Green Energy: An Ontario Perspective

Glenn Fox

Department of Food, Agricultural and Resource Economics, University of Guelph

Overview of Presentation

- Policy Development in Ontario
- Review of the Danish Experience
- Review of the German Experience
- Recent Criticisms of Ontario's approach
  - Environmental Criticisms
  - Political Criticisms
  - Economic Criticisms
- Implications

Policy Development in Ontario

- Green Energy Act introduced in the Ontario Legislature in February, 2009

- Passed in May, 2009

- The culmination of a policy development process established in 2003

Policy Development in Ontario

Rationale for Policy

- Environmental Stewardship
  - Reduce ghg emissions
  - Phase out coal
- Industry Innovation and Leadership
  - Supply equipment to expected US market
- Emulate European experiences

Policy Development in Ontario

Main Elements of Policy

- "Steamlined"approval process
- Feed in tariffs

Policy Development in Ontario

•The Green Energy Act was proposed by the Ontario Green Energy Alliance, a coalition of environmental groups, the Ontario Sustainable Energy Association, trade associations, equipment manufacturers and developers

•According to Deborah Doncaster, Executive Director of the Community Power Fund, and founding Executive Director of the Ontario Sustainable Energy Association,

> "This government likes Acts. We wrote the legislation."

Feed in Tariffs in Ontario

Feed in Tariffs - Ontario, August 13, 2010

Production System		*Size*	*Contract Price (¢/kwh)*
Biomass		≤10MW	13.8
		>10 MW	13.0
Biogas	*On-Farm*	≤100 kW	19.5
		>100 kW ≤250 kW	18.5
	Off Farm	≤500 kW	16.0
		>500 kW ≤10MW	14.7
		>10 MW	10.4
Waterpower		≤10 MW	13.1
		>10 MW	12.2
Landfill Gas		≤10MW	11.1
		>10 MW	10.3
SolarPV	*Rooftop*	≤10kW	80.2
		>10 kW ≤250 kW	71.3
		>250 kW ≤ 500 kW	63.5
		>500 kW	53.9
	Ground Mounted	≤10 kW	64.2
		>10 kW ≤10MW	44.3
Wind	*Onshore*		13.5
	Offshore		19.0

Feed in Tariffs in Ontario

- According to Keith Stelling
  - the average producer price paid for electricity from other conventional sources in 2009 was 3.23 cents per kwh
  - it will cost $5 billion to construct the additional transmission lines and infrastructure to collect electricity anticipated under the Green Energy Act

Wind Energy in Ontario

Electricity Production from Wind in Ontario

Current Installed Capacity	*Additional Planned Capacity*	*Actual Output*
Amaranth Wind Farm (200 MW) Prince Wind Projects (I and II) (189 MW) Kingsbridge Wind Power (40 MW) Ripley Wind Power Project (76 MW) Kruger Energy Port Alma Wind Power Project (101 MW) Underwood Wind Farm (182 MW) Port Burwell Wind Farm (99 MW) Wolfe Island Wind Power Project (198 MW)	2010 Byran Wind Project (64.5 MW) Raleigh Wind Centre (78 MW) 2011 Raleigh Wind Centre (78 MW) Greenwich Wind Farm (99 MW) Talbot Wind Farm (99 MW) Kruger Energy Chatham Wind Project (101.2 MW) 2012 Gosfield Wind Project (50 MW)	**132 MW** **12.2% of capacity, during record setting heat wave!** 11 am to 12 noon, September 2, 2010
Total Installed Capacity – September 2, 2010 1085 MW	Total Additional Capacity by 2012 569.7 MW	

Review of the Danish Experience

CEPOS
Center for Politiske Studier

September 2009

WIND ENERGY

THE CASE OF DENMARK

CEPOS Landgreven 3, 3. Copenhagen, Denmark +45 33 45 60 30 www.cepos.dk

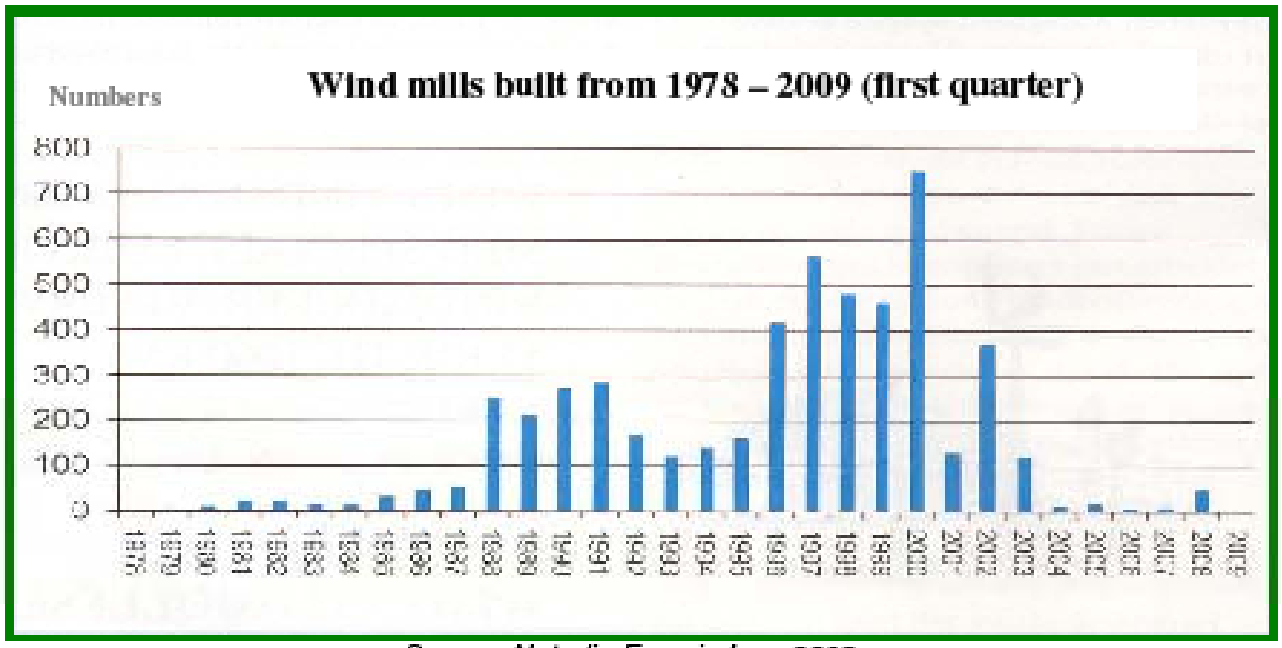
Review of the Danish Experience

- **Claim** – Denmark generates ~20% of its electricity demand from wind energy
- **Reality** – total wind production/total consumption ~= 20%. But ½ to ¾ of the electricity generated from wind in Denmark over the last 5 years is not consumed in Denmark
  - Wind energy production is not synchronized with demand
  - Surplus wind electricity is exported (at a low price) when production is high and demand is low and then electricity is imported (from Norway and Sweden) at a higher price when demand is high.
  - The technical feasibility of the Danish system is made possible by integrated electricity trading arrangements with Sweden and Norway, whose hydroelectric capacity are used to cover Danish surpluses and shortages

