Clean Innovation: Proposed Research Priorities

Positive Energy: Trust in Transition Workshop

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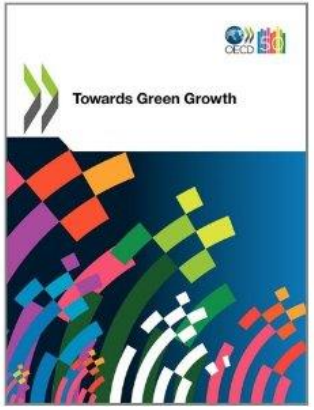
Growing consensus that

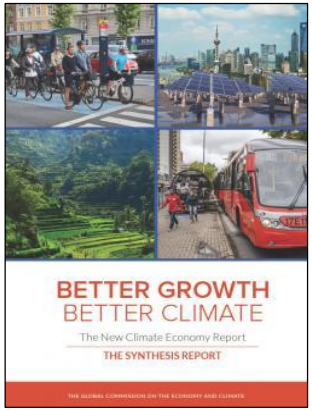
the Emerging Global Economy ...

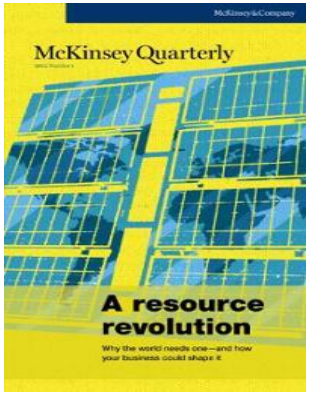
Will reward countries that are

- *eco-innovative*
- *energy efficient*
- *low polluting*, and
- *use resources productively*

➢ across *all* sectors







Clean Innovation (CI) is Vital for …

The Economy

- Clean tech market will double ($2.5T) by 2022 – jobs, research, exports (Analytica)
- Resource efficiency and innovation = $3.6T opportunity by 2030 (McKinsey)

The Environment

- Reduce costs of meeting Paris targets

Canada

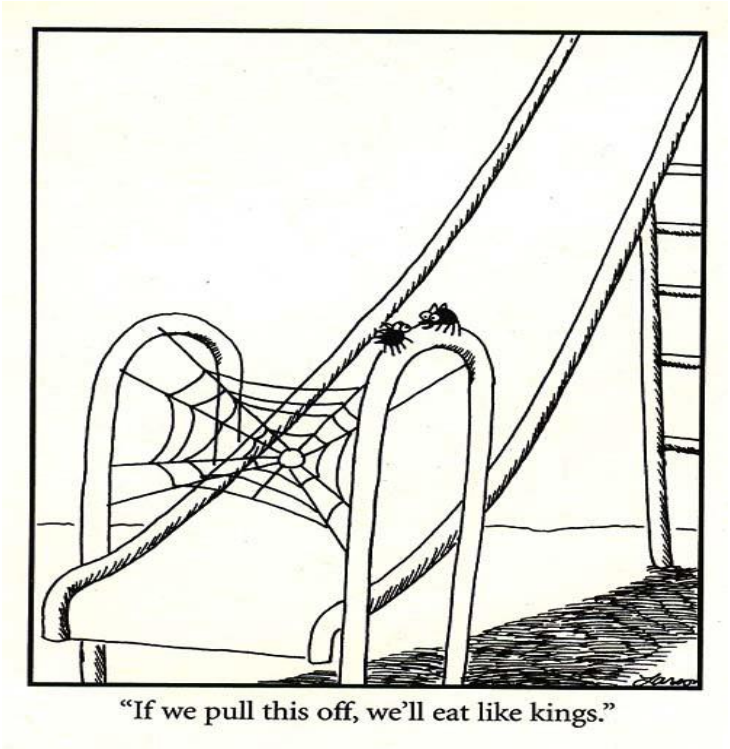
- Keep pace with world leaders
- Build a global brand of clean performance and innovation, across all sectors

How do we capture this opportunity?

