

Pathways to Climate Solutions: Assessing  
Energy Technology and Policy Innovation  
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# **Technology Deployment: Risk, Investment and Institutions in a Mosaic World**

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Resources for the Future

# Scene Set: Stabilizing GHG Concentrations

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- **Net CO<sub>2</sub> emissions must fall to zero (and other GHGs)**
- **Global issue...behavior of developing nations will be critical**
- **Transformation of the economy occurs through deployment of technology systems: (technology, infrastructure, supply and value chains, finance, business models, legs/regs/permits/courts...)**
- **Outcomes depend on:**
  - Innovation/options: (R&D, Finance, Business Models, Management Systems, ...)
  - Policy (2-way risks, e.g. imposing a new or larger carbon price, creation or removal of subsidies, anticipated policy that never materializes, policy shocks)
  - Investment decisions
- **National institutions play a fundamental role/determine:**
  - Policy choice, implementation, enforcement... business climate, credibility of policy
  - Investment decisions

Climate change is only one of many compelling priorities

# Three major developments since 2008

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- Demise of the international top-down approach (CoP 15 Copenhagen)  
advent of the Mosaic World
- (Ongoing) Financial challenge/crisis  
inability of public finance to meet growing expectations of  
developing world regarding “climate” aid and compensation
- Energy innovation revolution in tight gas and oil  
higher opportunity cost of moving from fossil fuels

# Framework for the Talk

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- Climate policy in the context of efforts aimed to limit global warming to less than 2 °C (which requires rapid transformation to a zero carbon economy)

## The need to

- Move beyond analyses based on the current generation of Integrated Assessment Models using highly idealized policies
- Account for the role of national institutions in a fragmented Mosaic World, especially on decisions for policy and major investments

Many serious analysts are convinced that 2 °C/450 CO<sub>2</sub>eq is already in the rearview mirror

# Twin International Energy Challenges

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- **Meeting significant increase in energy demand and improving access to energy**
- **Responding to GHG risks**

## Context (IEA):

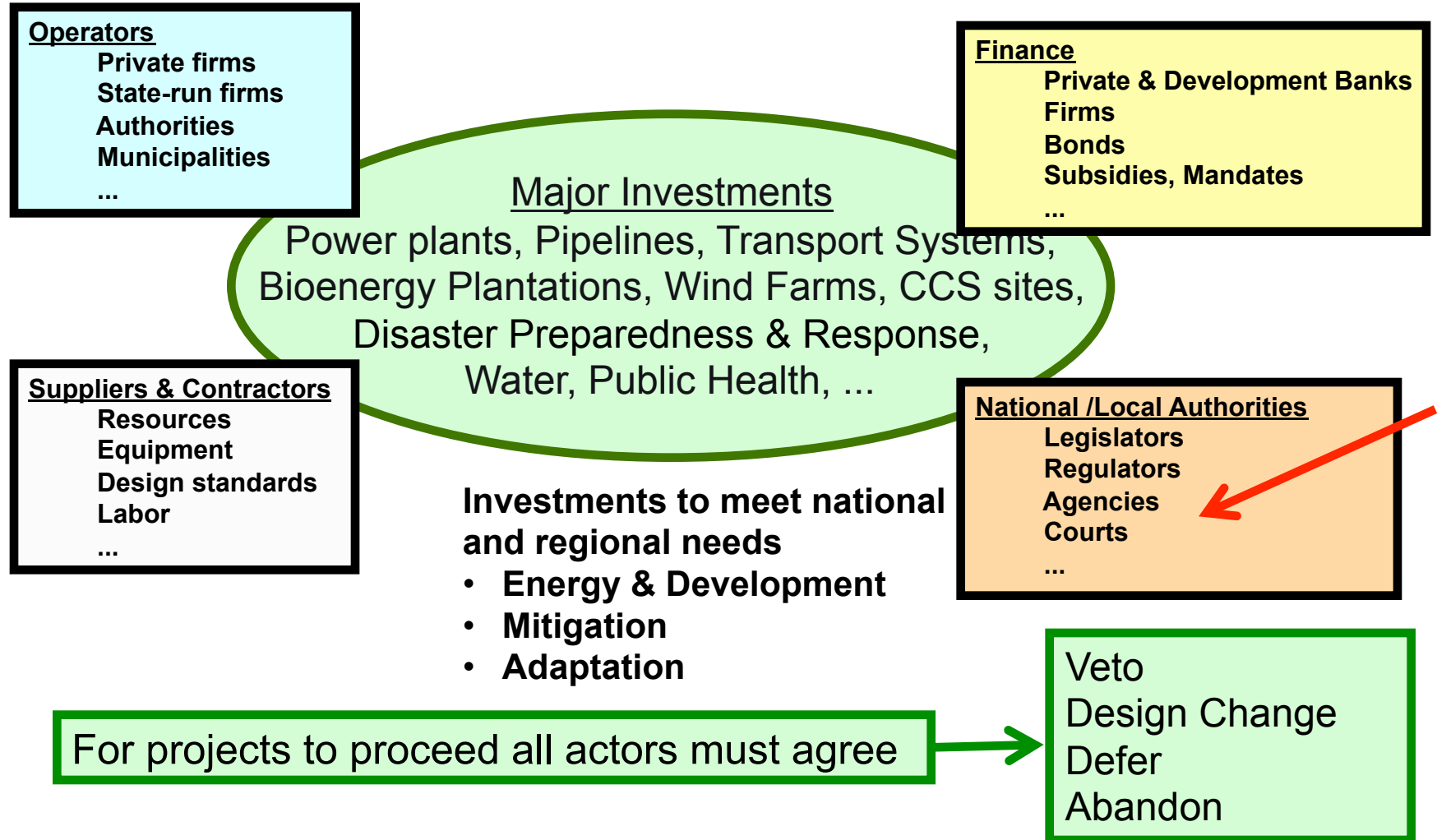
2B People without access to commercial energy  
\$22T Investment (through 2030) energy supply and distribution  
\$45T Additional investment (through 2050) to manage climate risks

Accelerated development and deployment of advanced technology will be essential to meet aspirations and manage risks at affordable costs

Deployment will occur globally in thousands of multi-billion dollar investment projects, many for *currently non-commercial technologies*

# Investments and Decision-Makers

What actors, criteria and enabling frameworks are required?

