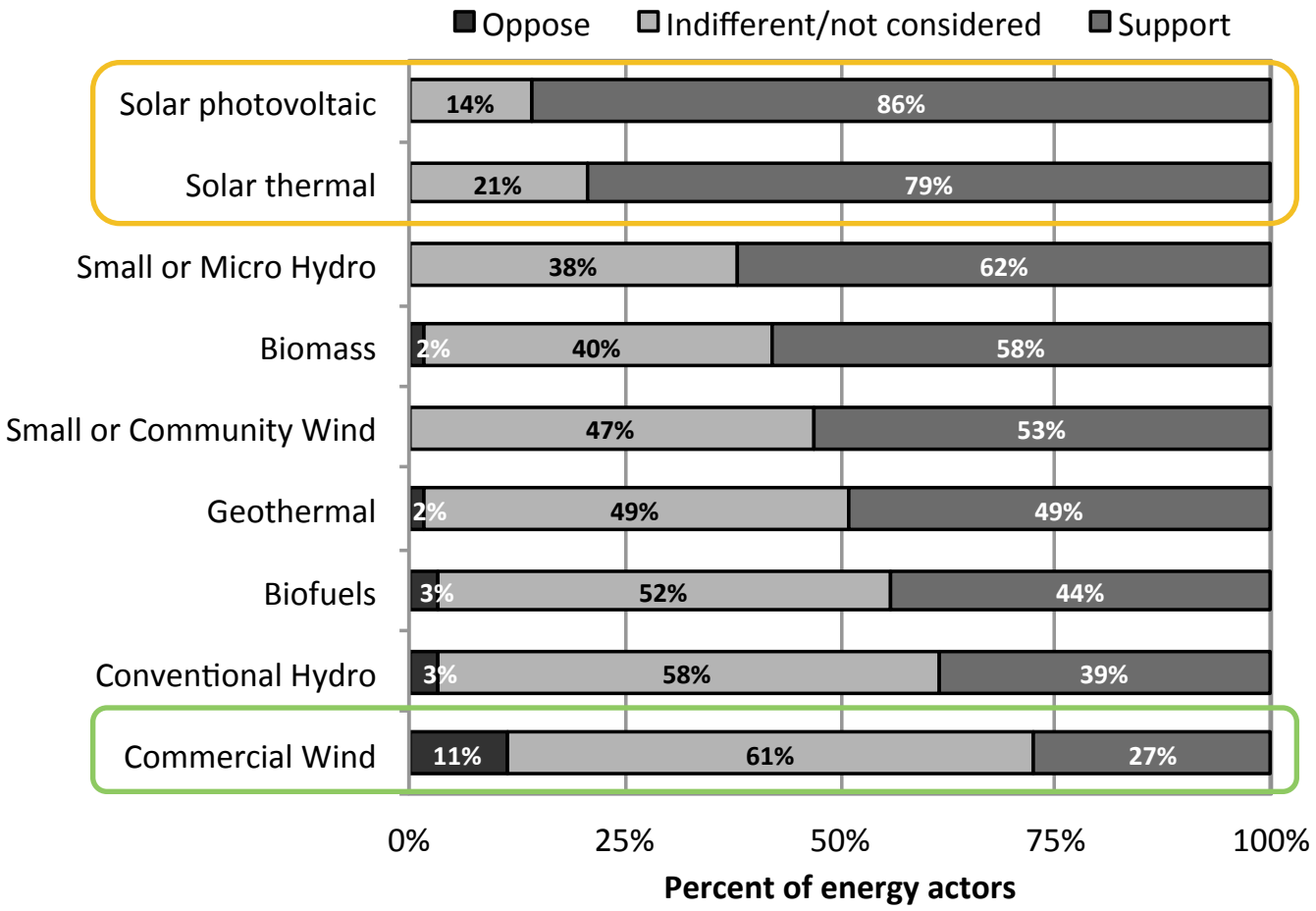
Resources

What energy related resources has your energy committee (coordinator) used for planning and implementation purposes? (Check all that apply)



