ERB INSTITUTE

FOR GLOBAL SUSTAINABLE ENTERPRISE

UNIVERSITY OF MICHIGAN

Economics of Renewable Energy

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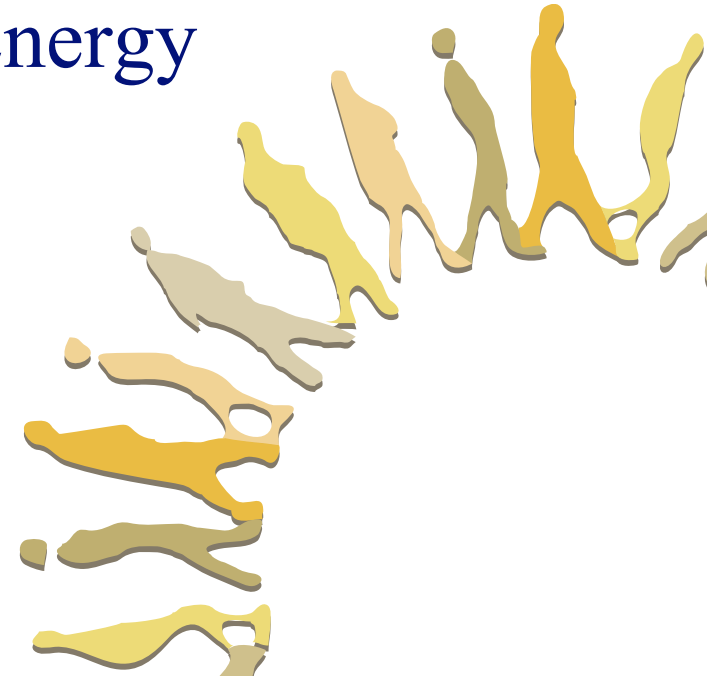

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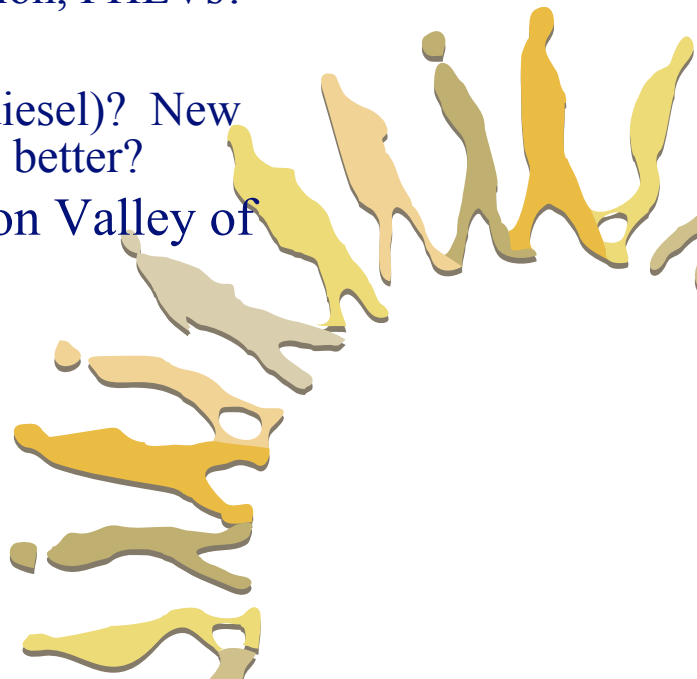
Renewable Energy Challenges