Review of the Danish Experience

- Danish electricity prices are the highest in the EU
- The implicit export subsidy for Danish wind energy is estimated as over 900 million euros from 2001-2008
- Wind energy in Denmark has reduced ghg emissions at a cost of ~$124 per metric ton of CO_2
- Many 10 to 15 year old turbines are past their useful life
- The Danish turbine manufacturing industry has a strong global position, as a result of domestic subsidies. But it would not be able to compete without these subsidies.
  - The subsidy per job created is ~ $90,000 to $140,000
  - Value added per employee is 13% below the Danish national average

Review of the Danish Experience



Source: *Naturlig Energi, June 2009*

Review of the Danish Experience

"Achieving own-consumption of all its wind power is technically impossible in the short term and will remain entirely hypothetical until electricity consumption rises and new technical and demand-side solutions have been developed and implemented. In most cases, these have yet to be even invented, let alone proven and costed."

CEPOS Report, 2009

Review of the German Experience

Review of the German Experience

•Feed in tariffs introduced in 1991

". . German renewable energy policy, and in particular the adopted feed in tariff scheme, has failed to harness the market incentives needed to ensure a viable and cost-effective introduction of renewable energies into the country's energy portfolio"

•By setting prices for different categories defined as renewable rather than setting a renewable price and letting alternative methods of production compete

Review of the German Experience

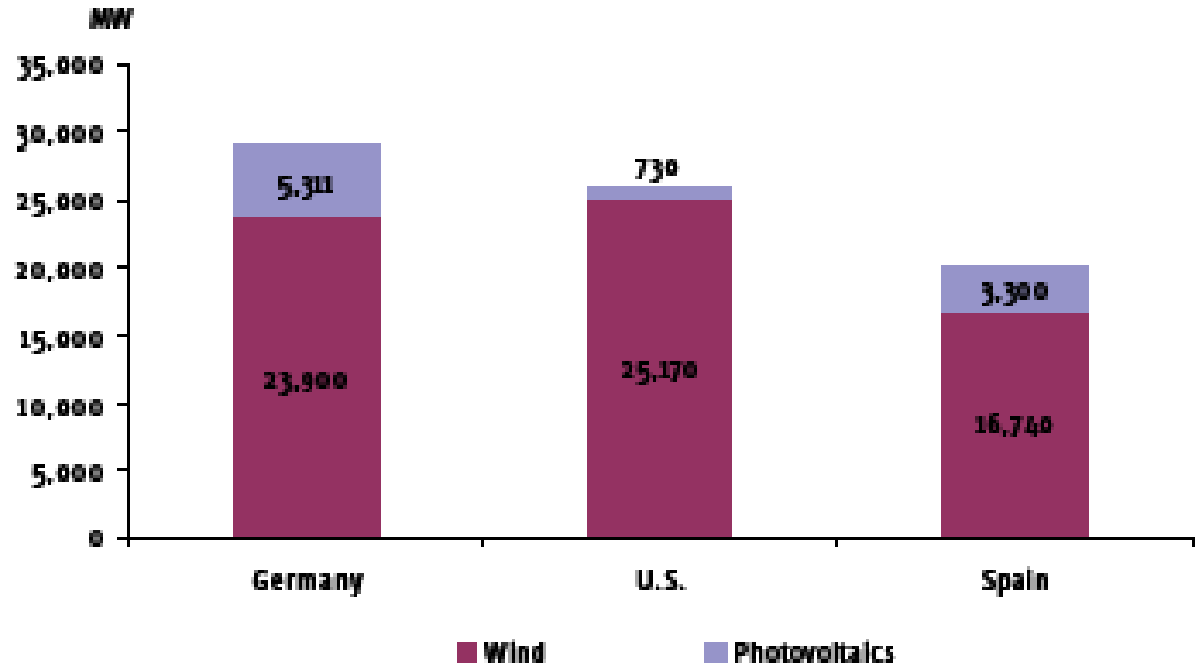
Table 1: Technology-Specific Feed-in Tariffs in Euro Cents per kWh

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Wind on-shore	9.10	9.10	9.00	8.90	8.70	8.53	8.36	8.19	8.03	9.20
Wind off-shore	9.10	9.10	9.00	8.90	9.10	9.10	9.10	9.10	8.92	15.00
Photovoltaics	50.62	50.62	48.09	45.69	50.58	54.53	51.80	49.21	46.75	43.01
Biomass	10.23	10.23	10.13	10.03	14.00	13.77	13.54	13.32	13.10	14.70
Mean Tariff	8.50	8.69	8.91	9.16	9.29	10.00	10.88	11.36	12.25	--

Sources: BDEW (2001 through 2009), EEG (2000, 2004, 2009)

Review of the German Experience

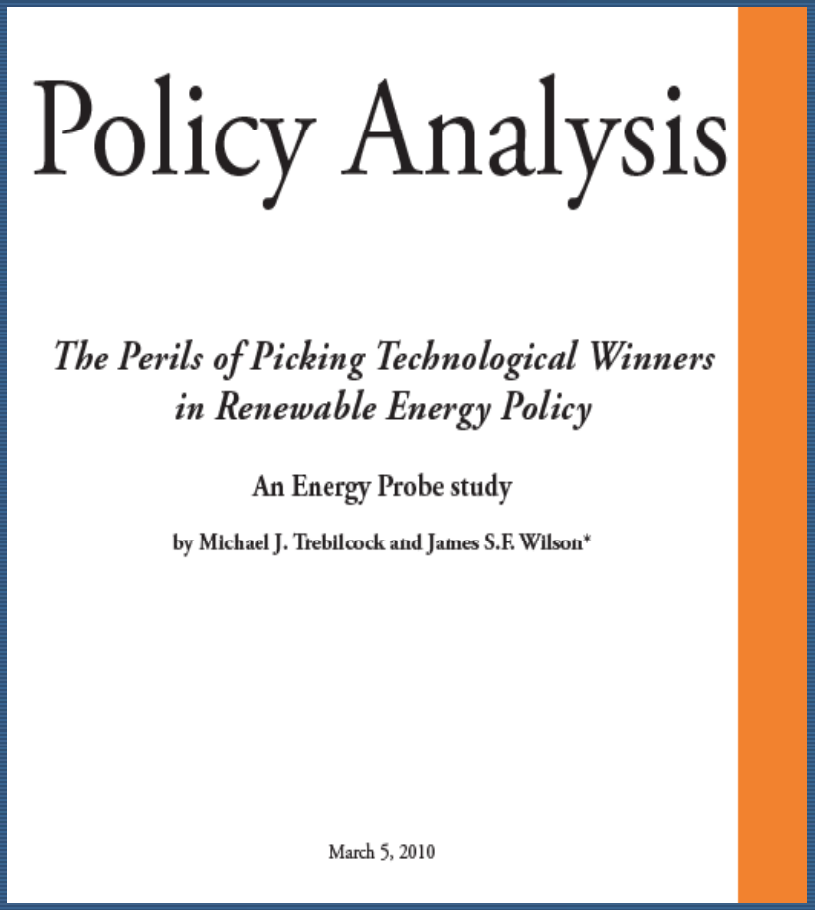
Figure 3: Installed Capacities of Wind Power and PV in 2008 (REN21)



