

History and Economics Provide Better Renewable Energy Strategies

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Humanity and Wood Fuel

- Many societies have prospered using wood as their primary energy source
- Most depleted local timber supplies with bad consequences
- There was a successful transition from *wood to coal* in 17th century England

A History of Deforestation

- **Mountains of Lebanon**
- **Spain**
- **Chaco Canyon (The Anasazi)**
- **Greenland (The Norse)**
- **Easter Island**
- **England**

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Battle of Gravelines, 1588

The destruction of the last great Spanish forest!



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Easter Island

- Settled by 900AD, creating a vibrant society
- Created huge ornaments to their gods
- They cut down every tree on the island
- Without the forest, the 10% remaining alive had a squalid and miserable life



Observations for Easter Island

- On an island with no place to go
- Population exceeded sustainability
- Ran out of trees with no replacement
- Overthrew their gods and rulers
- Civil war became endemic
- 90% were dead when discovered

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England

- **Britain was a late developer in Europe, and therefore retained large forest longer**
- **Wood was used as a general fuel but also for shipbuilding, construction, and as industrial material**
- **Great increase in iron usage caused large quantities of wood to be consumed**

Charcoal Production

- Iron production consumed great amounts of wood (as charcoal)



Wood Shortages

- From the 1620s until the end of that century, England was short of wood.
- Iron production fell due to wood scarcity.
- Coal was not hot enough to smelt iron.
- Coal began to be burned directly but sulfurous smoke and fumes were terrible.
- Wood was then imported from the European mainland and North America.

Technology to the Rescue!

- **The English, by 1603, understood that the charcoaling process would work for coal (would be called “coke”).**
- **Coke burns hotter and more cleanly than coal.**
- **First usage of coke was in 1642 for roasting malt in Derbyshire.**

Observations for England

- Price increases were disruptive,
- Scarcity affected industry,
- Were now importing wood,
- National security was at risk.
- Coal was plentiful but “won’t work”, “too messy”, “not the way we do things”, etc.

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- Coal was plentiful but “won’t work”, “too messy”, “not the way we do things”, etc.
- **The transition to coal was still waiting for something... .**

Adam Smith (1723–1790)

- ***The Wealth of Nations***
 - All endeavors are subject to the *laws* of economics
 - Still the preeminent foundation for the subject of economics



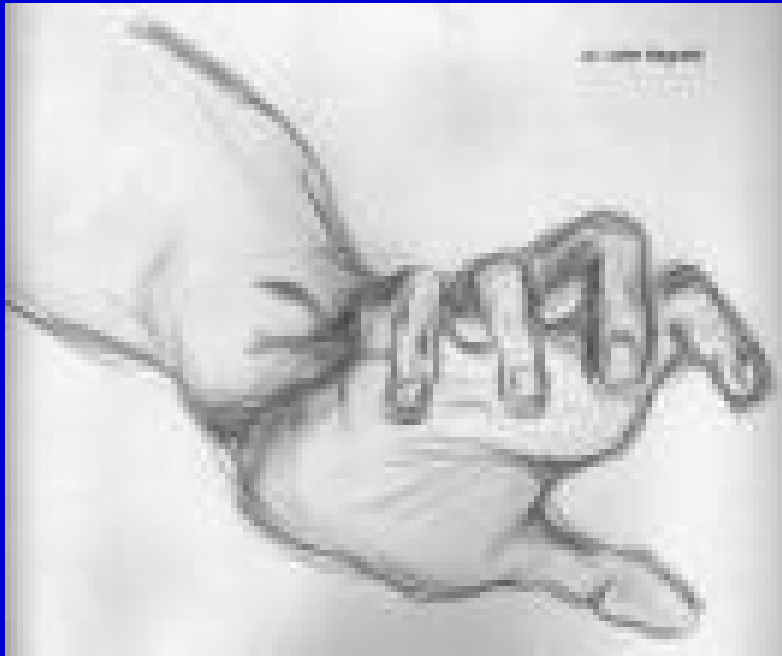
From *The Wealth of Nations*

*...every individual ... intends only his own gain, and he is in this, as in many other cases, led by an **invisible hand** to promote an end (to benefit society) which was no part of his intention.*

– Adam Smith

The Invisible Hand

Many people refer to the “invisible hand” as a substitute for market forces or personal self interest.



**The Cold, Dead Hand
of Adam Smith!**

Transition to Coal

- **Coal (in form of coke) slowly began to replace wood**
- **Coke was used for cooking, making iron, and fueling train locomotives**



Observations

- **Cost, not technology, was the primary driver to change.**
- **All of these changes were directed by “the hand” described by Adam Smith.**

Similarities

- **Increasing fuel prices**
- **Fuel shortages**
- **National security issues**
- **Environmental issues**
- **New technologies emerged as needed**

Differences

Wood to Coal (England 1600–1750)	Fossil Fuels to Renewables (World Now)
Wood often unavailable	Oil/Coal available at some monetary and environmental price
“Low” World Population → local transition	“High” World Population → global transition
Similar <i>per capita</i> energy usage worldwide and across social classes	Huge deficit in available energy to the world’s underclass vs. the affluent

Successful Strategies

- **Changing must be economically profitable.**
- **The strategy must fulfill the energy load.**
- **The results must be environmentally sound.**

Risk Considerations

- **Temporary price drops should not delay or stop migration to renewable energy**

Risk Considerations (cont'd)

- **Transition strategy must include payoff for underdeveloped parts of the world.**

Conclusions

- **History has shown us that failure is more likely than success.**
- **Adam Smith tells us that economics will set the pace for the energy transition.**
- **Pursue cost reductions relentlessly!**

"That's all Folks!"



USA

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2001