Britain's Electricity Supply
Here Today but Where Tomorrow?

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“Nothing in Progress can Rest on its Original Plan. We may as well think of Rocking a Grown Man in the Cradle of an Infant”

- Edmund Burke, 1777

H.M. Government Intervention in the Electricity Supply Since WW1

1919	**Electricity (Supply) Act** – Electricity Commissioners established
1922	**Electricity (Supply) Act** – Additional powers given to Commissioners
1926	**Electricity (Supply) Act** – CEB created: National Grid planned
1935	**Electricity (Supply) Act** – additional powers given to CEB
1947	**Electricity Act** – Industry nationalized
1954	**Electricity Reorganization (Scotland) Act** – SSEB set up
1957	**Electricity Act** – Electricity Council and CEGB formed
1969	Proposals for wholesale reorganization. Electricity Authority to be established to plan and control the industry
1976	White Paper proposes one single Authority in England and Wales for the industry
1980	Secretary of State for Energy announces no changes in organizational structure of the industry
1989	**Electricity Act** – Privatisation of generators and distributors
2000	**Utilities Act** – Closer alignment of regulatory structure in England, Scotland and Wales. The Act also provided a legislative framework for new electricity trading arrangements (NETA)
2003	Energy White Paper
2004	**Energy Act** – “Cleaner, greener power” via implementation of commitments made in the Energy White Paper (2003). The Act will also create single wholesale electricity market for Britain (BETTA)

The Goals of our New Energy Policy
The Energy White Paper, February 2003

- To put ourselves on a path to cut the UK's CO_2 emissions by some 60% by about 2050, with real progress by 2020.
- To maintain the reliability of energy supplies.
- To promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and improve our productivity.
- To ensure that every home is adequately and affordably heated.

The Energy White Paper, February 2003 - The Main Agenda?

"Our Energy Future – Creating a Low Carbon Economy."

"Cleaner, Smarter Energy: Policies for a Low Carbon Future."

"We will put ourselves on a Path Towards a Reduction on Carbon Dioxide Emissions of some 60% from Current Levels by about 2050."

So, What's Happened Since the Energy White Paper of February 2003?

- Passing of The Energy Act, 2004.
- Sharply Rising Fuel Prices.
- Increasing Fuel Poverty.
- Uncertain Generating Plant Spare Capacity Margin.
- Renewables: Behind the Target and just a Load of Wind!
- No Reduction in CO_2 Emissions.

‘Forces at Work’ in our Society

- Concern for the Environment.
- Health and Safety.
- Security.
- Competition.
- Short Termism and Profit.
- Low Rates of Growth of Utility Products.
- ‘Ultimate’ Democracy.
- “Little Knowledge is a Dangerous Thing” and the Internet.
- Widening Gap Between Rich and Poor.

‘Forces at Work’ on the ESI

- Environmentally Friendly Generation.
- Fuel Choice and Emissions Trading.
- Difficult Site Selection and Undergrounding.
- Not in my Back Yard (NIMBY).
- Pressure Groups for and Against Proven and Unproven Generation Technologies.
- Satisfying Governments and Regulators.
- Ignorance, Spin and PR.
- Rising Costs and Project Overruns.
- Targets, Damned Targets and Penalties.
- Profit.

The Great Debates

- Renewables: Trying to Pick Winners.
- The Nuclear Debate.
- Gas and Electricity Infrastructures – Time to Invest More Heavily.
- Fuel Mix Prices and Security.
- Life with less Carbon.