Review of the German Experience

- 2009 policy amendment extended 20 year guarantee of prices to new facilities
- However, German feed in tariffs are stated in nominal terms
- Estimated ghg emission reduction costs of 716 to 1000 euros per metric ton of CO_2 for photovoltaic and 54 euros per metric ton for wind
- Indirect effect of increased consumer prices for electricity reduces employment outside of the electricity production industry
- Innovation stifled by price structure differentiated by renewable energy type

Recent Criticisms of Ontario's Approach



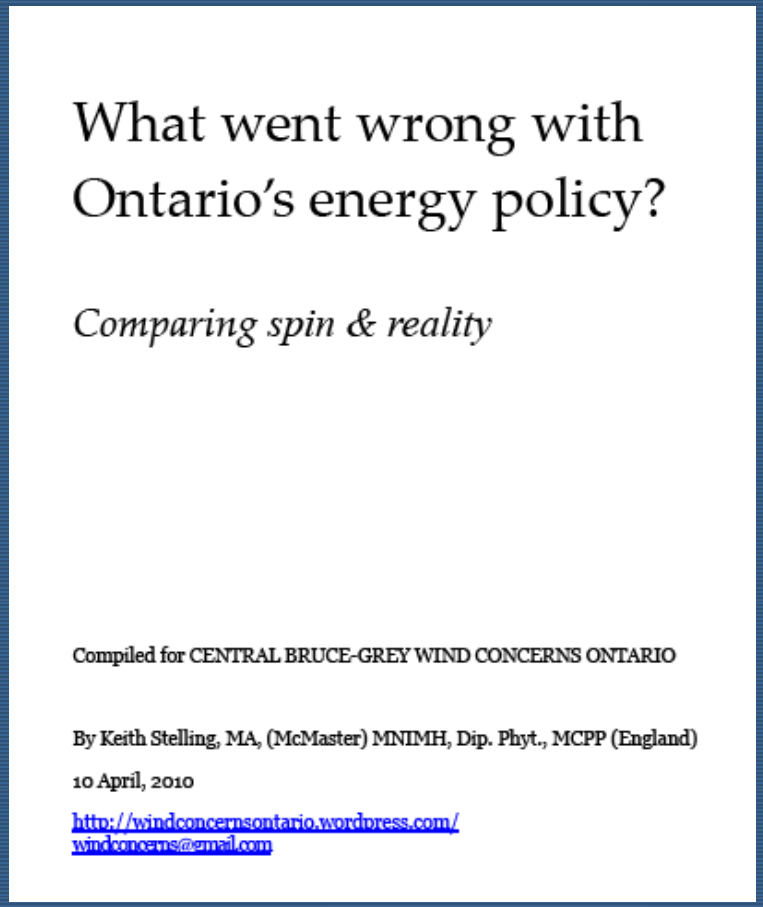
Policy Analysis

The Perils of Picking Technological Winners in Renewable Energy Policy

An Energy Probe study

by Michael J. Trebilcock and James S.F. Wilson*

March 5, 2010



What went wrong with Ontario's energy policy?

Comparing spin & reality

Compiled for CENTRAL BRUCE-GREY WIND CONCERNS ONTARIO

By Keith Stelling, MA, (McMaster) MNIMH, Dip. Phyt., MCPP (England)

10 April, 2010

http://windconcernsontario.wordpress.com/
windconcerns@gmail.com

Recent Criticisms of Ontario's Approach

Recent Criticisms of Ontario's Approach

"In summary, a failure to articulate the real costs and tradeoffs involved in the transition to a green economy, coupled with aggressive action based on untested assumptions or short-sighted political calculations, may have deleterious effects for the environment as well as environmental policy in the long term."

Trebilcock and Wilson, March 2010

•Policy in Ontario is often motivated by a desire to replicate European experience, especially Denmark and Germany

Recent Criticisms of Ontario's Approach

Environmental Criticisms

- The need for backup supply (fossil fuel driven) offsets ghg emissions reductions

- Bird and Bat mortality
  - ~1800 animals at the Wolfe Island wind farm during its first 8 months of operation

- Human health effects from noise and vibration

- Viewscape and property value effects

Recent Criticisms of Ontario's Approach

Political and Legal Criticisms

- Facility approval process is not subject to existing local zoning and permitting processes

