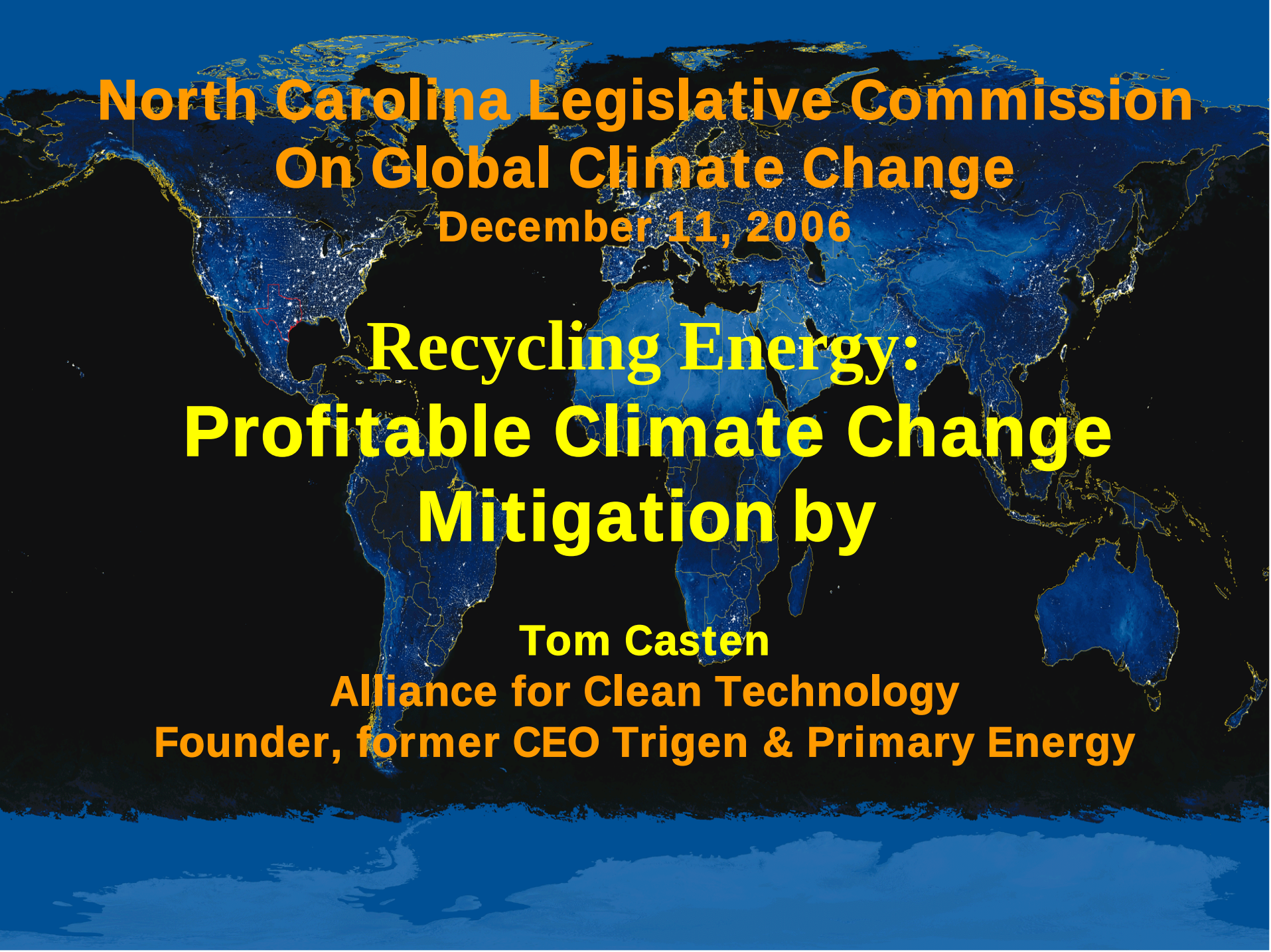


North Carolina Legislative Commission On Global Climate Change

December 11, 2006

Recycling Energy: Profitable Climate Change Mitigation by

Tom Casten

Alliance for Clean Technology

Founder, former CEO Trigen & Primary Energy

Commission Mission

- **Reach consensus on what NC can do to alleviate or prepare for the effects of climate change**
- **Solicit ideas from experts**
- **Take advantage of economic opportunities**
- **Actions taken will shape the direction of NC economy for decades**

Presentation Summary

- **The central generation of electricity is not optimal**
- **The better option – local generation that recycles energy waste – faces regulatory barriers, is denied benefits it creates**
- **The Alliance for Clean Technology (ACT) proposes a suite of policies to encourage 'clean technology'**
- **ACT believes governments can profitably mitigate climate change with a 'blue box' energy policy – recycling waste energy**

Introducing the Alliance for Clean Technology (ACT)

- **ACT is new, a coalition of local power developers, WWF, Greenpeace, Sierra Club, Suzuki Foundation, unions, and gas and electric distribution utilities**
- **Mission is polices that induce deployment of *clean technology* to profitably reduce greenhouse gas emissions**
- **These policies will reduce pollution, improve industrial competitiveness, preserve good jobs and lower societal heat and power costs**

An Inconvenient Truth

- **Al Gore describes global warming as an 'Inconvenient Truth' – a reality that we would rather not face.**
- **Why inconvenient?**
  - **Conventional wisdom assumes energy conversion is optimal; thus mitigating climate change will increase energy costs**
- **Why wrong?**
  - **The energy system is not optimal**
  - **Electric generation efficiency peaked in 1960, creates 38% of US GHG**

