



**Berkeley Roundtable on the International Economy**  
University of California, Berkeley

# **The Energy Systems Transition: Governments, Markets, and Green Growth**

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# **Green Growth and Climate Mitigation: The Energy System Transformation**

- Can an Energy System transformation drive “green growth” and business opportunities?
- What are the proper roles for markets, prices, and governments



# **The Energy Systems Transformation**

**The Old:** *Inefficient high-carbon*

**The New:** *Efficient low-carbon*



# The Energy Systems Transformation

**The Old:** *Inefficient high-carbon*

**The New:** *Efficient low-carbon*

- Optimize the existing system?
  - Higher gas mileage
  - Longer lasting light bulbs



# The Energy Systems Transformation

**The Old:** *Inefficient high-carbon*

**The New:** *Efficient low-carbon*

- Optimize the existing system  
RATHER
- Create a new system
  - Smart efficient buildings
  - Renewables



# ***Creating a New System Require:*** **Suites of Complementary Technologies**

- A Energy System Shift means: Suites of technology that shift together
- Renewable energy sources are intermittent:
  - Require *smart grid*
  - Require *storage*
- Electric Cars
  - Require more *electricity*
  - Require *“Fueling” Stations*



# The Energy Systems Transformation

Not the first such transformation:

- Wood → Coal
- Coal → Oil
- Rise of electricity



# **Until the Tipping Point: *Optimize Within the Old System***

- Wood to coal: Coal required transportation\*
- Oil: Rockefeller captured a critical link
- Electricity: Edison captured the whole system

\* Mark Huberty, "Energy Systems and Climate Policy: Applying lessons from the adoption of coal to its elimination", a CITRIS-BRIE Working Paper, September 2009.





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# **How Green Tech Drives Growth:**



# **How Green Tech Drives Growth:**

**An Energy System Transformation  
is Central to  
Green Growth**



# How Green Tech Drives Growth:

- Building out the pieces
  - Windmills
  - Solar Panels
  - LED lighting
  - Building controls



# How Green Tech Drives Growth:

- Building out the pieces
- Transformative (Disruptive) Technology Changes Choices Throughout the Economy
  - Railroads
  - Electricity
  - Semiconductors



# **How Green Tech Drives Growth:**

- Building out the pieces
- Transformative (Disruptive) Technology Changes Choices Throughout the Economy
- Will Green Technologies Be Transformative, Disruptively Productive?



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# **Toward a Green Growth Trajectory:**



# **Toward a Green Growth Trajectory: *Green Will be Different From ICT***



# **Toward a Green Growth Trajectory: *Green Will be Different From ICT***

ICT was System Change Without Even Trying





# **Toward a Green Growth Trajectory: *Green Will be Different From ICT***

ICT: Exceptional Balance of Market and State

- Government helped create the trajectory
  - Micro-electronics
  - The internet



# **Toward a Green Growth Trajectory: *Green Will be Different From ICT***

## **ICT: Exceptional Balance of Market and State**

- Government helped create the trajectory
- Private actors positioned to drive it
  - Dominant players limited from entry
  - VC (Venture Capital) model idea



# **Toward a Green Growth Trajectory: *Green Will be Different From ICT***

**ICT: Exceptional Balance of Market and State**

- Government helped create the trajectory
- Private actors positioned to drive it
- Real immediate market advantages for ICT
  - Price
  - Performance
  - Production



# **Toward a Green Growth Trajectory: *Green Will be Different From ICT***

## **Why Green Transformation is More Difficult**

- **The Retrofit problem: Western energy systems are built out**
- **Large investments for the long term**
- **Operational continuity in Energy is essential**
- **Established large players in production/distribution**
- **Price disadvantage, at present, for many low carbon energy sources**



# **Toward a Green Growth Trajectory: *Promoting Transformative Technology***

## **What Role for Governments and Markets?**

- **Private Sector and the Price of Carbon: High carbon prices will be necessary, but not sufficient**
  - **Risk of slow pace of change**
  - **Risk of optimizing in the old system**



# **Toward a Green Growth Trajectory: *Promoting Transformative Technology***

## **What Role for Governments and Markets?**

- **Prices, high carbon prices won't be sufficient**
- **Government:**
  - **Regulate: for innovation, to capture the low hanging fruit, let energy efficiency help create that new system**
  - **Define and Promote the new system**
    - **Infrastructure and core technologies that**
      - **Grid**
      - **Storage**
  - **Establish standards**



# **Toward a Green Growth Trajectory: *Promoting Transformative Technology***

## **What Role for Governments and Markets?**

- **Prices, high carbon prices won't be sufficient**
- **Government: Promote and Regulate for the new System**
- **Joint Private/Public**
  - **Technology roadmapping:**
    - **Use power of convening to define suites of technology**
    - **Identify the policy / technical issues.**
  - **Define for the public the necessity of the transition**



# **The Energy System Transformation: Advantages**

- Emissions are derivative of the energy system
- Energy Security: Limiting imports
- Potential growth





# **The Energy System Transformation: A Priority**

- Long term Green Growth can only come from *redefining the energy system*
- Europe Has demonstrated advantage in *systems* innovation
  - Trains
  - Energy
- There will be a significant challenge from China
- EU Leadership will be essential