- Also bypass Ontario Energy Board (OEB), the electricity regulatory authority

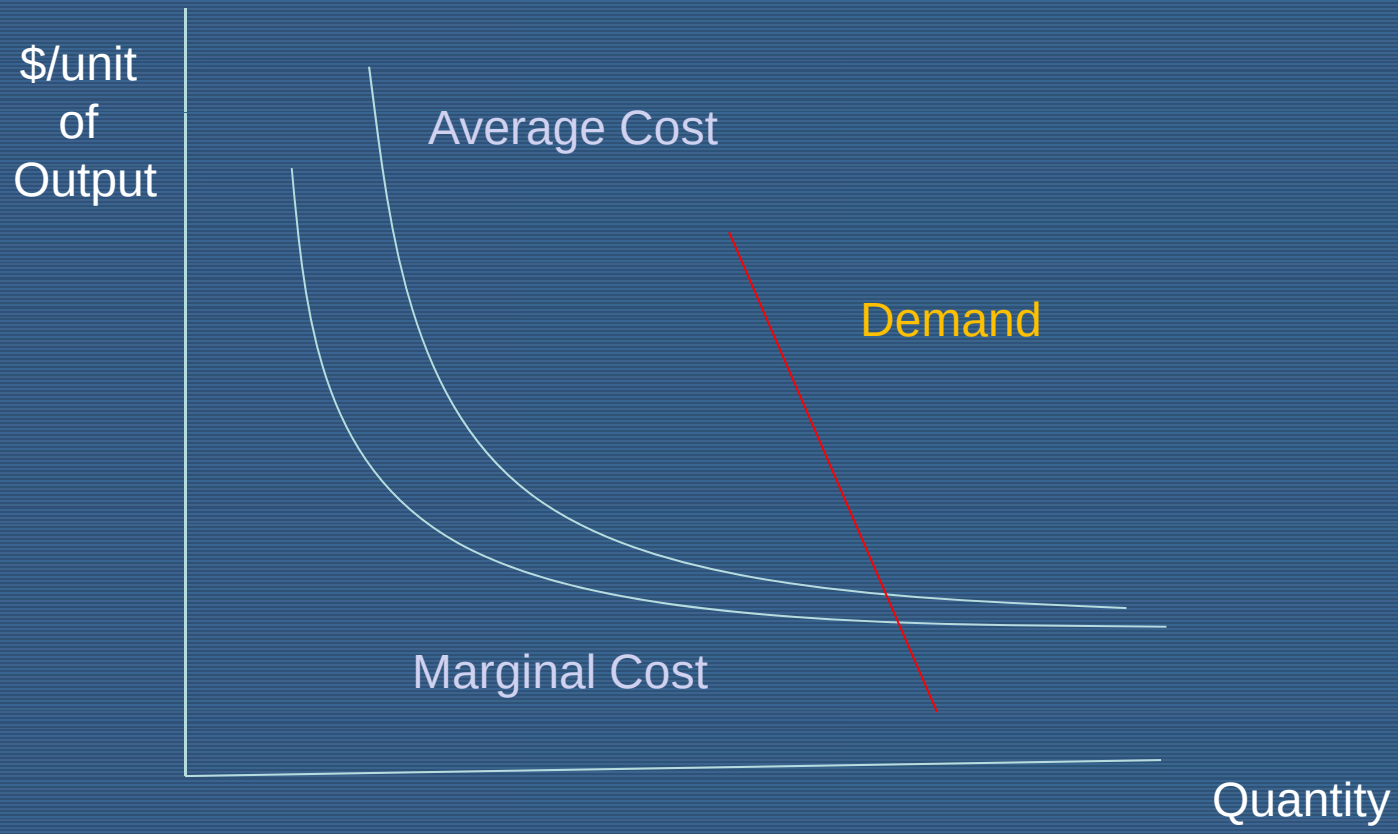
- Accusations of conflicts of interest between the Government of Ontario and the Ontario Green Energy Act of Ontario

Recent Criticisms of Ontario's Approach

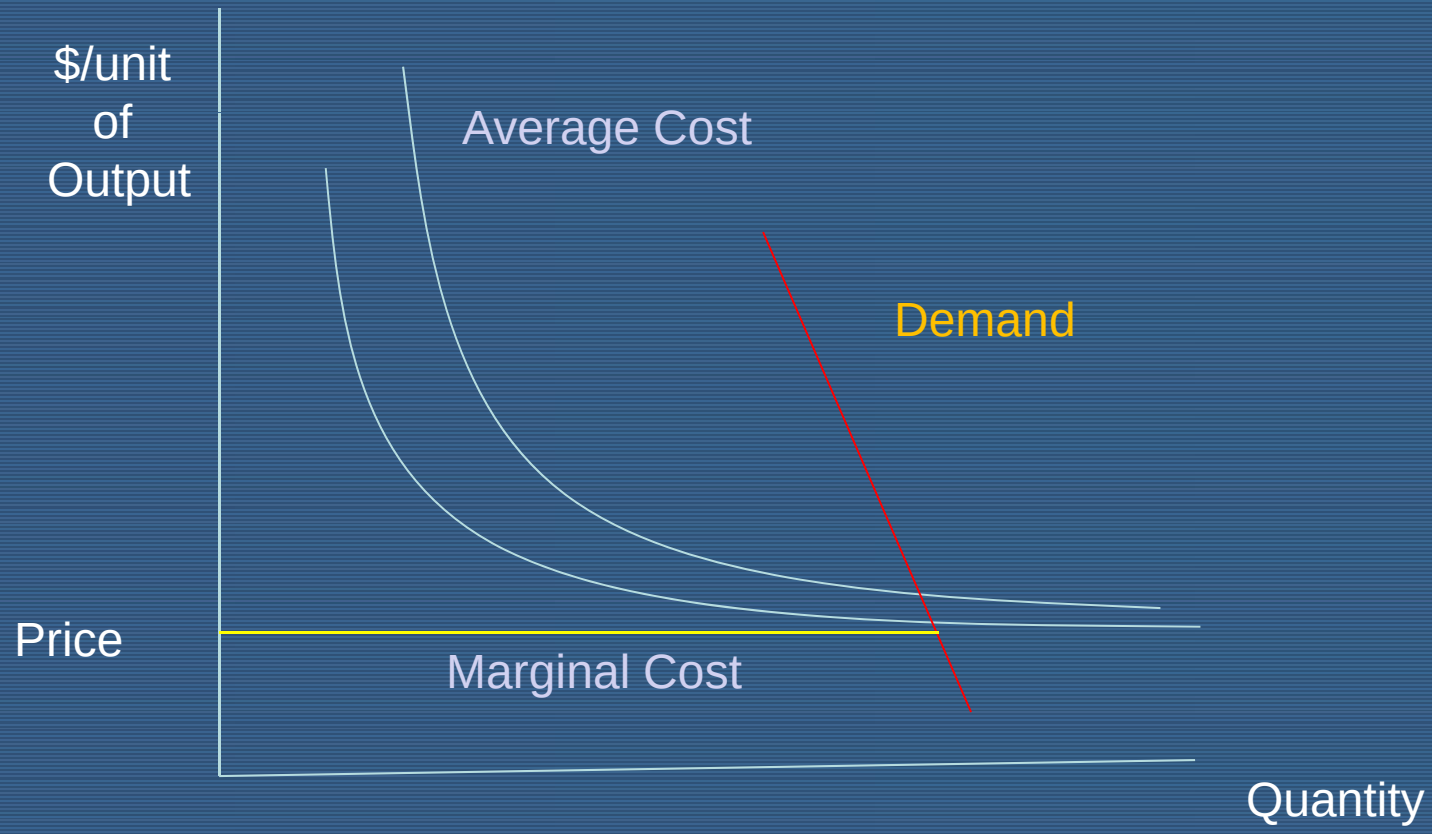
Economic Criticisms

- Less frequently made, but may be ultimately the most important
- Costly approach to restructuring electricity system
- Infant Industry argument