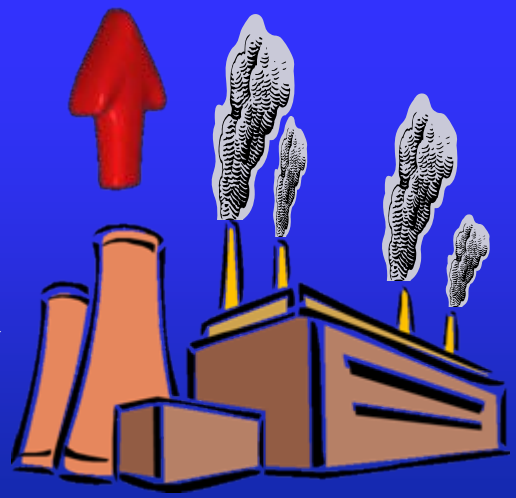
Conventional Central Approach 1960 Data (& 2003 Data)

Pollution

Waste Heat

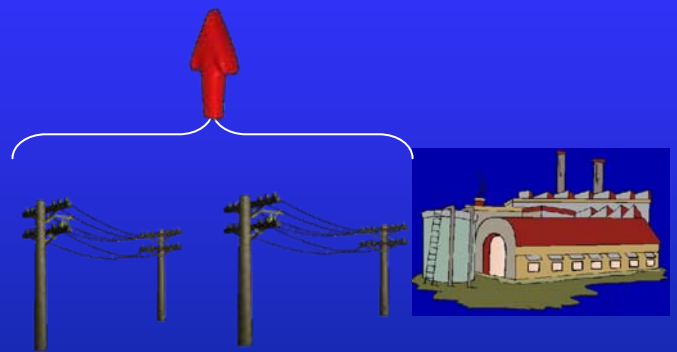
Fuel

100 units



Power Plant

Transmission Line Losses
3 units (7.5%)

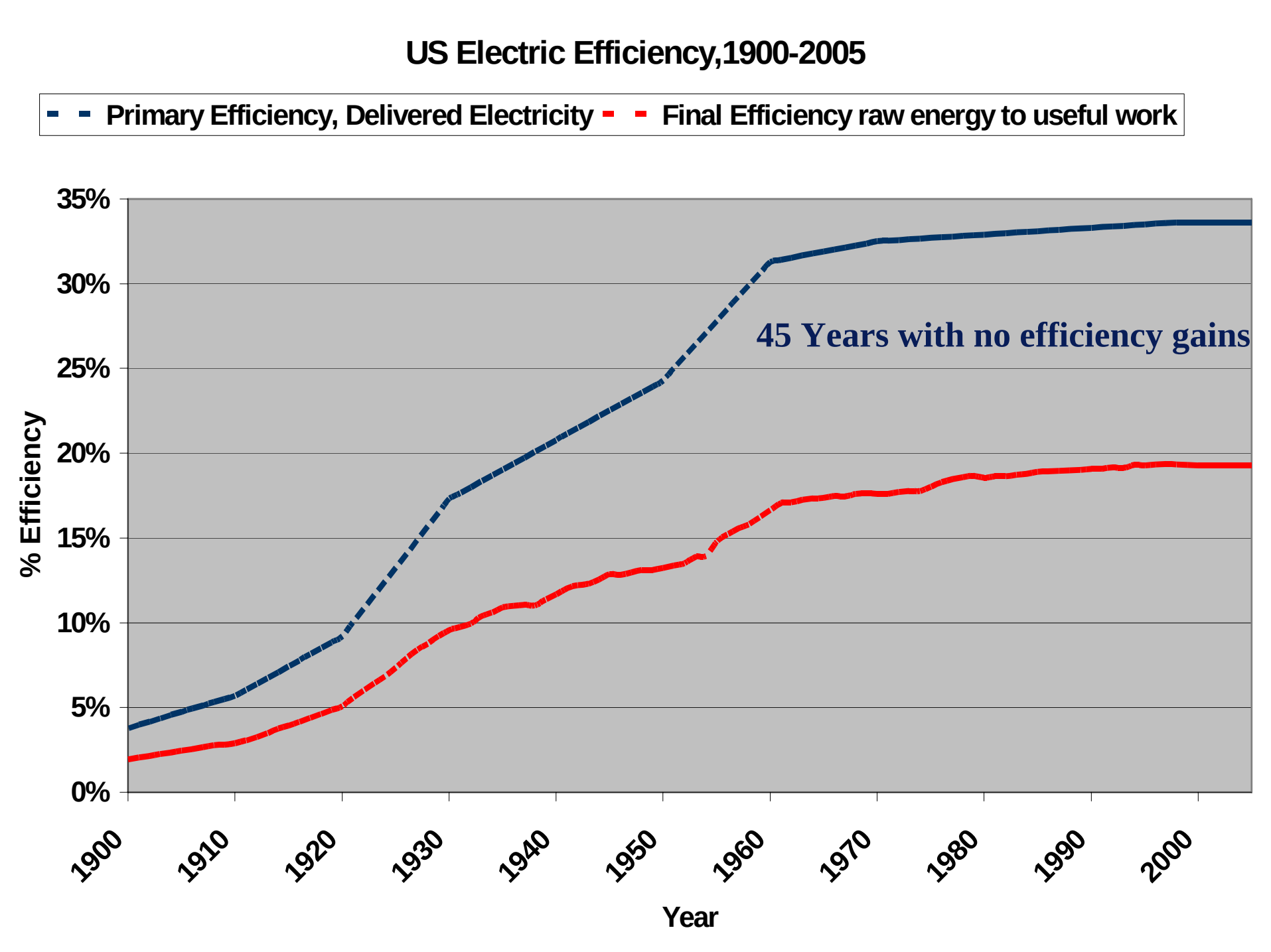


End User

=

67 units Waste Energy

33 units Electricity


US Electric Efficiency,1900-2005
Primary Efficiency, Delivered Electricity
Final Efficiency raw energy to useful work
45 Years with no efficiency gains
% Efficiency
35%
30%
25%
20%
15%
10%
5%
0%
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Year