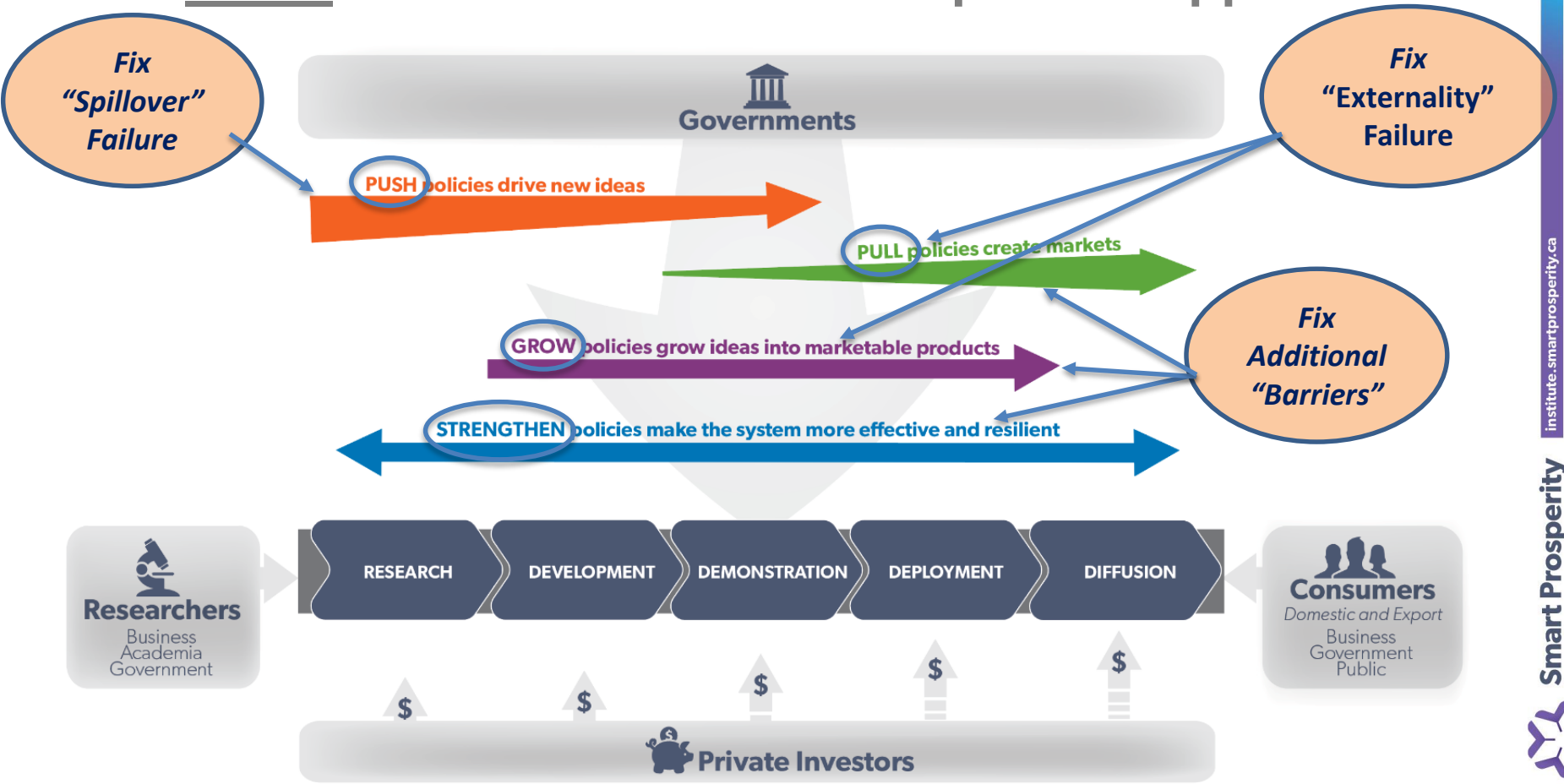
… & What does the answer suggest about research on public trust & CI?

Requires Support for Each Stage of Innovation System:

1. Pull: Boost market demand (environmental policies, pricing, procurement)
2. Grow: Finance scale-up, deployment, export (leverage private $s)
3. Push: Generate new ideas and technologies (R, D & D)
4. Strengthen innovation system: Clusters, incubators, data, skills, strategy/constituency



Clean innovation needs extra public support



Clean Innovation:
Reasons for Public Intervention

General innovation:

- Market failure – knowledge spill-overs (boost R&D)
- Boost private risk capital (overcome lock-in, etc.).