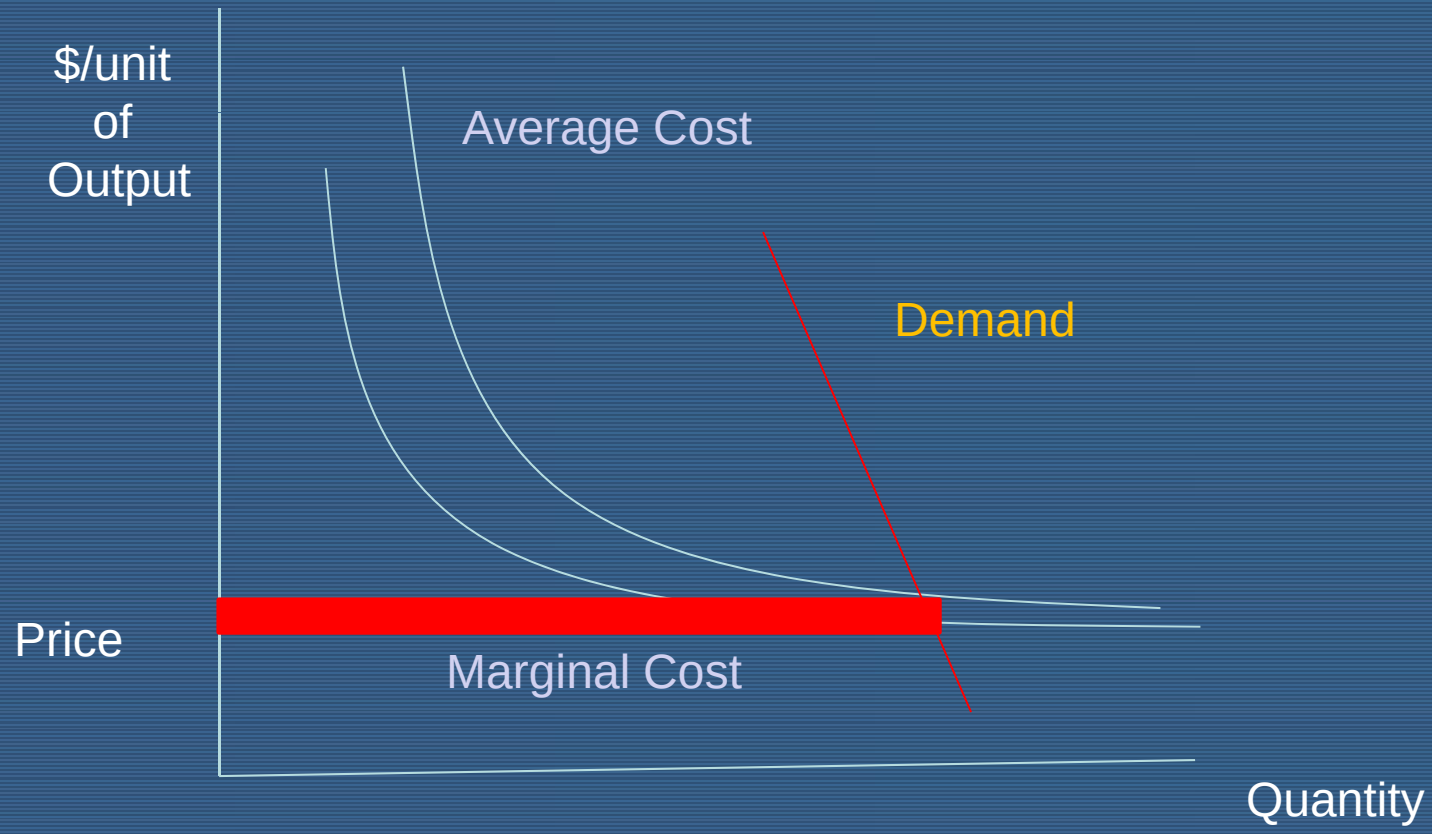
Simplified Economics of Electricity of Utility Regulation – "Natural Monopoly"



Simplified Economics of Electricity of Utility Regulation – "Natural Monopoly"



Simplified Economics of Electricity of Utility Regulation – "Natural Monopoly"