We Have Better Electric Generation Options

Local generation can recycle energy to reduce costs and pollution

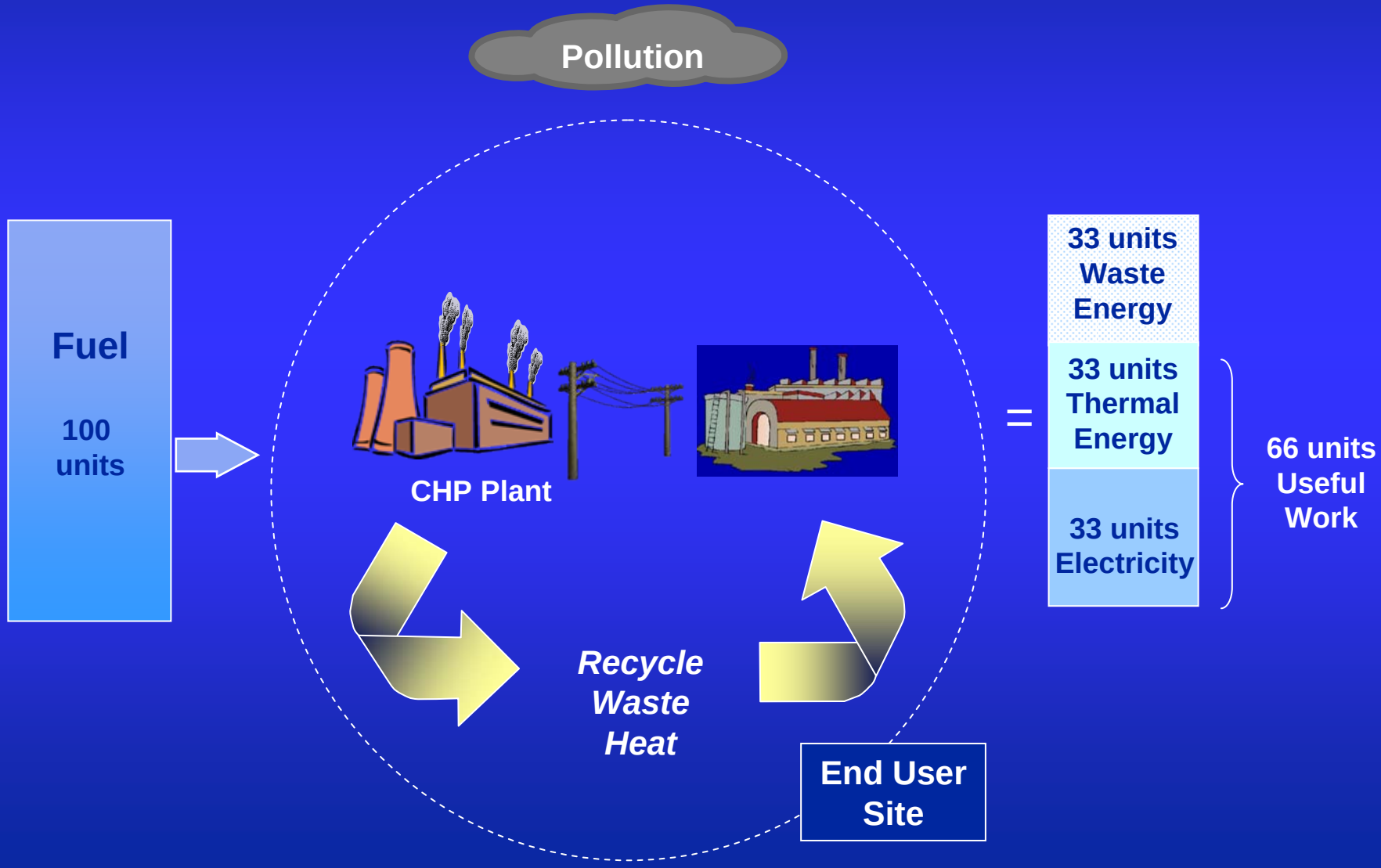
ACT's 'Convenient Truth'
Energy Recycling Eases All Problems

- **Recycling industrial waste energy could produce 20% of US electricity, fuel free**
- **Combining heat and power generation (CHP) produces electricity with half the fossil fuel of conventional central generation**
- **Recycling waste energy will improve US competitive position**