Percent of energy actors that have used each resource

Attitudes Toward Renewables

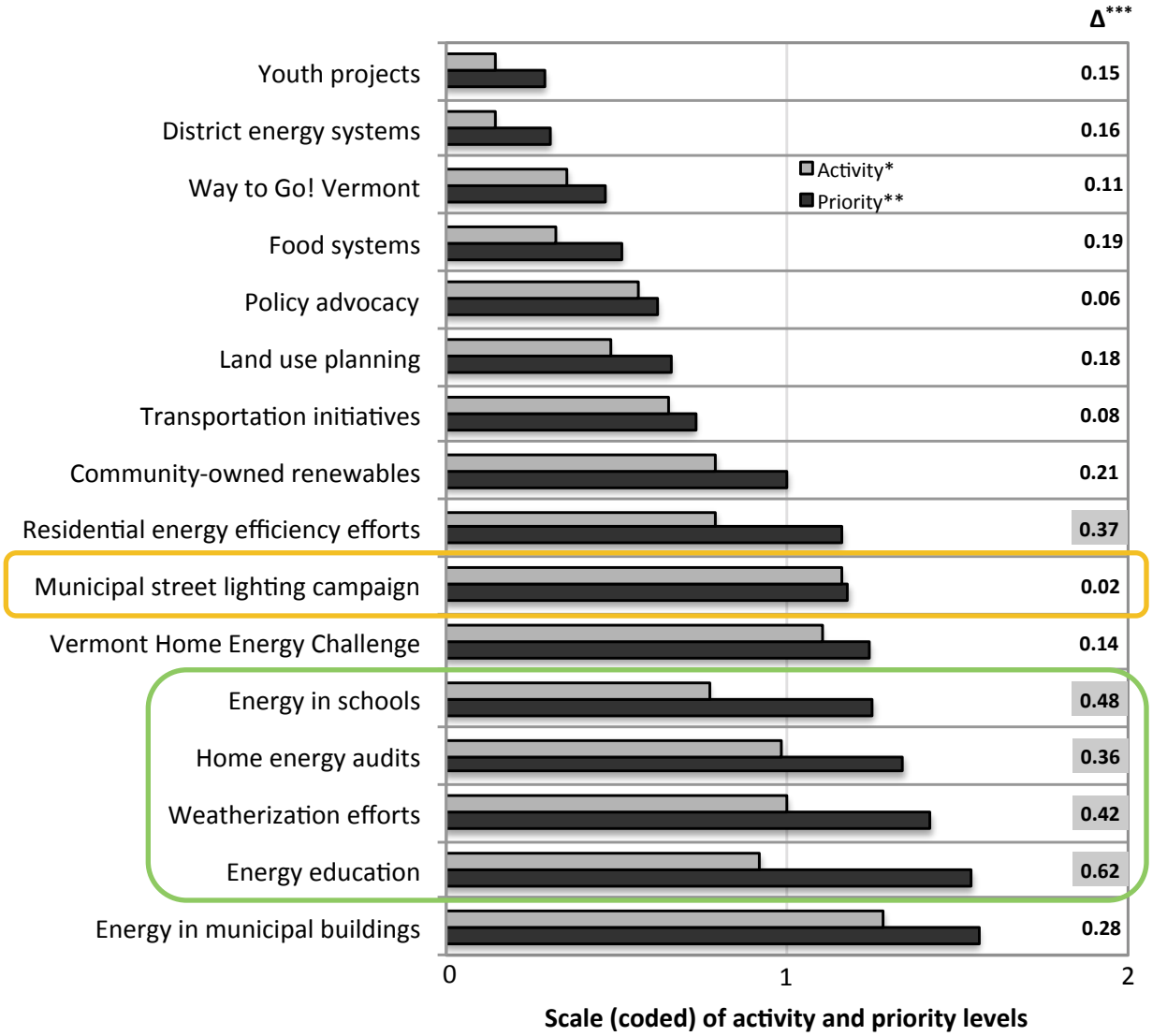


Difference b/n Aspirations and Actions

Success in street lighting

Difficulties in education, audits, weatherization, schools

Average activity and priority levels (ordered by priority from low to high) of energy initiatives



*Activity level choices coded so "Not active"=0, "Somewhat active"=1, and "Very active"=2.
**Priority level choices coded so "Not a priority"=0, "Somewhat a priority"=1, and "A high priority"=2.
***Delta values (difference between priority and activity) greater than .30 are shaded gray.

