#### ETHzürich



# Has climate mitigation been trapped in the wrong paradigm?

Anthony Patt ETH Zurich, Department of Environmental Systems Science 16<sup>th</sup> Swiss Global Change Day, Bern, 1 April 2015





# Annual Town Meeting - Saturday, March 28th

Bromfield Gymnasium - 9:00am Click here to view the Finance Committee booklet.

#### Town Election - Tuesday, April 7th

7am - 8pm - Bromfield Cafeteria Click <u>here</u> to view the official ballott.







A whole lot of fun
Great photo opportunities
Lots of money spent on food



- Reflection on meaning
- Community participation
- A modest amount of fun

- Private corporation
- Exclusive rights
- Freedom to choose

- Volunteer committee
- Public facilities
- Limited budget



#### Nordhaus, Science, 1992

- **1992 United Nations Framework Convention on Climate Change**
- **1995** Agreement in Berlin to negotiate a first set of binding targets
- 1997 Kyoto Protocol, 5% reduction averaged across industrialized countries, including economies in transition



# Shared Resour





Sta





leted Resource





Quantity of consumption



Market-based instruments compared to technology standards

- Emissions cuts gradually shift to where they are less expensive.
- Achieve a given level of emissions reductions at the least economic cost.
- Provide industry with an incentive to innovate.





#### Associated Upscaling of Low-Carbon Energy Supply



#### GHG Emission Pathways 2000-2100: All AR5 Scenarios





#### Associated Upscaling of Low-Carbon Energy Supply



#### Source: IPCC AR5 WGIII

GHG Emission Pathways 2000-2100: All AR5 Scenarios



Datenquelle: US Energy Inform. Admin.



# Electricity

# Biomass & Biofuels

- Electric heating and mobility systems
- Reliable CO<sub>2</sub> free electricity generation
- Sustainable biofuels production
- Increased energy efficiency

Are the technologies available? Mostly Do they make our lives easier and better? Some do Are they so good we can cut the cord to fossil fuels? Not yet



Theory of transitions of technological systems







Grübler et al., *Energy Policy*, 1999



Grübler et al., Energy Policy, 1999

- 1. Value of international treaties
- 2. Economic incentives
- 3. System integration
- 4. Critical challenges

#### Value of international treaties

Economic incentives System integration Critical challenges





You will agree to reduce your herd size, if you know the others will do so too, because that will boost productivity.

# Value of international treaties

Economic incentives System integration Critical challenges



- Nobody knows if a modern economy can function without fossil fuels.
- An international treaty can assure countries that we are all in it together.
- The valuable part is in cooperation with respect to planning and finance.

#### System integration Critical challenges



# Value of international treaties

# **Economic incentives**

System integration Critical challenges



System integration Critical challenges



- To promote diffusion of any technology, economic incentives need to start big and then taper off.
- Technology-specific incentives can work well in this manner.
- Achieving the same diffusion through disincentives for fossil fuels is much harder.

# System integration

**Critical challenges** 



# System integration

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Zürich

# System integration

**Critical challenges** 



Source: Open Charge Map

# System integration

**Critical challenges** 



- Public policies need to address these system integration issues
- It can be hard to anticipate them in detail, and which solutions will work best
- Every technology poses its own set of issues; there is no one-size-fits-all policy



Own graph, based on data from IPCC AR5 WGIII, Ch6

Swiss primary energy consumption, excluding heating





2013 Mobility

Swiss primary energy consumption, excluding heating





Visperterminen, VS







- The transition to renewable energy is sort of like building an airport.
- Issues of land-use and permitting, as well as international trade, are among the most challenging.
- This kind of strategic infrastructure rarely gets built without a strong public sector involvement.



- For a long time, a set of theories have guided climate policy that are appropriate for marginal reductions in pollution, but not the transitions needed to completely eliminate pollution.
- Theory suggests, and empirical research confirms, that the associated policy instruments have been largely ineffective.
- Empirical evidence also confirms that policies grounded in an evolutionary understanding of transitions offer far more promise.



# One set of goals



# A different set of goals

Let Disney do it

Form a committee



Eliminate greenhouse gas emissions

Tragedy of the commons Environmental externalities Uncertainty and doubt Strong initial economic incentives Attention to integration challenges Public planning of infrastructure