UK Government Encouragement of Renewable Generation

- Non-Fossil Fuel Obligation 1991
- Climate Change Levy 1999
- Performance and innovation Unit's Energy Review 2001
- Introduction of Renewable Obligation Certificates (ROCS) 2002
- Energy White Paper 2003
- Extended Targets and Extra Money 2004

Sources of Energy Eligible for the Renewables Obligation

Source	Eligibility
Landfill gas	✓
Sewage gas	✓
Energy from waste	Only non-fossil derived energy will be eligible. Energy from incinerating mixed waste will not be eligible. Energy from the non-fossil derived element of mixed waste using advanced technologies will be eligible.
Hydro exceeding 20MW declared net capacity (dnc)	Only stations commissioned after the date the Order is made.
Hydro 20MW or less dnc	✓
Onshore wind	✓
Offshore wind	✓
Co-firing of biomass	Eligible until 31 March 2011 for up to 25% of a supplier's obligation. At least 75% of biomass fuel to be energy crops from 1 April 2006.
Other biomass, e.g. agricultural and forestry residues	✓
Geothermal power	✓
Tidal & tidal stream power	✓
Wave power	✓
Photovoltaics	✓
Energy crops	✓

Renewables:
Some Difficulties to Overcome

- Planning & Organised Objections.
- Shortage of Technical People and Informed Opinion.
- Manufacture and Building Rates.
- Firm Capital and O&M Costs.
- Grid System Limitations.
- Distribution System Limitations.
- Price Reviews.
- Offshore Track Record and Unknowns.
- Intermittency Spare Capacity and Storage.
- Overall Wholesale Electricity Prices
- Specific “City” Fears for Renewables.

New Generation Technologies have Racing Certainties?

Technology	Contribution	Odds Against
Energy from Waste	1	10/1
Small Hydro	1	Evens
Offshore Wind	4	9/2
Co-firing of Biomass	2	5/2
Energy Crops etc	2	4/1
Geothermal	1	66/1
Tidal	1	9/2
Wave	3	8/1
Photo voltaiics	1	10/1
Micro CHP	1	4/1
Coal Gasification	4	5/1
		100/1 Bar

Notes: 15 Year Horizon

"Contribution" – 1 = <1% of Total Generation Capacity

4 = ~10% of Total Generation Capacity

"Odds Against" – Likelihood of Technology Becoming 'Mature' and Delivering "Contribution"

Who are the Carbon Culprits?

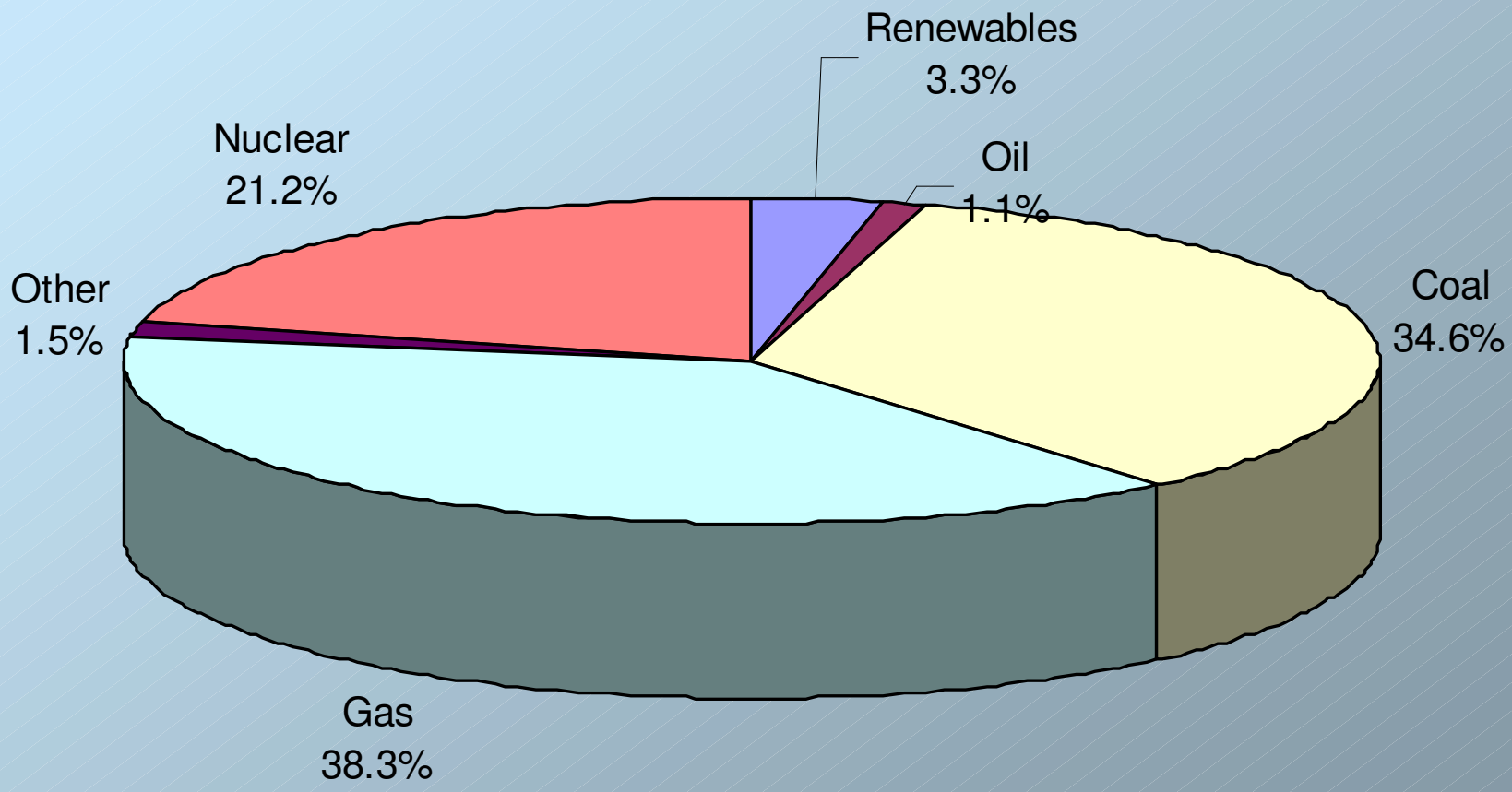
User/ Polluter	Percentage of Total UK CO_2 Emissions
* Transport	26
Industry	24
Electricity Generation	22
Domestic	14
Commercial	12
Other	2