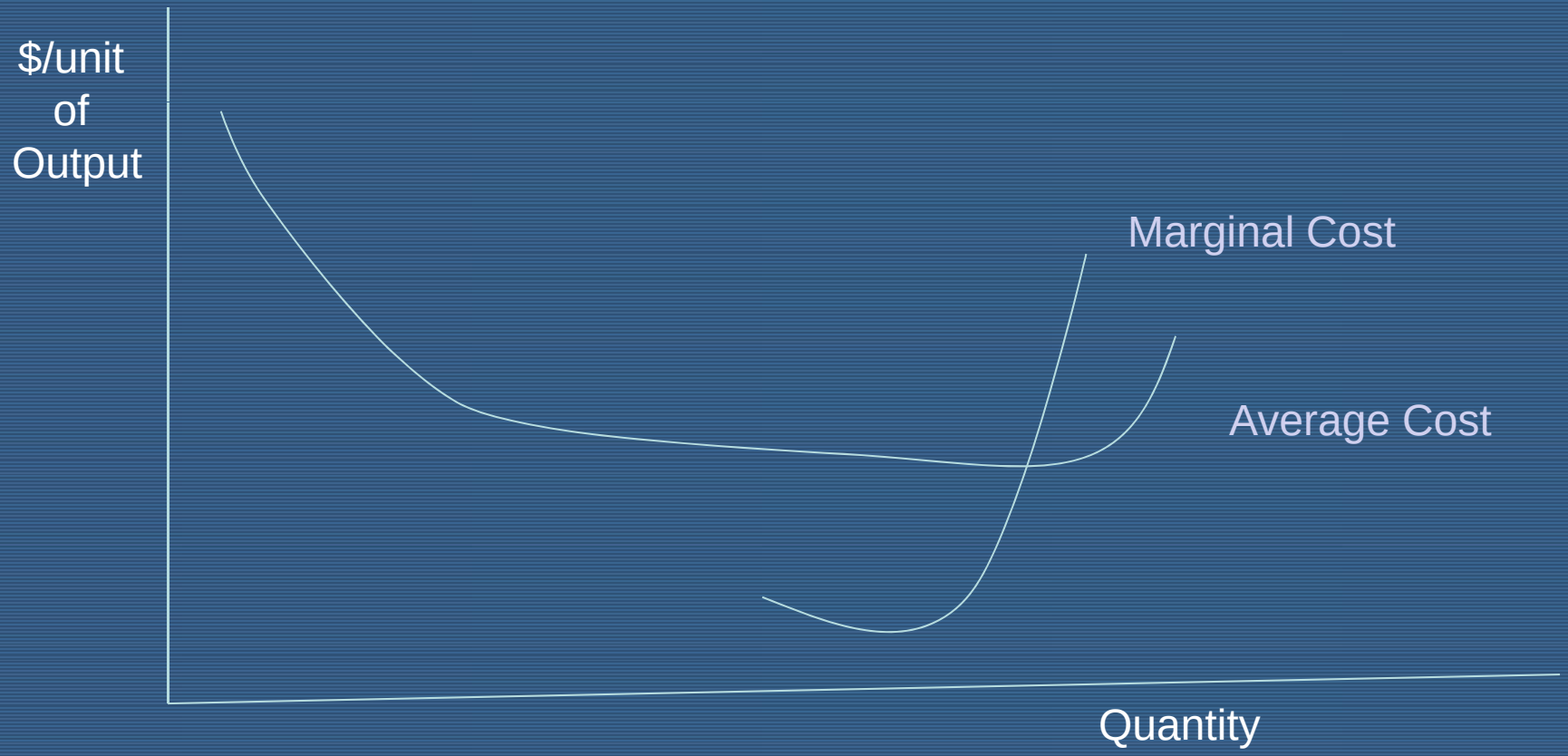


Solution: Two part tariff

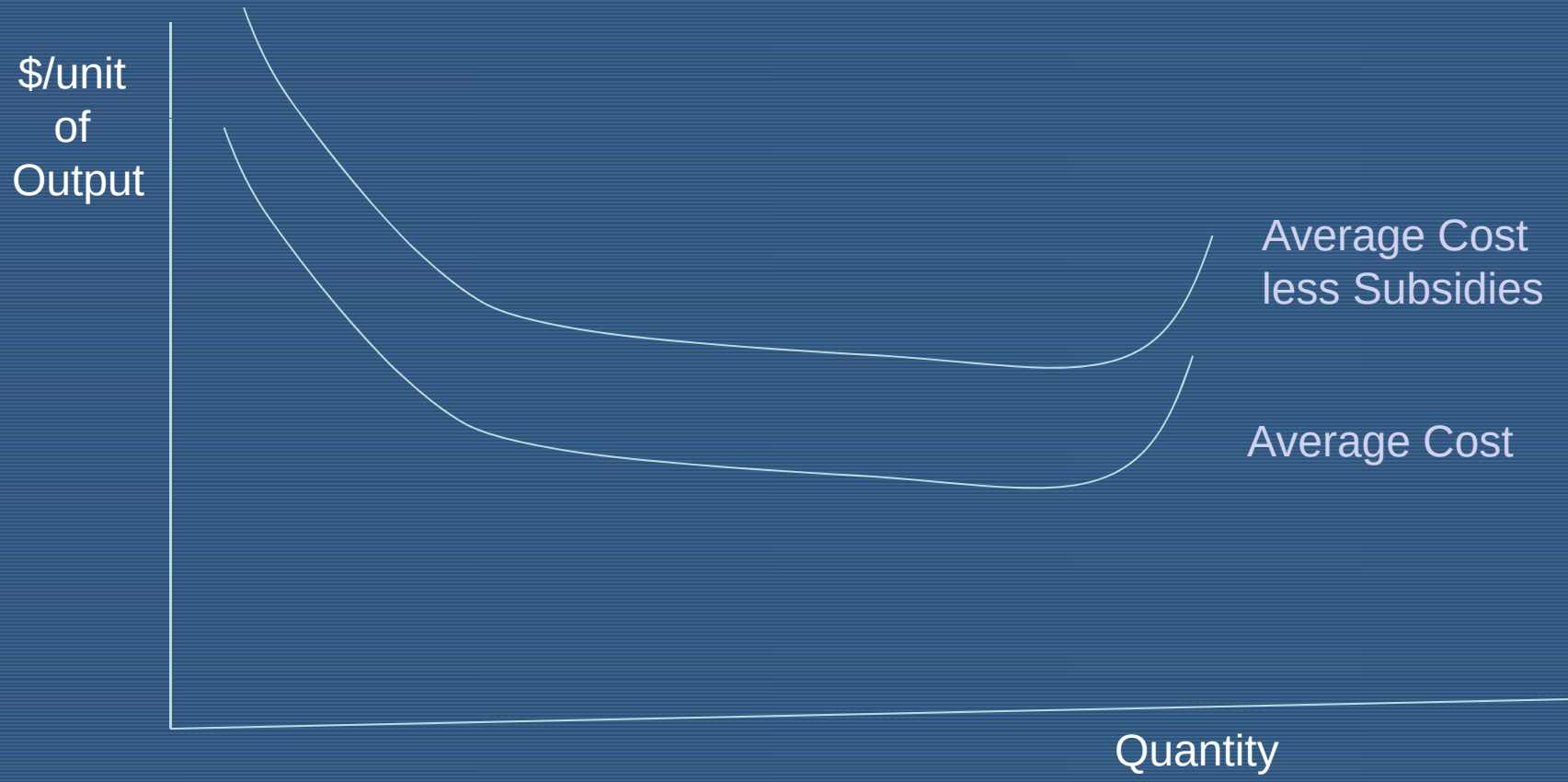
- Set price equal to marginal cost, to determine the level of output

- Add a charge that spreads the red area losses over this output to each customer's bill

