

# Renewable Energy –

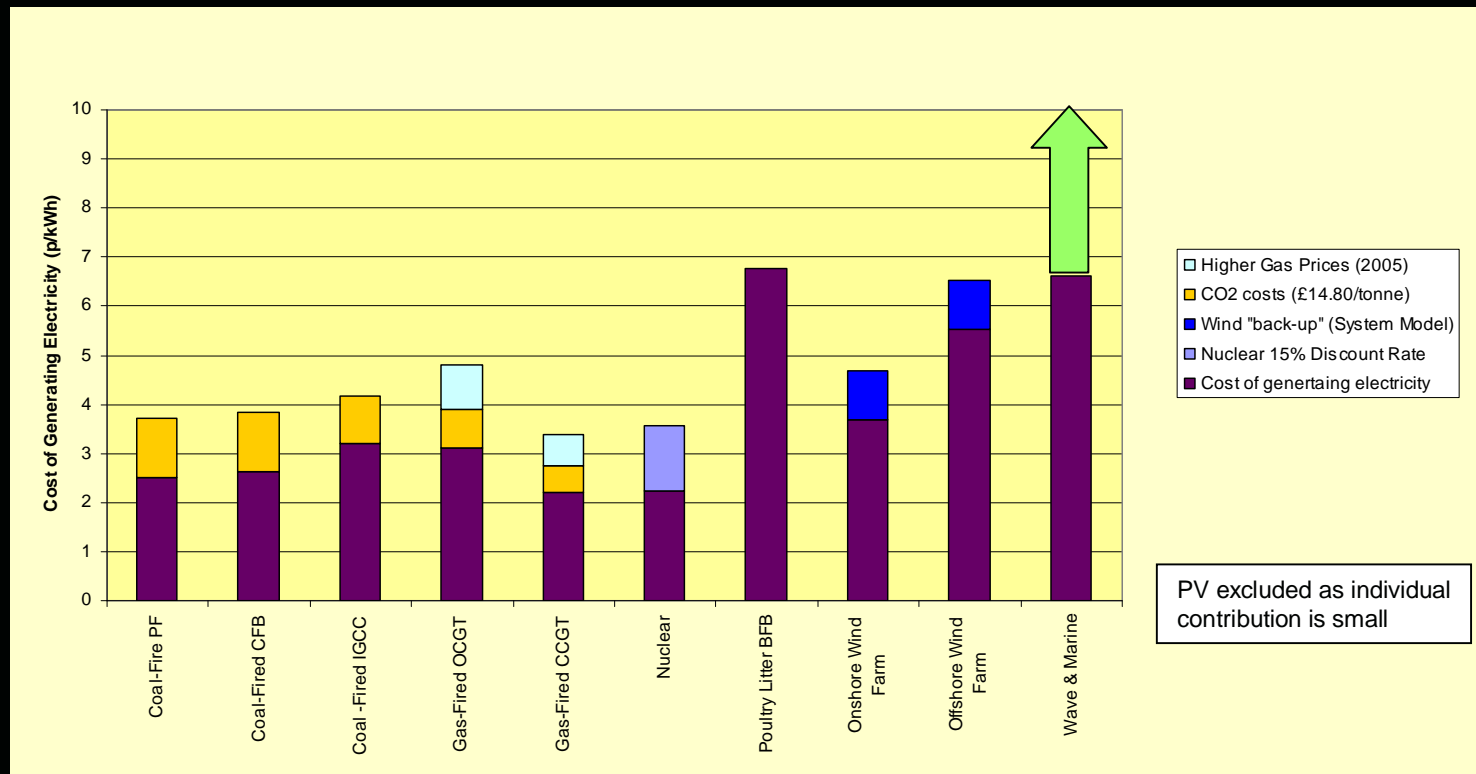
How much can we expect it to increase  
supplies over the next two decades

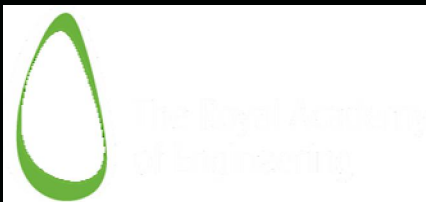
**Less Than We Hope**

Dr M W Kennedy CBE FREng FRSE  
18/10/05



# The Costs of Generating Electricity





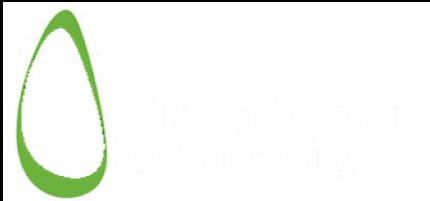
## The British View of Renewables: Sources eligible for the Renewables Obligation