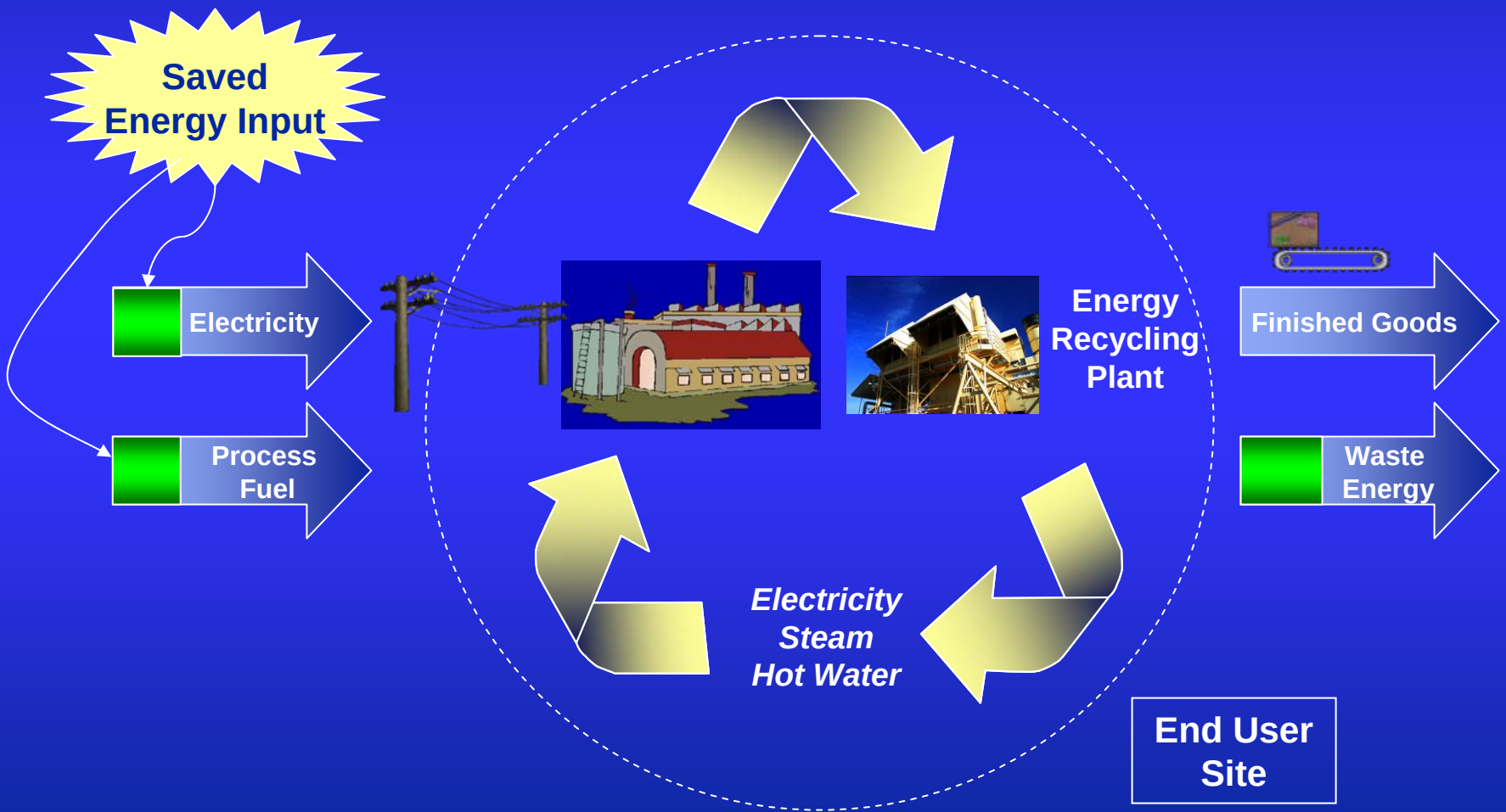
What is Recycled Energy?

- Recycled energy is useful energy derived from:
  - Exhaust heat from power generation or industrial processes
  - Tail gas that would otherwise be flared
  - Pressure drop in steam or any gas
- Promoting energy recycling is a ‘blue box’ energy policy