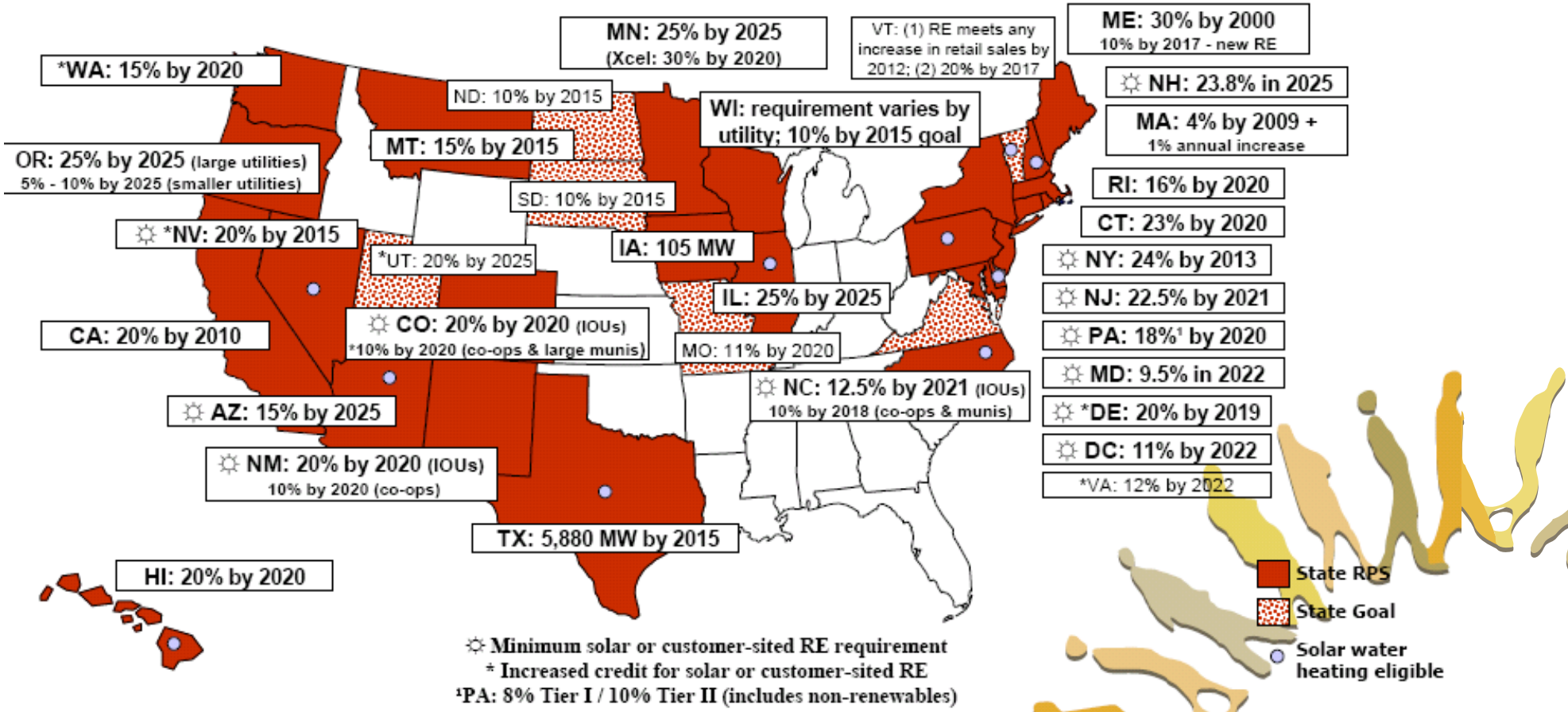
- Benefits (climate, sustainability) not fully internalized in prices
  - Why do governments adopt particular policies, e.g. carbon taxes, cap-and-trade, or Renewable Portfolio Standards?
  - What motivates firms to invest in renewables?
- Many renewable technologies are not yet fully mature
  - What mix of policies and R&D funding is best?
- Intermittency of supply and lack of storage makes it hard to integrate renewables into the electric grid at large scale
  - What is the role of transmission, distributed generation, PHEVs?
- Many unknowns face transportation fuels
  - What source (coal-to-liquid, cellulosic ethanol, biodiesel)? New infrastructure needs (esp. for hydrogen)? Are PEVs better?
- States and nations competing to become the "Silicon Valley of renewable energy"



The Adoption of RPS

As of 2008, 28 States Have Adopted RPS

Renewables Portfolio Standards



☼ Minimum solar or customer-sited RE requirement
* Increased credit for solar or customer-sited RE
¹PA: 8% Tier I / 10% Tier II (includes non-renewables)

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Which States are Early RPS Adopters?

- We model the state decision of adopting RPS from 1991 to 2007 as a hazard model that defines the probability that state *i* adopt RPS in year *t*, given it did not adopt RPS in year *t-1*, as a function of relevant variables.
- RESULTS: Early adopting states have
  - **High wind and solar potential**
  - **Democratic control of legislature**
  - Staffed ASES Chapter
  - Low unemployment rates
  - Restructured electricity markets
  - Low share of natural gas in fuel mix
- Many things do NOT seem to matter:
  - State income
  - GHG emissions
  - Electricity prices
  - Presence of coal, oil or gas supply in state

Policies for PHEV Clusters

- In ongoing work funded by the Michigan PSC, I am studying policy measures that might help to create an industrial "cluster" around plug-in electric vehicles in Michigan
- We identify three sources of cluster effects:
  - Labor market pooling
  - Specialized intermediate inputs
  - Knowledge spillovers
- Key parts of the PEV value chain:
  - Battery
  - Motor
  - Drivetrain control devices
  - Inverter/converter
- Goal is a set of policies that will create a sustainable competitive advantage for Michigan in PEVs
- How will this play out as other states attempt to do the same?

Future Plans/Collaboration

- Do RPS's really lead to increased renewables investment?
- What factors drive electric utilities to invest in renewable generation?
- How does policy uncertainty affect investment?
- What are the costs and benefits of decentralized and uncoordinated energy and climate policies?