Clean innovation has extra barriers / needs:

- Extra market failure – **environmental externalities** (boost demand)
- Infrastructure dependence (e.g. energy, transport)
- Finance risk: capital intensive, disruptive, longer time to ROI (often)
- Policy risk: low carbon economy transition driven by political agreement

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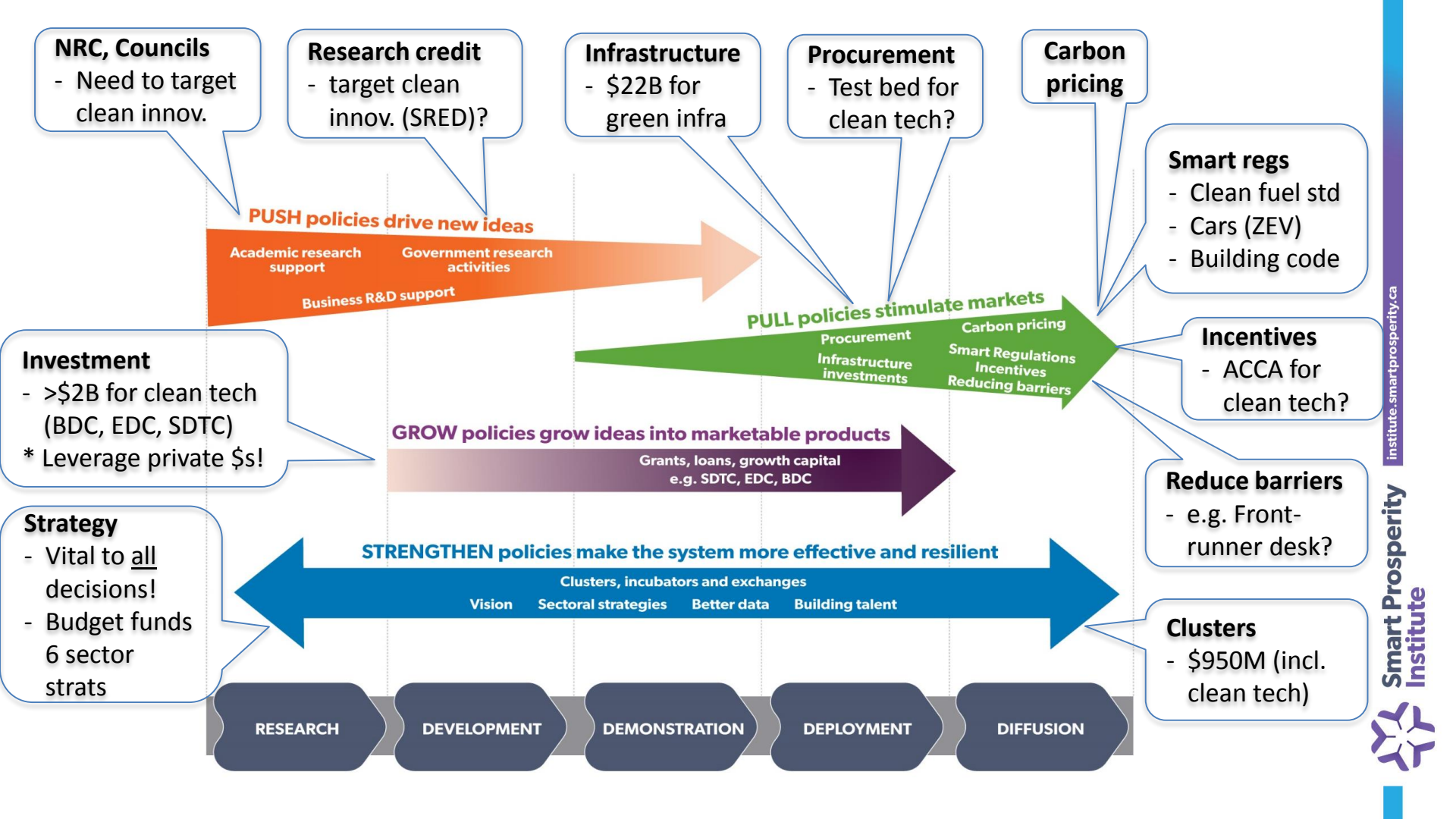
NRC, Councils
- Need to target clean innov.
Research credit
- target clean innov. (SRED)?
Infrastructure
- $22B for green infra
Procurement
- Test bed for clean tech?
Carbon pricing
Smart regs
- Clean fuel std
- Cars (ZEV)
- Building code
PUSH policies drive new ideas
Academic research support
Government research activities
Business R&D support
PULL policies stimulate markets
Procurement
Carbon pricing
Infrastructure investments
Smart Regulations
Incentives
Reducing barriers
Incentives
- ACCA for clean tech?
Investment
- >$2B for clean tech (BDC, EDC, SDTC)
* Leverage private $s!
GROW policies grow ideas into marketable products
Grants, loans, growth capital
e.g. SDTC, EDC, BDC
Reduce barriers
- e.g. Front-runner desk?
Strategy
- Vital to all decisions!
- Budget funds 6 sector strats
STRENGTHEN policies make the system more effective and resilient
Clusters, incubators and exchanges
Vision
Sectoral strategies
Better data
Building talent
Clusters
- $950M (incl. clean tech)
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1: ‘Pull’ – Stimulate Demand