Decentralized Generation Option
Combined Heat and Power



Industrial Energy Options



Backpressure Turbine-generators Extract Electricity from Gas/Steam Pressure Drop

High Pressure steam in

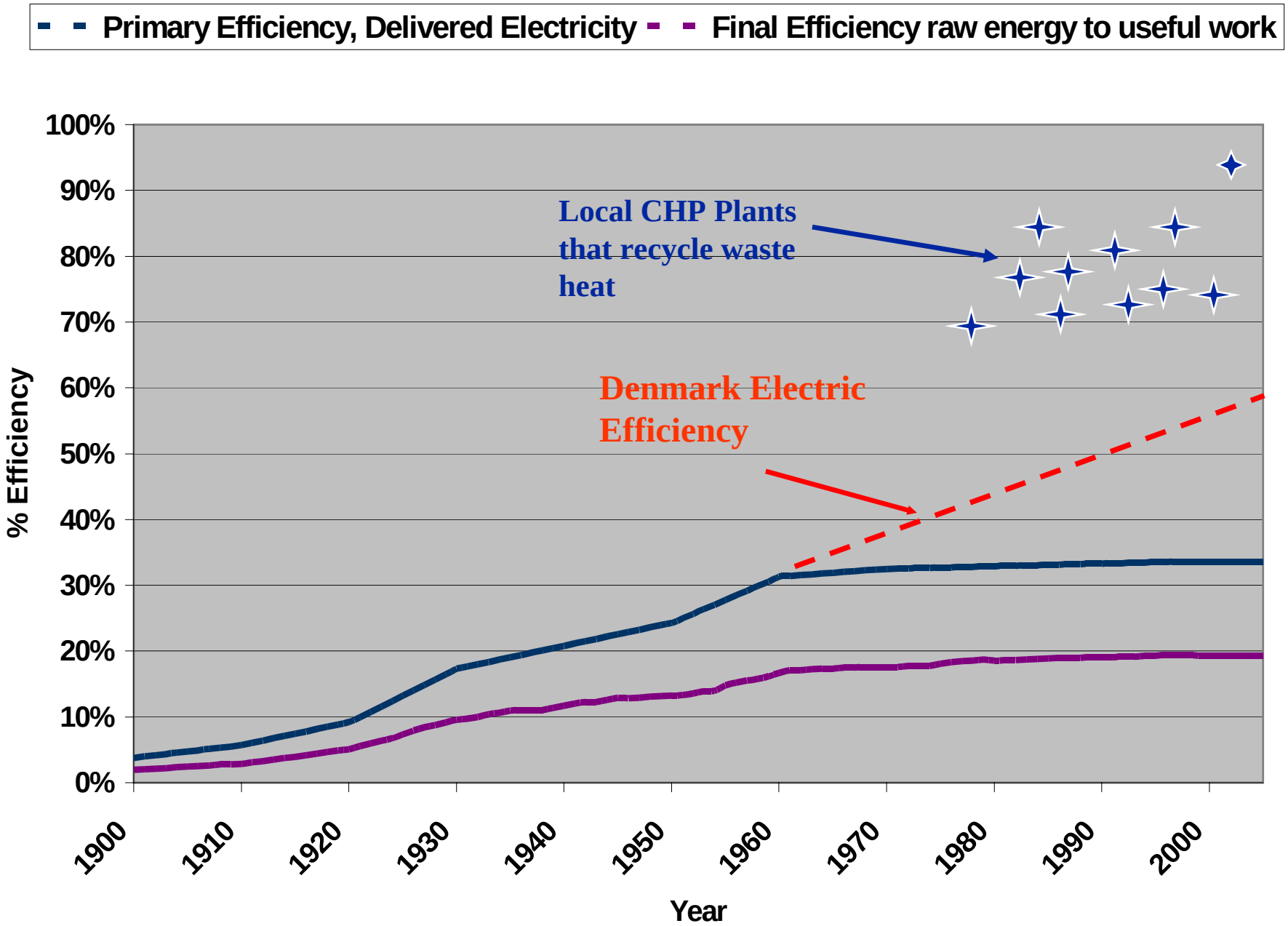
Low Pressure steam out

Extracted kWh reduces steam price

Potential applications save money at industrial plants, hospitals, universities, and district energy systems and natural gas city gates

Industrial Energy Recycling
90 MW Recycled from Coke Production

US Electric Efficiency,1900-2005



Energy Recycling Impact on the Grid

- **Local generation reduces grid loading, line losses and need for new T&D**
- **Local generation stabilizes voltages and reduces vulnerability to extreme weather and terrorists**
- **Only local generation can recycle waste energy; it is not economic to recycle waste energy from remote generation plants**

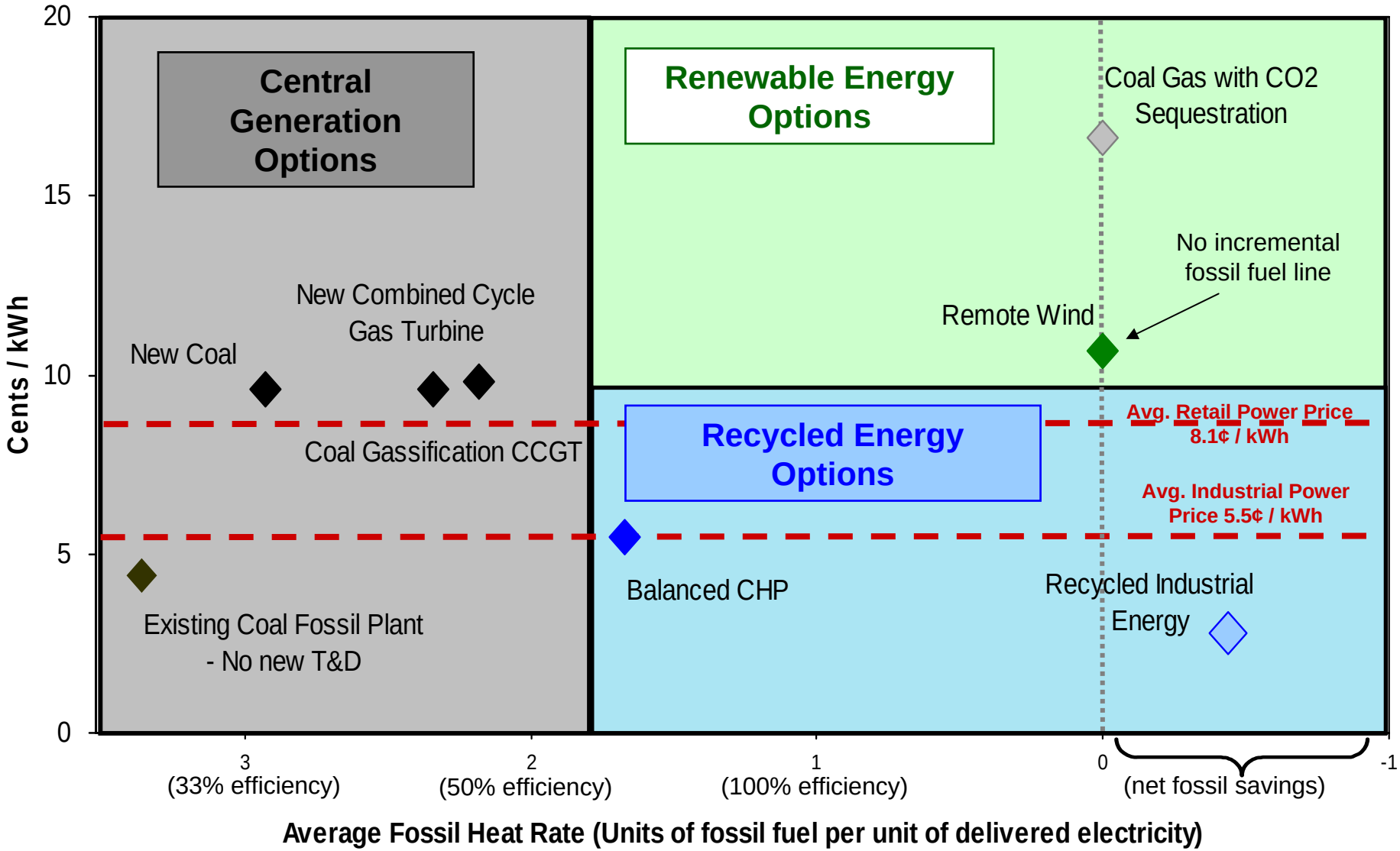
What About Economies of Scale?