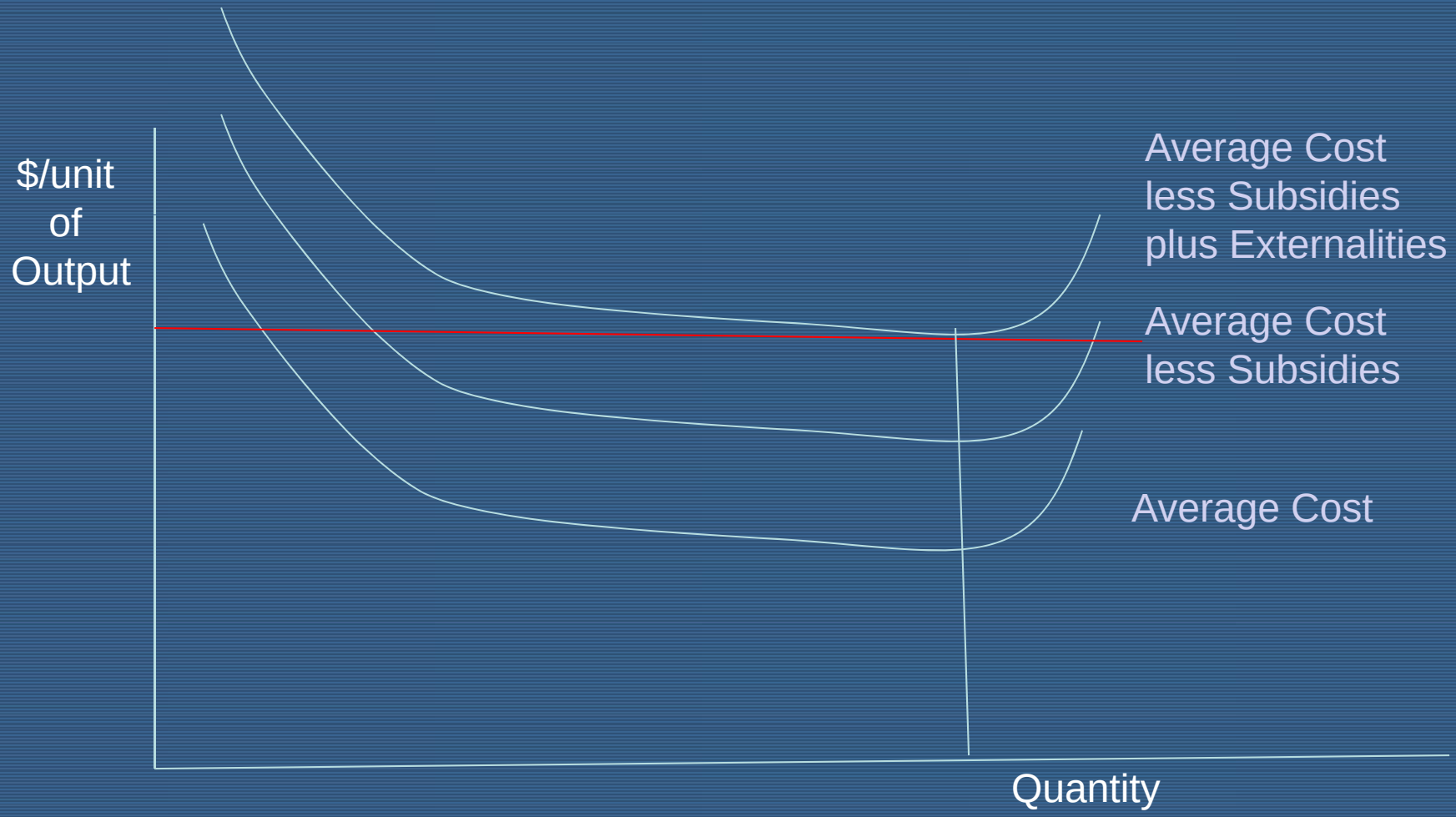
Not So Simplified Economics of Utility Regulation – Subsidies and Externalities



Not So Simplified Economics of Utility Regulation – Subsidies and Externalities



Not So Simplified Economics of Utility Regulation – Subsidies and Externalities



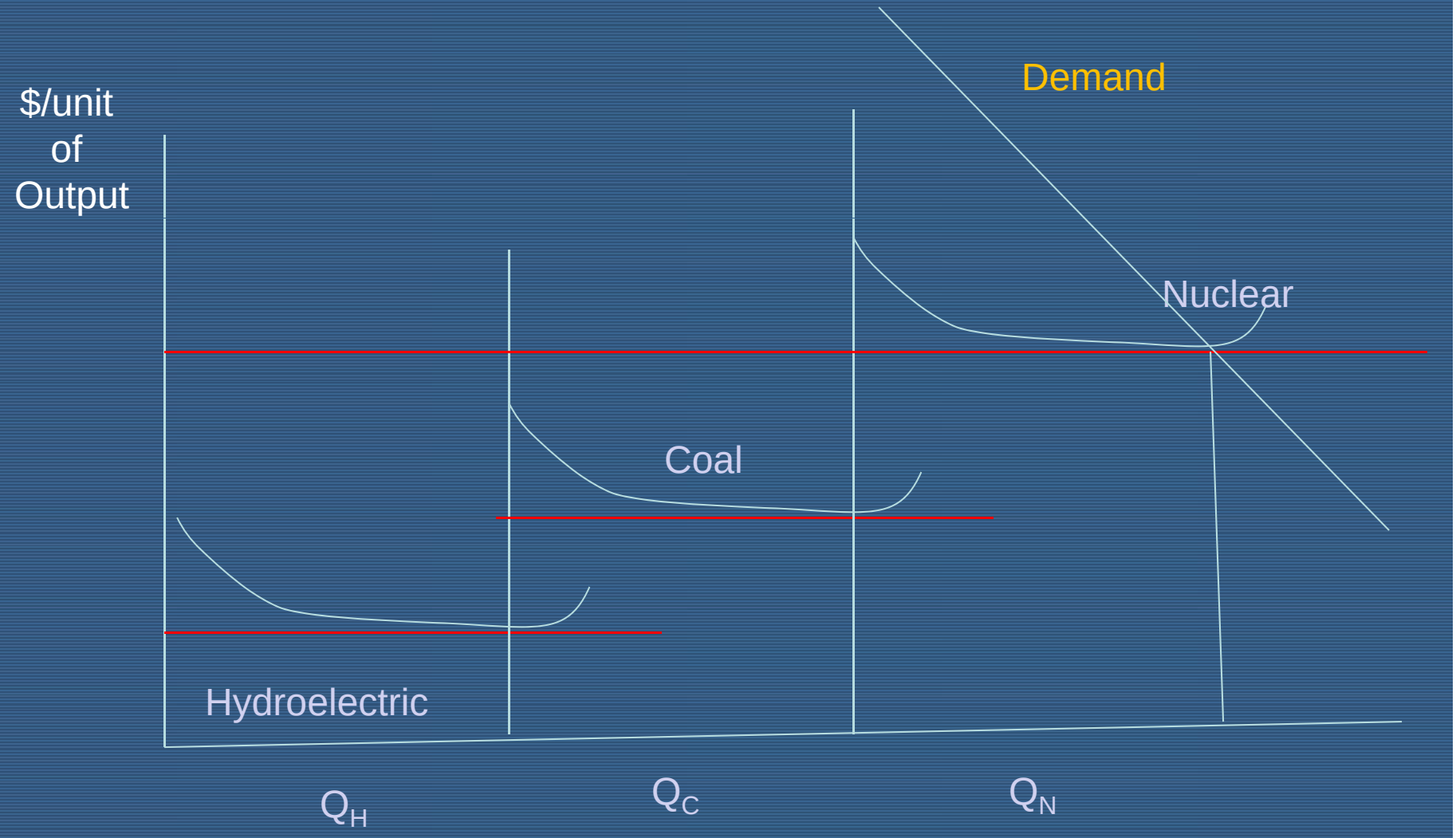
Multiple Sources of Supply: The Efficiency Approach