Projects

Weatherizing Town and School Buildings

Corinth: Comprehensive retrofit of town garage ($65,000)

Energy Education and Outreach

Jericho: Best icicle photo contest (free home energy audit)

Monkton: Energy fair brought together over 30 energy contractors and suppliers

Street Lighting Campaigns

Berlin: Removed 10 of the 83 streetlights and replaced remainder with LED

Renewable Energy Projects

Williston: Installed 5 Solar Trackers that supply over 25% of the municipal electricity

Advocacy/Opposition

Bennington: “A little over 2 years ago (we) stopped the regional hospital from building a new 50 million dollar oil-fired heating system”

Structural Analysis

Independent variable cluster classes

Four categories

Two or three classes

Category	Variable	Survey Question	Class 1	Class 2	Class 3
Demographic	Income	--	Low	High	--
	Population	--	Low	High	--
Structure	Actor Set-Up	2	Has only an energy committee	Has only an energy coordinator	Has a committee and a coordinator
	Organization *	6	Independent	Municipal	--
	Local Officials *	11	No local official members	At least one local official member	--
Resources	Budget	12/42	Yes	No	--
	Time *	14	Less than 5 hours a month	5 or more hours per month	--
	Interest	15/43	Never or rarely	Occasionally or regularly	--
	Knowledge	16/44	Agree (strongly agree or agree)	Did not agree (neither agree nor disagree, disagree, strongly disagree)	--
	Volunteers	17/45	None	Fewer than 10	10 or more
	Network	19/47	Low network interactions (not at all or a few times during the year for another internal actor)	High network interactions (about once a month or more than once a month for another internal actor)	--
Planning	Baseline	21/49	Yes	No	--
	Plan	23/51	Yes	No	--
	Goals	25/26/ 53/54	Yes (at least one)	No (none)	--
	Evaluation	31/59	Yes	No	--

Structural Analysis

Categorical Activity Associations

Actor Set-Up
- VHEC, audits, weatherization

Knowledge
- Technical, complex, broader

Network (interactions)
- District energy systems

Planning
- Strategic, long-term, comprehensive

P-values for Pearson chi-square testing of variable pairs.
Significant results (p-values ≤ .05) are shaded.

		Activity (categorical)																
		Activity (aggregate)	Education	Street lighting	VHEC	Efficiency	Weatherization	Audits	Municipal buildings	Schools	Policy	Way to Go!	Transportation	Community renewables	District energy	Food	Youth	Land use
Demographic	Income	0.20	0.55	0.85	0.09	0.94	0.02	0.26	0.32	0.88	0.96	0.34	0.14	0.87	0.19	0.64	0.38	0.70
	Population	0.01	0.70	0.07	0.51	0.53	0.56	0.94	0.60	0.77	0.06	0.06	0.11	0.37	0.16	0.98	0.83	0.96
Structure	Actor Set-up	0.01	0.06	0.44	0.03	0.15	0.00	0.00	0.96	0.90	0.48	0.09	0.34	0.25	0.88	0.98	0.26	0.76
	Organization*	0.03	0.89	0.20	0.35	0.34	0.66	0.69	0.03	0.06	0.49	0.21	0.25	0.46	0.92	0.69	0.05	0.87
	Local Officials*	0.75	0.90	0.61	0.24	0.63	0.91	0.86	0.96	0.75	0.82	0.82	0.92	0.18	0.92	0.48	0.58	0.11
Resources	Budget	0.00	0.21	0.12	0.90	0.22	0.16	0.19	0.05	0.20	0.15	0.17	0.04	0.04	0.19	0.29	0.90	0.59
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	Goals	0.13	0.62	0.14	0.44	0.89	0.05	0.54	0.47	0.11	0.00	0.01	0.00	0.17	0.37	0.03	0.55	0.10
	Evaluation	0.93	0.05	0.40	0.27	0.09	0.10	0.27	0.88	0.35	0.49	0.22	0.19	0.19	0.70	0.12	0.04	0.39