Skeptics claim local generation will raise capital costs

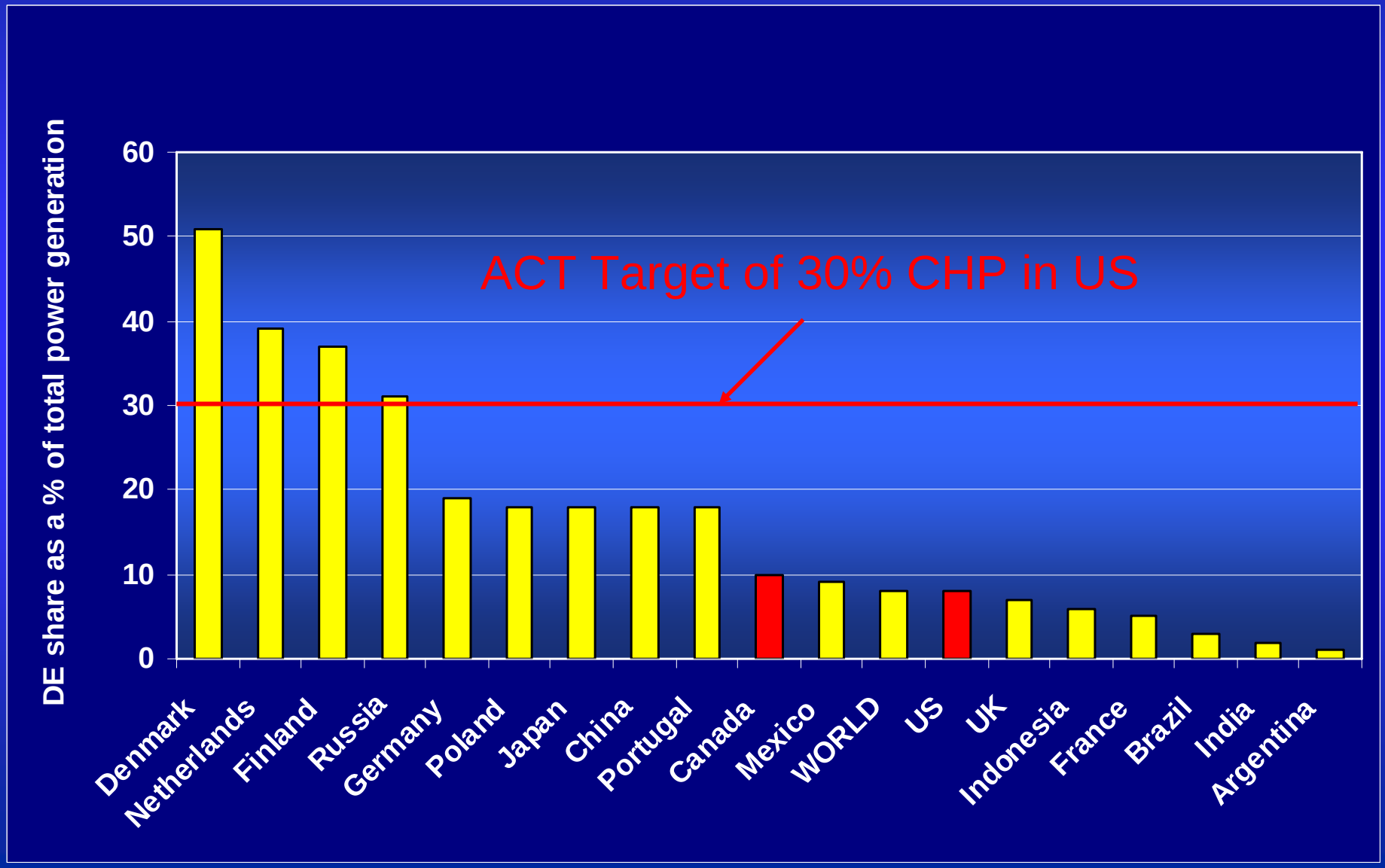
Economies of Scale?
Central versus Decentralized Generation