- Hydroelectric
- Nuclear
- Coal
- Natural Gas

Each has its own cost structure

Cost structure determines market share

Multiple Sources of Supply: The Efficiency Approach



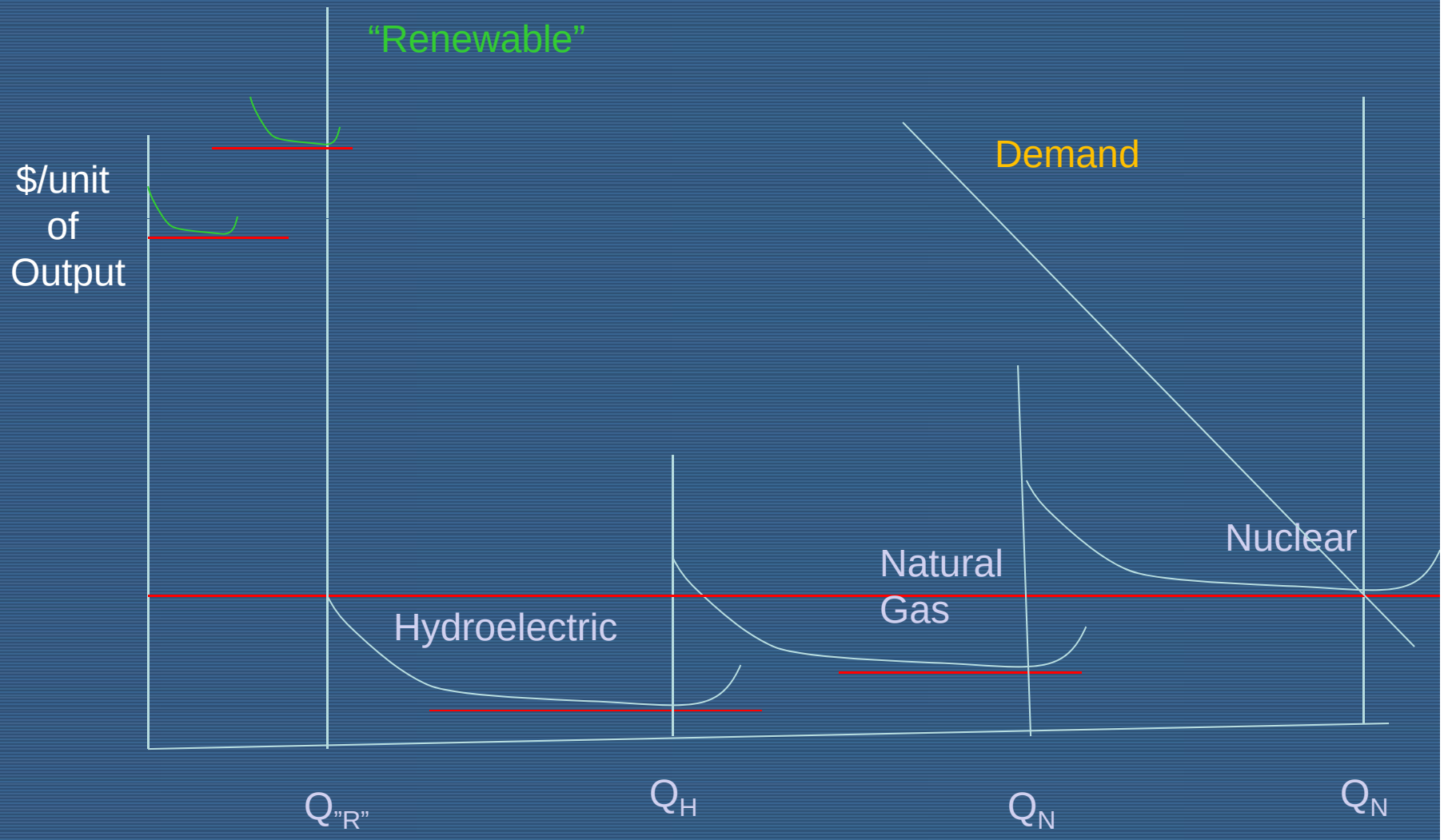
Multiple Sources of Supply: The Quota Approach

- Predetermine market shares for certain categories of supply
- Estimate unit costs
- Set “Feed in Tariffs” to attract supply to fill quotas

Implications of the Quota Approach

- Lack of competition among alternative sources of renewable energy
- Higher cost structure
- Problems of estimation of required levels of feed in tariffs

Multiple Sources of Supply: The Quota Approach



Summary

- The accelerated development of wind and more recently solar powered electricity production systems is transforming rural Ontario – and has become one of the most divisive issues in rural policy in the province

- The motivation for the development of these systems was based on a desire to emulate experiences in other jurisdictions, especially Denmark and Germany, and to promote industrial development in wind and solar electricity production

Summary

- Recent legislation was developed by a consortium of environmental and commercial interests

- Recent studies of the Danish and German experiences indicate that there are critical limitations to these approaches

- Environmental, legal, political and economic criticisms of Ontario's approach are emerging

Implications

- It appears that the economic model underlying the Green Energy and Green Economy Act is not sustainable – who will pay for the anticipated higher electricity costs?
  - Taxpayers?
  - Ratepayers?
- Will the financial pressures lead to policy change?
- If yes, who will be left holding the stranded assets?

Costs and Revenues of Wind Turbines in Ontario						
Current Capacity and Estimated Cost			Revenue			
Installed Capacity	*Cost per MW*	*Total Cost*	*100% capacity*	*50% capacity*	*29% capacity*	*10% capacity*
1085MW	$2.5 million	$2.71 billion	1085 MW x 1000 x $0.135 per kwh x 24 hours ~ = $3.5 million per day, ~$1.28 billion per year	~$638 million per year	~$371million per year	~$128 million per year
		Producer Revenue per Year/Cost	47%	24%	14%	4.7%

Implications

- Will the hoped for environmental benefits and industry development be realized?
- Do “Infant Industries” ever grow up?
  - The Danish experiences suggests that the answer is no
  - Will the hopes of selling technology into the US market be realized?

Implications

- Need to integrate North American electrical production and consumption systems (I hesitate to call them "markets")
  - The unrecognized difference between electrictity production and consumption systems in Europe and in North America
  - Supply risk mitigation, Less costly backup supply
  - Challenges in interprovincial relations and North American trade policy
- 2011 promises to be an interesting year in Ontario!