* Fastest Growing, international air and marine transport not included

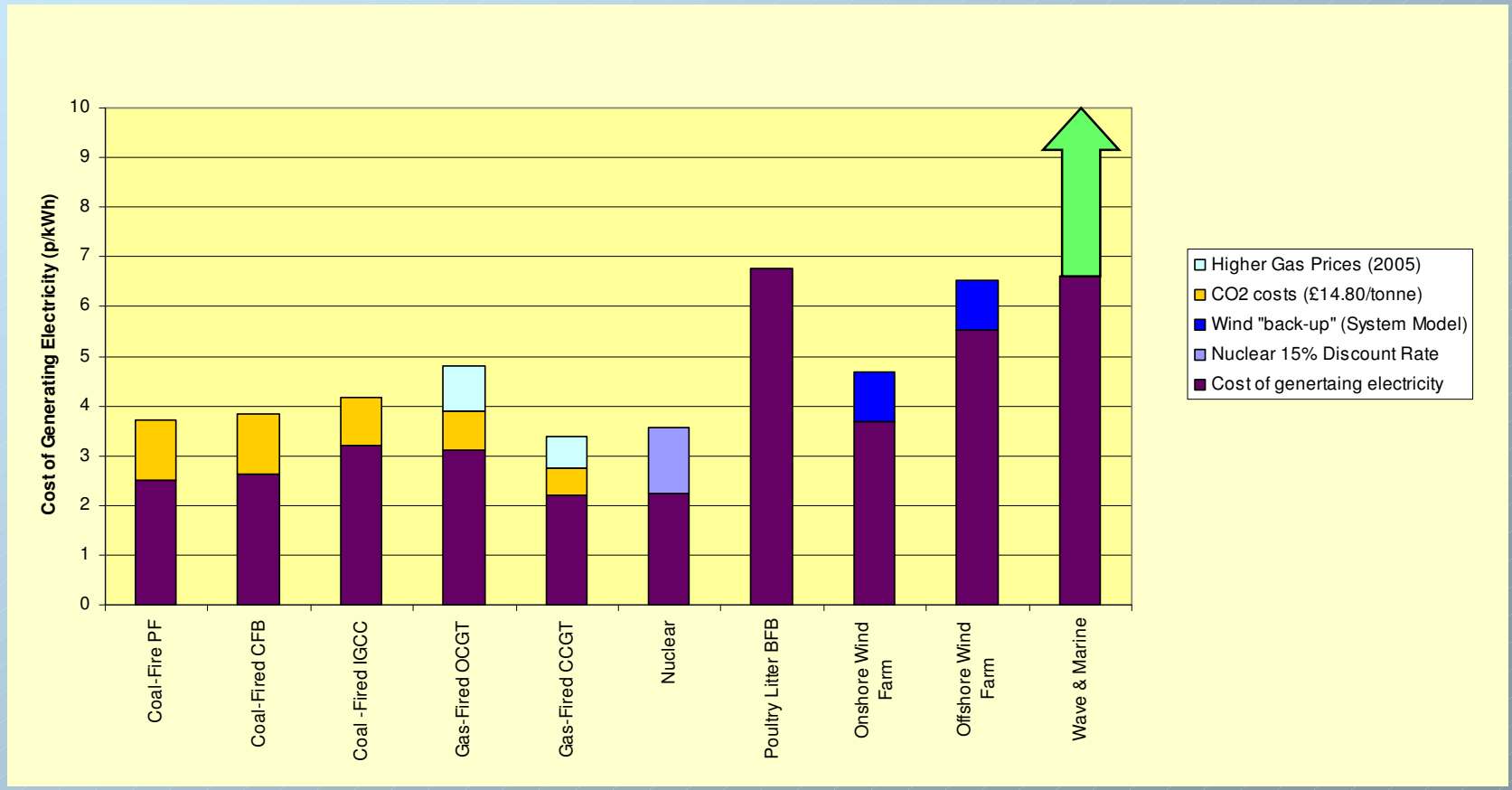
Some Determinants in the Future Growth of Electricity Demand