	Generation	Transmission & Distribution	Total / kW of Generation	KW required/ kW Load	Total costs/ kW New Load
Central Generation	$890	$1380	$2,270	1.44	$3,269
Local Generation	$1,200	$138	$1,338	1.07	$1,432
Savings (Excess) of Central vs. Local Generation	$310	$1,242	$1,068	0.37	$1,837
Central generation capital as a % of local capital	74%	1000%	213%	135%	228%

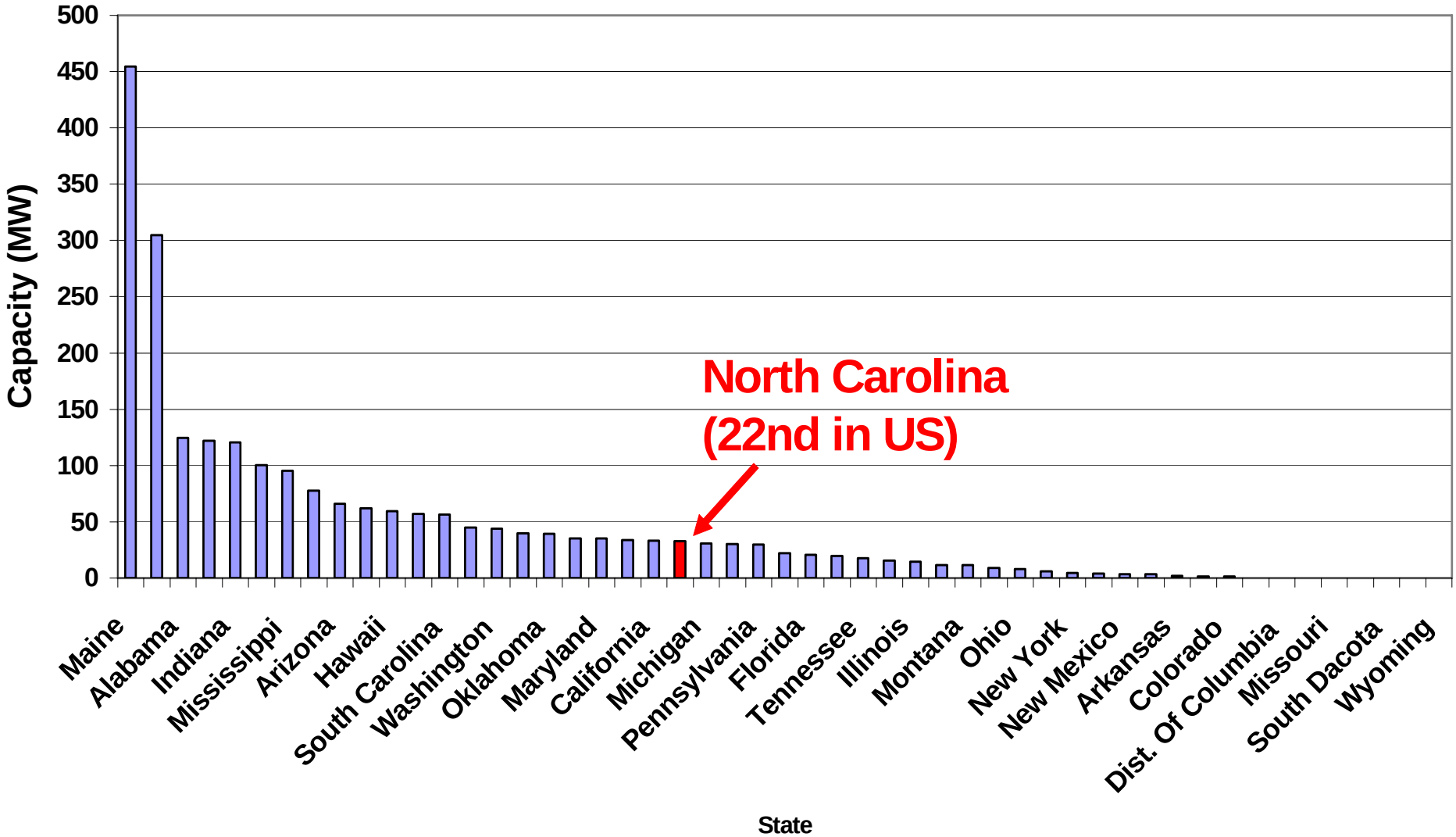
Future Generation Options



Comparative Deployment of Combined Heat and Power in 2004



Instaled Recycled Energy Capacity per capita (millions)



NC Industry Recycling Potential

- **Steel**
  - **Blast furnace gas, exhaust heat, pressure drop**
- **Refineries and chemical factories**
- **Natural gas pumping station exhaust**
- **Pressure drop at gas delivery points**
- **Glass & fiberglass factory exhaust heat**
- **Sewage gas, landfill gas, biomass, construction waste, recycled carpet, other**
- **All process thermal users, housing complexes, all central chilling users**

ACT Definition of Clean Technology

- **Over 57% delivered fossil efficiency (versus 33% for US central generation)**
- **GHG emissions less that one unit of coal-equivalent per unit of electricity (equal to 100% coal efficiency)**
- **No limits on size, technology, fuel, or location**

Two Barriers to Clean Technology

- **Barriers to local generation:**
  - **Interconnection costs and hassle**
  - **Standby charges**
- **Many clean technology benefits are not available to the facilities that create the benefits:**
  - **T&D avoidance**
  - **Line loss avoidance**
  - **Health and environmental savings**

