

# **History and Economics Provide Better Renewable Energy Strategies**

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# Humanity and Wood Fuel

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- 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 17<sup>th</sup> century England

# **A History of Deforestation**

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

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# Battle of Gravelines, 1588

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The destruction of the last great Spanish forest!



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# Easter Island

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- 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

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- 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

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- 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

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



# Wood Shortages

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- 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!

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- 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

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- 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)

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- *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*

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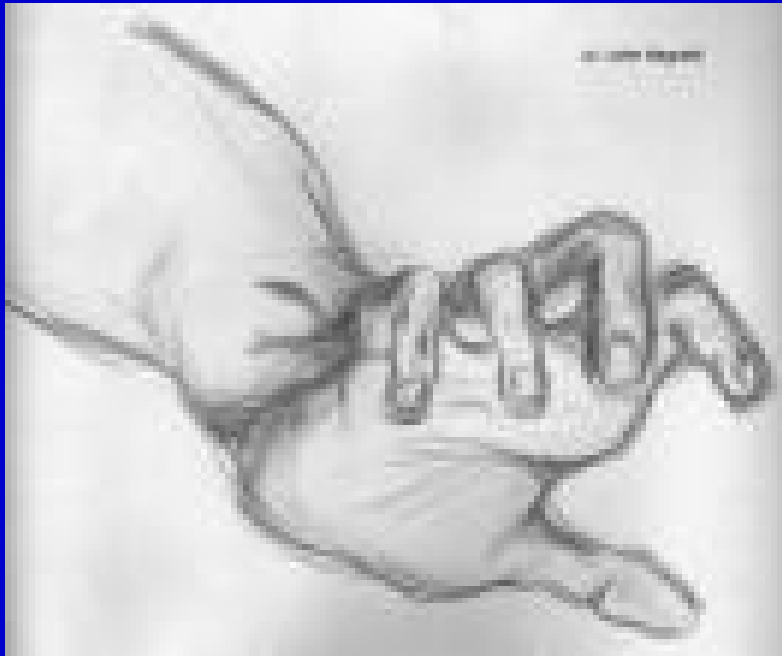
*...every individual ... intends only his own gain, and he is in this, as in many other cases, led by an **invisible hand** to promote an end (to benefit society) which was no part of his intention.*

– Adam Smith

# ***The Invisible Hand***

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**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

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



# Observations

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



# Similarities

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

# Differences

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

# Successful Strategies

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

# **Risk Considerations**

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

# **Risk Considerations (cont'd)**

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

# Conclusions

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- 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!