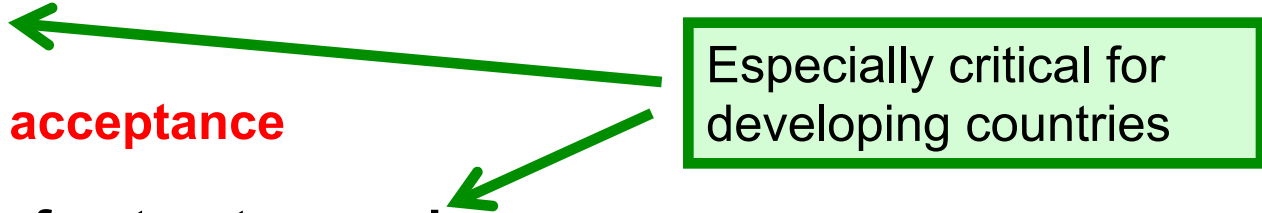


# Criteria for Technology Evaluation

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- **Safety, health and environmental impacts**
- **Performance**
- **Cost**
- **Consumer acceptance**
- **Enabling infrastructure and capacity**
- **Regulatory compliance**
- **Environmental and social impacts at large scale**

Especially critical for developing countries



Weakest link paradigm: failure in any dimension will prevent widespread commercialization

# Business Risks (new and existing technology)

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- **Technological**
- **Market**
- **Policy**
- **Competitor behavior**
- **Political**

Investors seek to manage risks, generate returns



# Enabling Frameworks for Business Contribution

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To fulfill its potential most effectively, business requires a proper enabling framework that includes:

- **Rule of law and good governance**
- **Honest, impartial judicial system**
- **Transparent, uniformly enforced regulations**
- **Stable regulatory and fiscal policy**
- **Protection of intellectual property**
- **Honoring of contracts**
- **Free, open markets**
- **Safe and stable communities**
- **Partnership and multilateral cooperation**
- **Vibrant society: education, communication, research ...**



**International Chamber of Commerce**

*The world business organization*

# Mosaic World

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- **A world in which nations and regions establish climate objectives and policies based on national circumstances and priorities**
- **Implementation depends on national policies and enforcement**
- **Economies and global GHG progress remain linked through, e.g.**
  - Formal bi- and multi-lateral linkages (in some cases)
  - Trade and investment
  - International offsets
  - Research and development
  - ...
- **As contrasted with, e.g.**
  - Cap & Trade World: Progressive evolution to a global system in which
    - + Nations with targets take on stronger targets
    - + Nations without targets graduate to take them on
    - + Linked cap-and-trade systems with offsets lead to a common carbon price
  - A Favela world of partially planned and unplanned policies

- Considers the real world of national policies
- Moves from idealized 1<sup>st</sup> best world

# Accounting for the Role of Institutions: (not just carbon price)

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- **Institutions are a key manifestation of national circumstances**
- **How do institutions condition national choices and framing of real world climate and development policy?**
  - National circumstances, priorities and strategies differ
  - Real world policies always deviate from ideal least-cost optimum
- **How do institutional actors affect design and decisions on policy and major capital project investments: equipment, plant, infrastructure ?**

Investors seek to manage risks, generate returns

# Reflections on Potential Technical Solutions

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- **Major technology systems that contribute to mitigation *in models* are challenged by significant interest groups**
  - Nuclear
  - Carbon Capture and Storage
  - Biofuels
  - Wind
- **Open questions in deployment will affect costs, availability**
  - Public acceptance
  - Regulatory frameworks for siting, operation, monitoring
  - Timely creation of required infra-structure
  - Liability
- **How might investments be affected by market and policy uncertainty and associated price volatility?**
- **More ambitious stabilization targets imply an enormous increase in the pace of capital-intense energy investment; bottlenecks affecting scarce inputs will increase costs, slow investment**

Many of these issues are primarily institutional and political, not cost-benefit economics

# Investment Decisions and Climate Policy

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- Decisions on major capital expenditures by private firms are based on a risk-adjusted expectation of adequate returns
- Many of the technology systems that show promise for mitigation face high costs, limited or no commercial experience and political controversy
- Higher costs, potential for permitting or regulatory delays, public acceptance, and policy and legislative uncertainty add to perceived risks and raise costs
- Inadequate returns force firms to seek alternate approaches, defer decisions, reject projects... or stay with what worked in the past
- Effective climate policies will need to work with mainstream project investment and finance processes, and with local and national approval processes
- Business seeks sufficient clarity to plan, propose and implement projects with confidence that they will be commercially viable and proceed in a timely fashion

The key issue in climate finance is not so much raising funds, as confidence in returns from successful projects

# Ways Forward

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- Reconnect climate policy discussion with the real world
- Incorporate consequences of national institutional behavior in climate policy analyses and models
  - Policy choice and implementation
  - Investment decisions
- Focus on major regions and technologies
  - US, EU, Japan, China, India, ...
  - Power, transport and fuels
- Creates new information needs, new model structure

shout out

Proposition: Institutional considerations imply that IAMs are overly optimistic about the costs, timing and (in some cases) feasibility of climate policy interventions for mitigation and adaptation

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# Thank You & Discussion