ACT Proposals to spur Clean Technology

- **Require distribution utilities to interconnect with clean technology plants, add to rate base**
- **No standby charges for clean tech facilities**
- **Permit clean technology as ‘pollution control’**
- **Statewide standard offer for clean technology to satisfy expected load growth, no size or time limits**
  - **Pay current market wholesale price for power and,**
  - **Pay half of calculated benefits that clean technology creates – roughly 4 to 6 cents per kWh**

Stimulating Recycling of Industrial Waste Energy

- State insure risk of industrial shutdown
- Provide limited loan guarantees for new industrial energy recycling plants
  - Payable only if host ceases to provide waste energy
  - Covers risk of industries ceasing production, creates a virtuous cycle
  - Will trigger an industrial boom in NC
  - Costs offset with added income taxes

Recycled Energy Benefits

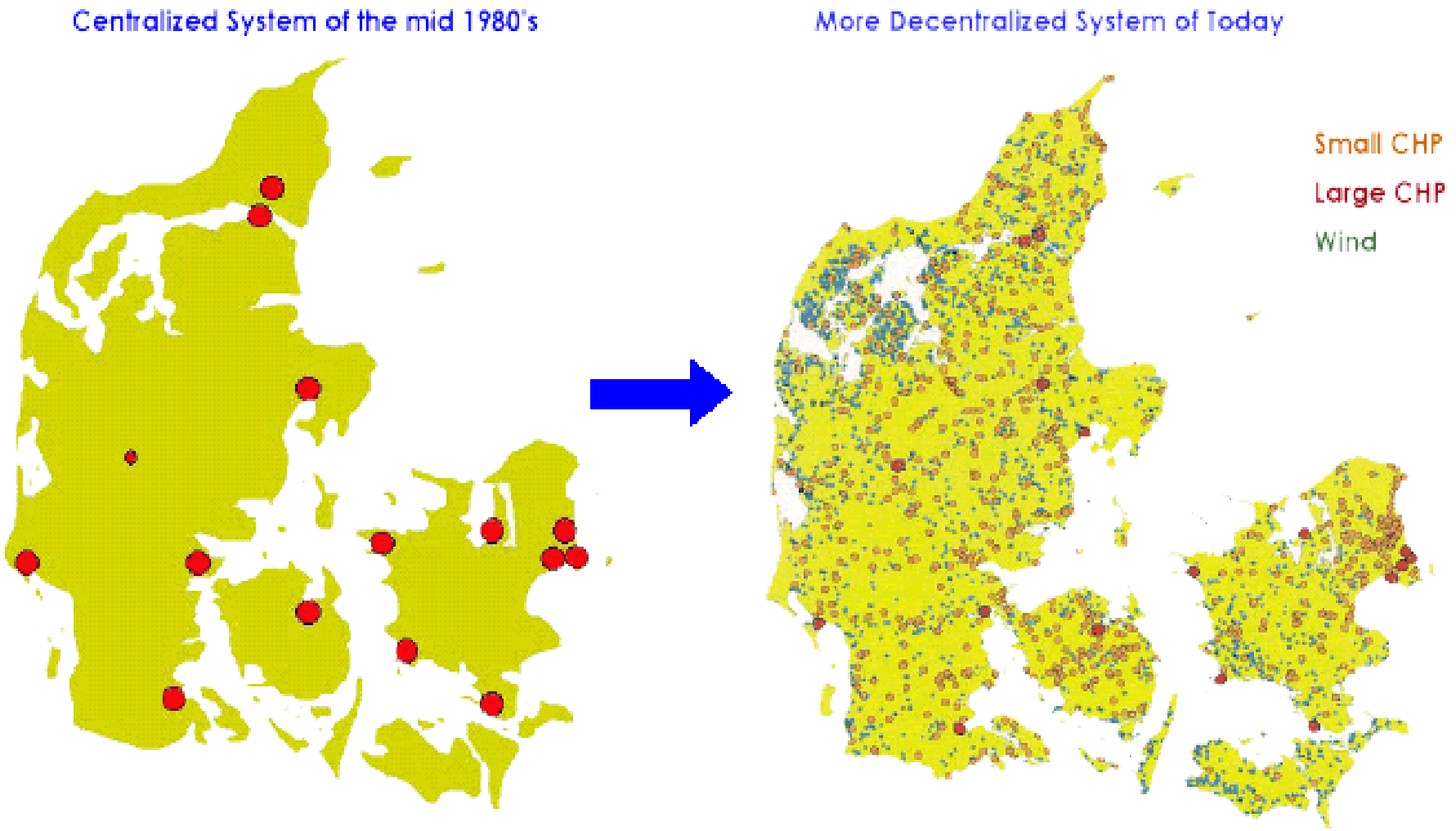
- **New Investment**
- **Job Creation**
- **New Revenue Streams for NC Industry**
- **Improved Industrial Competitiveness**
- **Public Sector Gains**

Conclusions: A Convenient Truth

Energy Recycling Solves Multiple Problems

- **NC can 'mine' industrial waste energy, create added revenue streams for industry**
  - **Recycle to provide affordable, clean energy**
- **Requires unconventional, innovative governance**
  - **Remove barriers to efficiency**
  - **Pay part of T&D and health savings to facilities that create those savings**
  - **Treat energy recycling as pollution control devices for environmental permits**

Denmark Changed in Two Decades




Thank you