- GDP
- Development (or decline) of traditional industrial processes
- New industry processes
- National, sectoral and individual economic activity
- Prices of other goods and services, wages and disposable incomes
- Taxation
- Technical innovation and new products
- Government policy

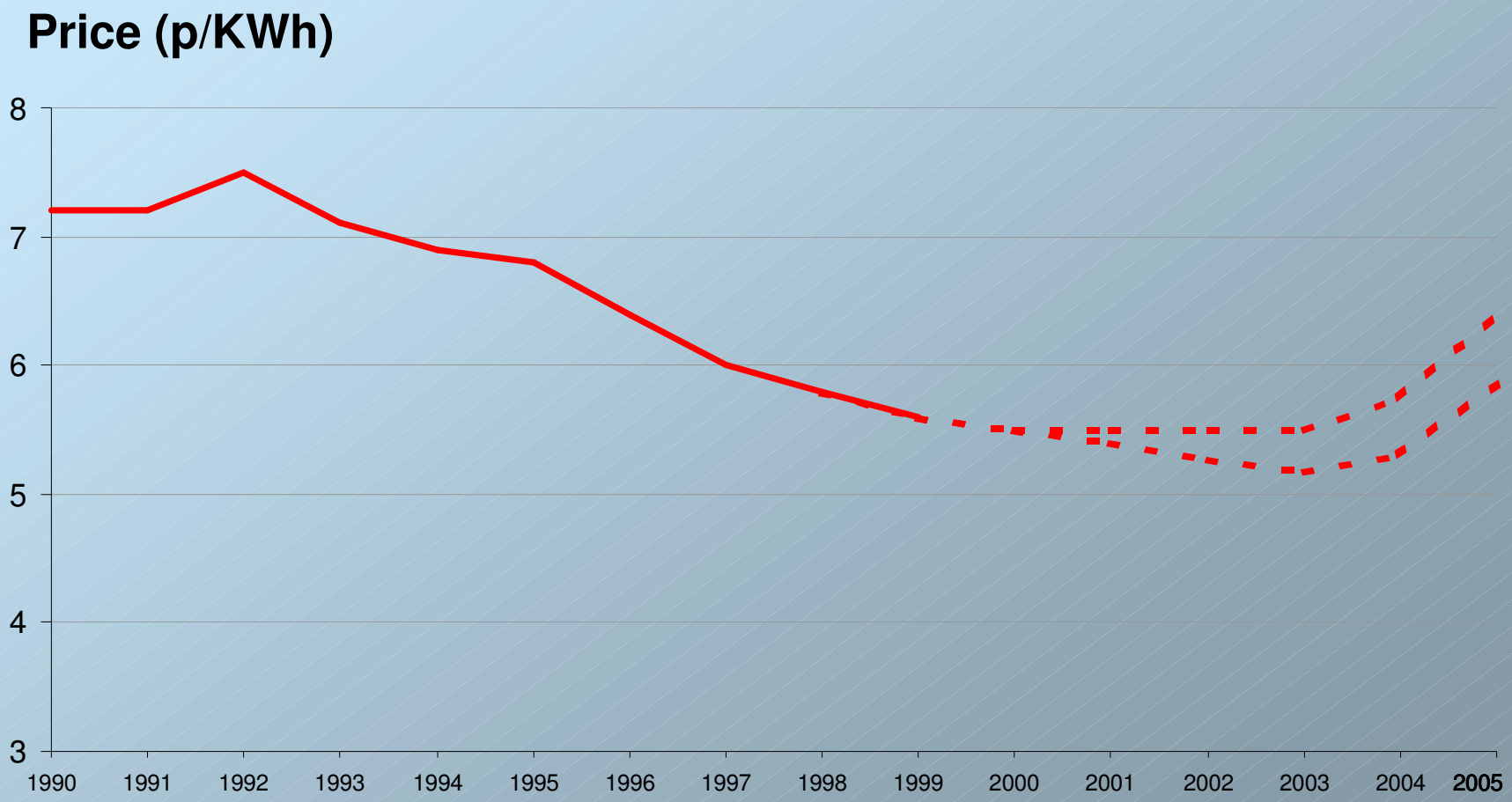
UK Electricity Generation 2004



Cost of Generating Electricity (pence per kWh)



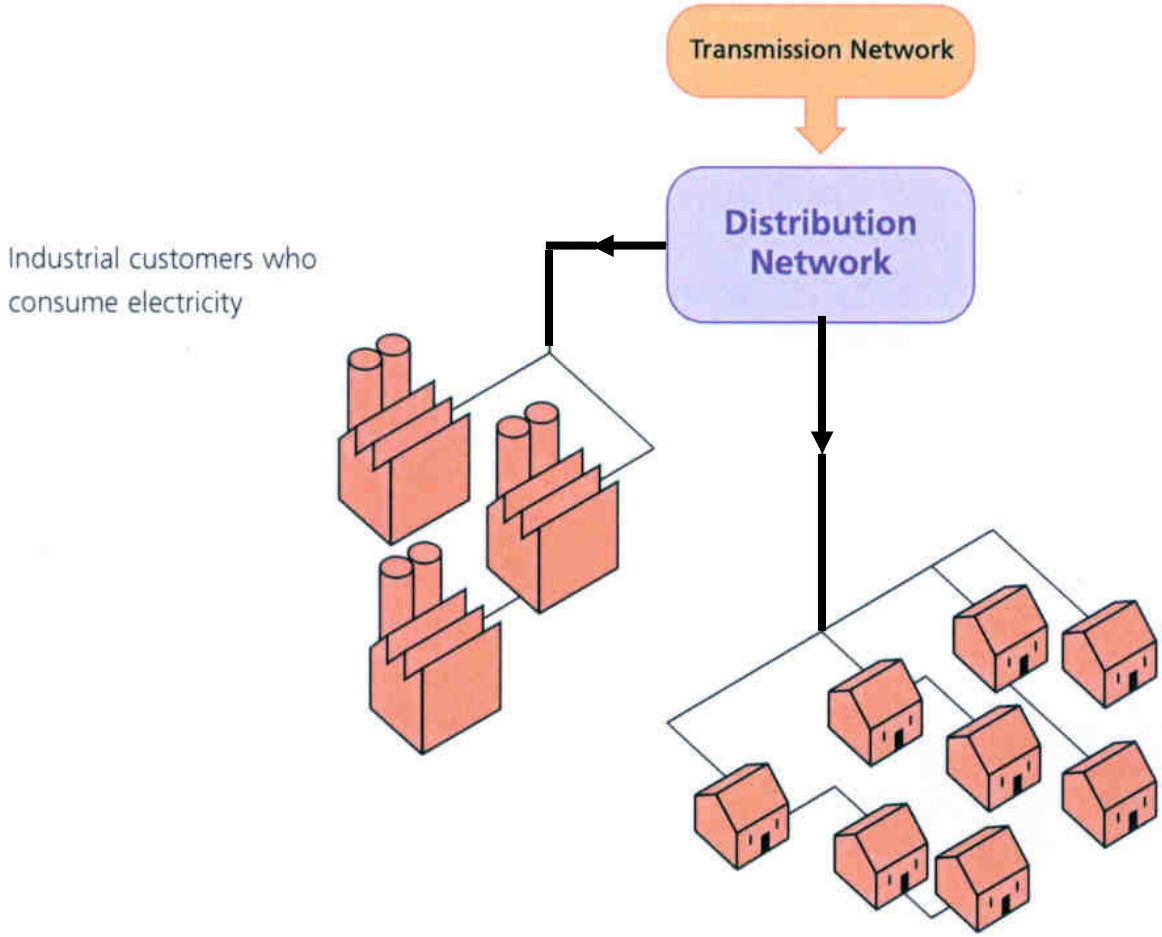
Domestic Price Reductions Since Privatisation in England and Wales