Stringent, flexible, predictable env’t policies drive innovation (OECD)

- *Flexible*: Pricing is key, plus flexible regulations (non-prescriptive)
- *Stringent:* World-class standards boost innovation, and market access
  - politically / economically hard (need adjustment period)
- *Predictable*: Critical to drive longer-term investment, sustain growth
  - signal rising stringency over 10-15 years (*not easy*, but can do)

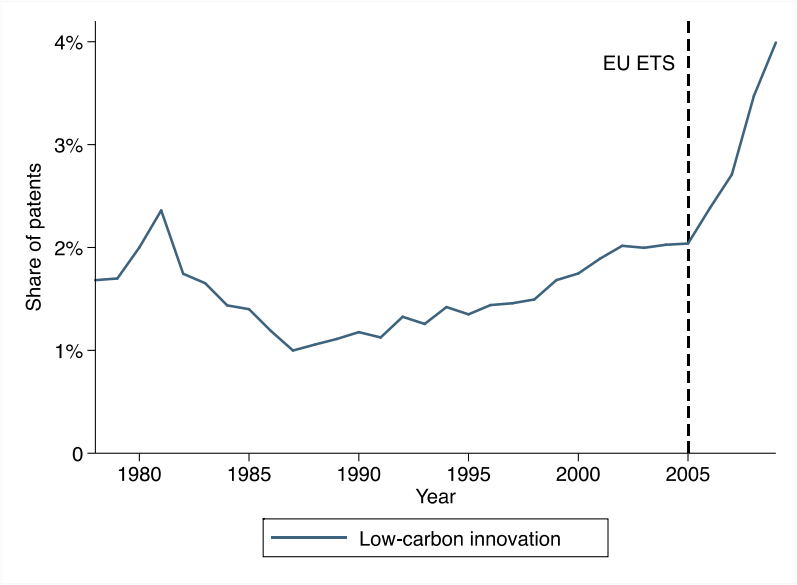
Key Design Questions re Public Trust / Confidence.

- Concerns of competitiveness, adaptability, equality of outcomes…
- *Predictability* and building of public constituency.

Need Research on the right mix of pricing/complementary policies

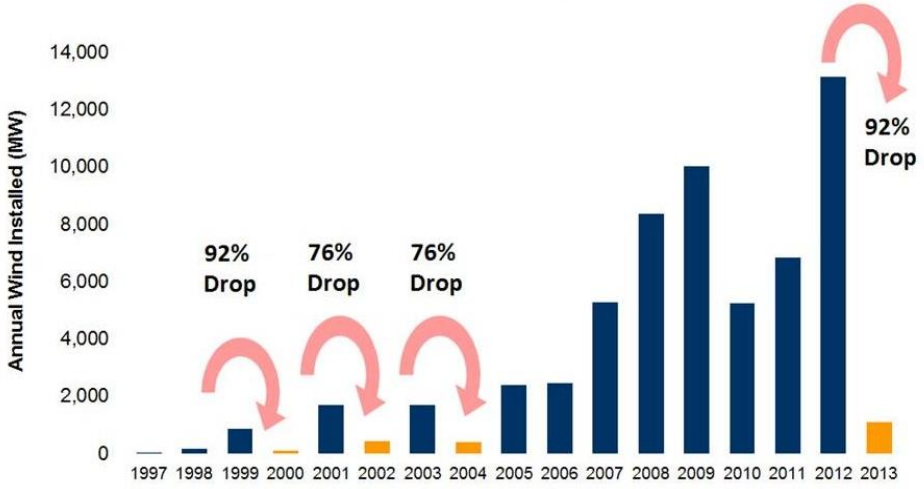
Stringent, flexible, predictable policy drives Innovation