Some Possible Causes of Blackouts

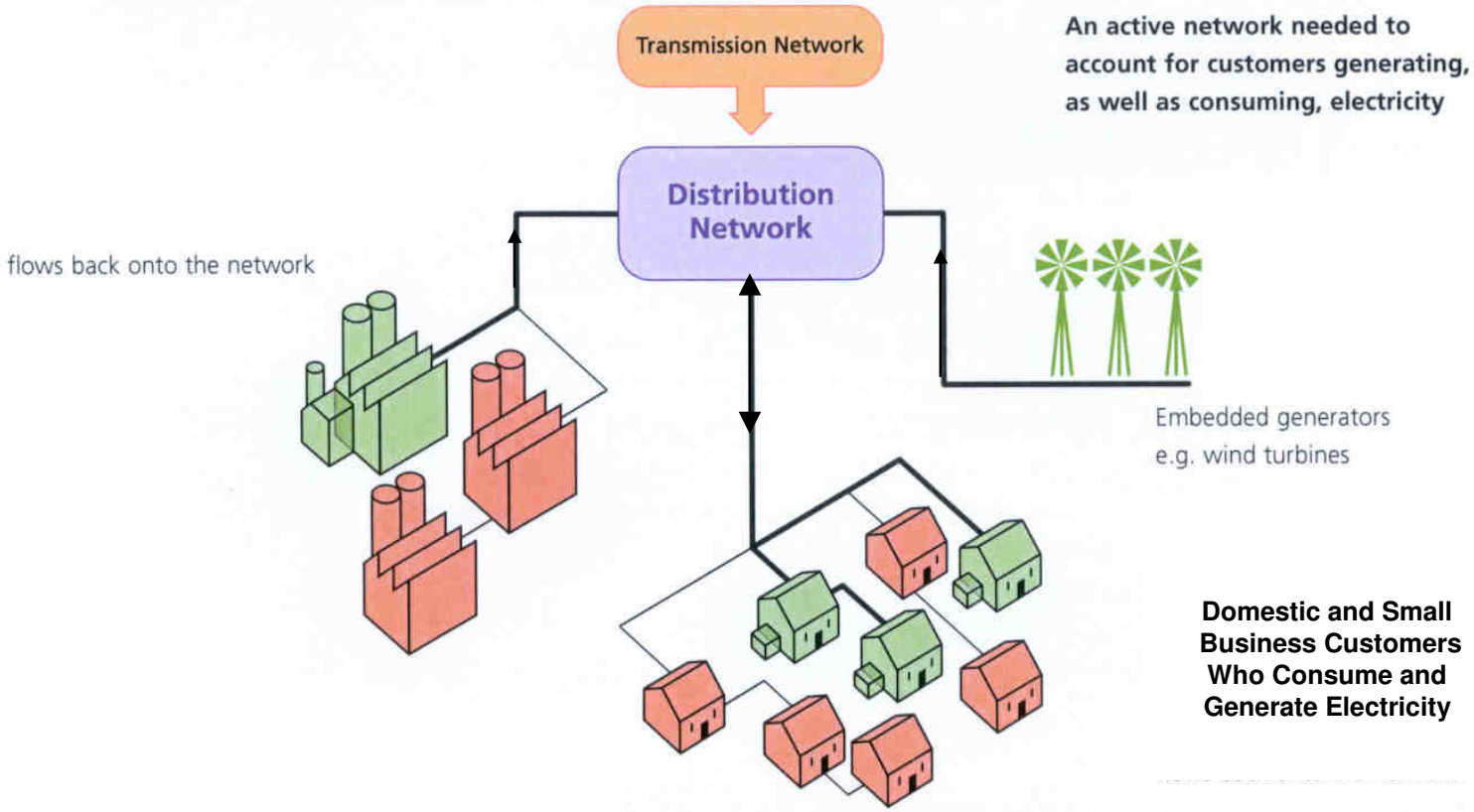
- Disaggregation of a previously aggregated industry resulting in impaired communications between competing firms
- Breakdown or malfunction of control, protection and communication equipment
- Reduced maintenance levels
- Disappearance of expertise and experience
- Operation nearer transmission limits due to increased trading opportunities
- Lack of investment in transmission and interconnecting systems