Share of low-carbon patents in Europe



Calel & Dechezleprêtre 2014

Historic Impact of Production Tax Credit (PTC) Expiration on Annual Wind Capacity Installation



American Wind Association 2015

Green Procurement (Pull / Grow)

Gov’t is biggest buyer - lead by example

1. **Lower gov’t environmental footprint**
   - Internal government carbon price (rising, life cycle)
   - Ambitious internal performance standards (buildings, vehicles)
   - Systems (carbon budgets, performance review, reporting)
     - ➢ These help esp. to deploy / diffuse (ready technologies)

2. **Innovation: Early adopter, showcase for Canadian clean tech**
   - Give critical first contracts (unlock private finance, sales)
   - Target x% of spending on Canadian clean tech (e.g. SBIR)
   - Incentives, information (expert advice): support for procurement

- ➢ Evidence shows procurement programs can drive clean innovation
- ➢ Some evidence that Canada lags in clean procurement

2: ‘Grow’ – Commercialize clean inventions

- **Emerging research says governments don’t just fix markets; but *co-create and shape* them to achieve important *public missions***
  - Must ‘tilt’ the playing field (i.e. provide direction) towards ‘clean’
- New research: Clean tech requires more/riskier public finance support:
  - Extra market failure and barriers (policy risk, finance risk, etc.)
  - Key gap is high-capex, long scale-up clean techs (must de-risk)
- **New Research on Design of government spending programs critical**
  - Maintaining public/political support while *increasing public risk-taking*
  - Build *new public risk-return models* (financial + environmental)
    - Learn from VC approach/other return-generating models?
  - *“Mission-Oriented” vs. Incremental*: implications for constituency building & social acceptance along transition path?

3: ‘Push’ (R&D) – Seed *tomorrow’s* technologies

- Canada’s R&D capacity good – must *target* clean innovation
  - NRC, Councils: Target clean innovation (research, networks, chairs)
  - Build our international links (e.g. global visiting chairs, joint research $s)
  - Break down walls b/w universities and research labs (public &private)

- Generate more/better IP and start-ups from research (incentives)
  - Get a Canadian ’story’ in the transition?

- Moon shots: Make some big (strategic) bets
  - Big investments in breakthrough clean tech / strategic areas (w/ private partners)
  - Need ARPA-E-like entity (nimble, system approach)?
  - Grand challenges / prizes -- design to catalyze public trust in transition???

4: ‘Strengthen’ the Clean Innovation System

- **Clusters, incubators, networks (connection spaces)**
  - E.g. Federal superclusters program – ensure clean innovation is key part
  - Also support smaller, regional (clean-tech) clusters and incubators
- **Build long-term evidence-based policy making capacity**
  - Review bodies, transparent updating of programmatic support?
  - Stock-taking & independent/expert review
  - Need better data – enable evidence-based decisions (public, private)
    - Gaps, inconsistencies, no central platform.
- **Talent – skills are key to clean innovation economy**
  - Prioritize clean innovation in training, education, immigration programs

5: Cross-cutting Issues / Challenges for Canada

Pick up public trust aspects on transition path...

- Need **overall clean growth/innovation strategy** – to inform all choices
  - Needs alignment, involvement across levels and parts of government
- **Build experimentation, risk-taking, evaluation/learning into all actions**
  - Try different things and learn from them (quickly) -- key (but not easy)
  - Mandate independent review of key policies, programs after 3-5 years
  - Building Predictability by fostering public engagement/constituency
- **Systems transition: overcoming lock-in of incumbent techs**
  - Esp. hard for highly regulated markets (energy) and commodities.
  - Create safe market 'niche' for new entrants (often the disruptive innovators),
  - Incumbents: Reduce institutional support / encourage disruptive innovation
  - Attention to potential distributional impacts / policy-program mix.