Distribution Network - Today



A Passive Network

Distribution Network – Tomorrow with Distributed Generation



Connecting New Generation to the System

DECADE	SET SIZE MW	CONNECTION VOLTAGE, kV
1920's	50	132
1980's	660	400
2000's	2/3	33

T and D: Some Challenges and Outstanding Questions

- Unforeseen Load Flows.
- Increasing Circuit Loadings but Need to Reduce Losses!
- Intelligent on-line Control and Relaying.
- Actively Managed Distributed Systems.
- Plant Life Extension.
- Condition Monitoring and Data Interpretation.
- Environmental Unfriendly Materials
- Data and Information Transmission.
- Space Compression and Undergrounding.
- New Cable Designs and Materials.
- System Issues arising from New Cable Technology.
- Power Electronics.
- Security Standards and Performance Incentives.
- Monopoly Business Embedded in a Competitive Industry.

What about the Rest of the Developed World

- Increased Cross Border Trading.
- Increased Consolidation of Ownership.
- National Champions in Europe.
- Increased Prices.
- Competition Real or Imaginary?
- Nuclear and Renewables – The Debate is Universal.
- Burnt Fingers!

Future Government Intervention

- Energy Efficiency and Fuel Poverty.
- More Financial Support for Renewables.
- System Security.
- Introduction of More Financial Incentives for CHP
- Resolution of the Nuclear Debate and Security of Fuel Supplies.

Changes in Store for the ESI Before 2020

- Environmental safety and public health issues with attendant delays and cost escalation.
- Increasing Government pressure on suppliers to make substantial improvements in energy efficiency.
- Face “ultimate” democracy requiring increasing public support.
- Develop half to full scale demonstration projects in coal gasification, energy storage, wave power and other nascent renewable sources.
- After no more than 5 years participate in a new gas fired combined cycle generation programme.
- See the beginnings in the same 5 year period of a new build nuclear generation programme.
- Onshore wind generation will saturate towards the end of the period, offshore wind will develop but only in shallow water.
- There will be transmission links to Ireland and adjacent continental European countries to facilitate more extensive trading.
- Innovative development to produce active local distribution networks to accommodate increased distributed generation including renewables and CHP.
- Oblige customers to pay significantly more for their electricity!

“My policy is to be able to take a ticket at Victoria Station and go any where I damn well please ”

- Ernest Bevin, 1951

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