Source	Eligibility
Landfill Gas	ü
Sewage Gas	ü
Energy from Waste	Only non-fossil derived energy will be eligible. Energy from incinerated 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	ü
Onshore wind	ü
Offshore wind	ü
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, eg agricultural and forestry residues	ü
Geothermal power	ü
Tidal & tidal stream power	ü
Wave power	ü
Photovoltaics	ü
Energy crops	ü



## Renewables: Some Difficulties to Overcome

- Planning & Organised Objections
- Shortage of Technical People and Informed Opinion
- Manufacturing and Building Rates
- Accurate Capital and O&M Costs
- Little Offshore Track Record for “Wet” Renewables
- Intermittency, Spare Capacity and Storage
- “City” Fears for Renewables
- Grid System Limitations
- Distribution System Limitations

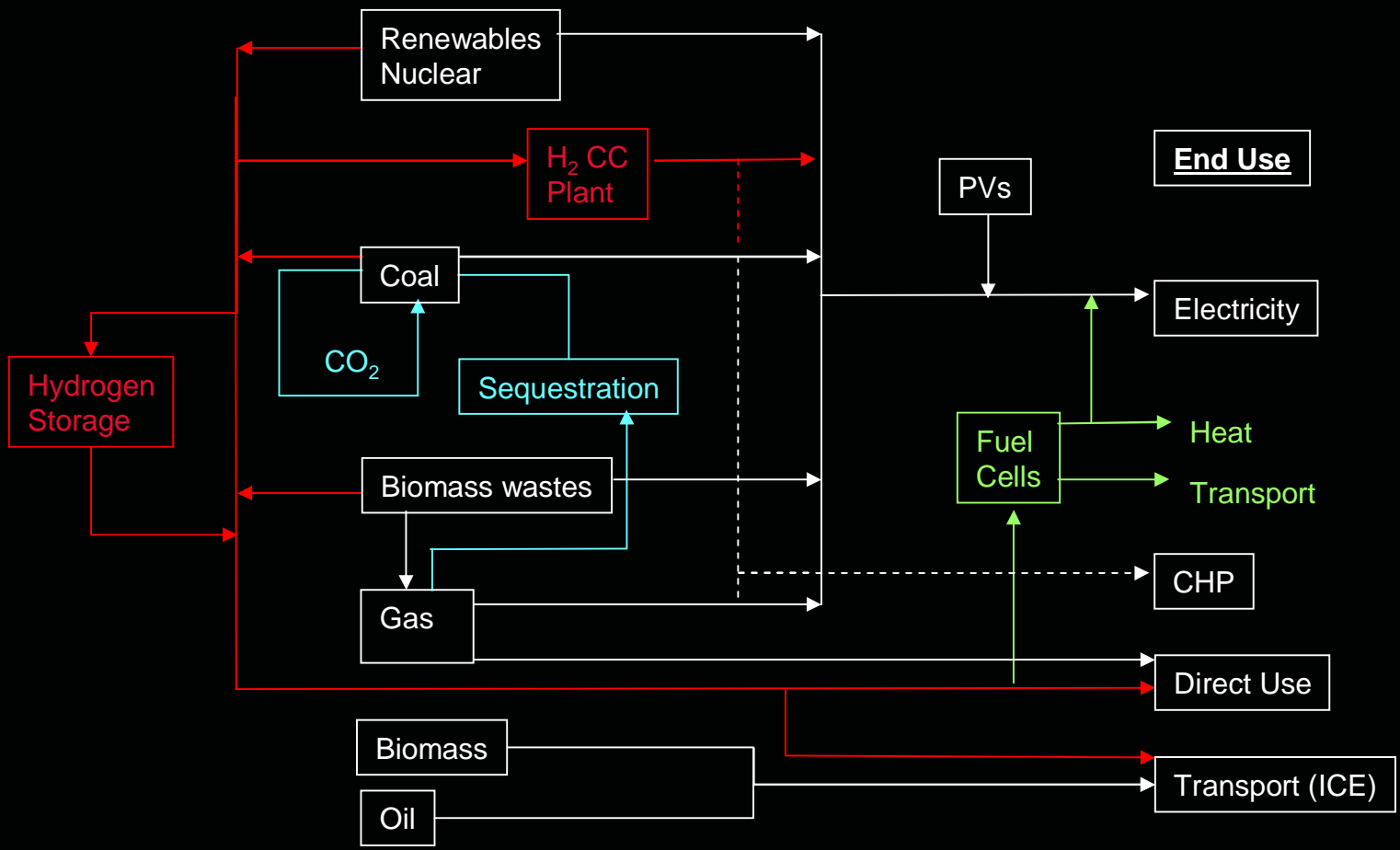


# Adding Complexity to the Energy System

+ Hydrogen

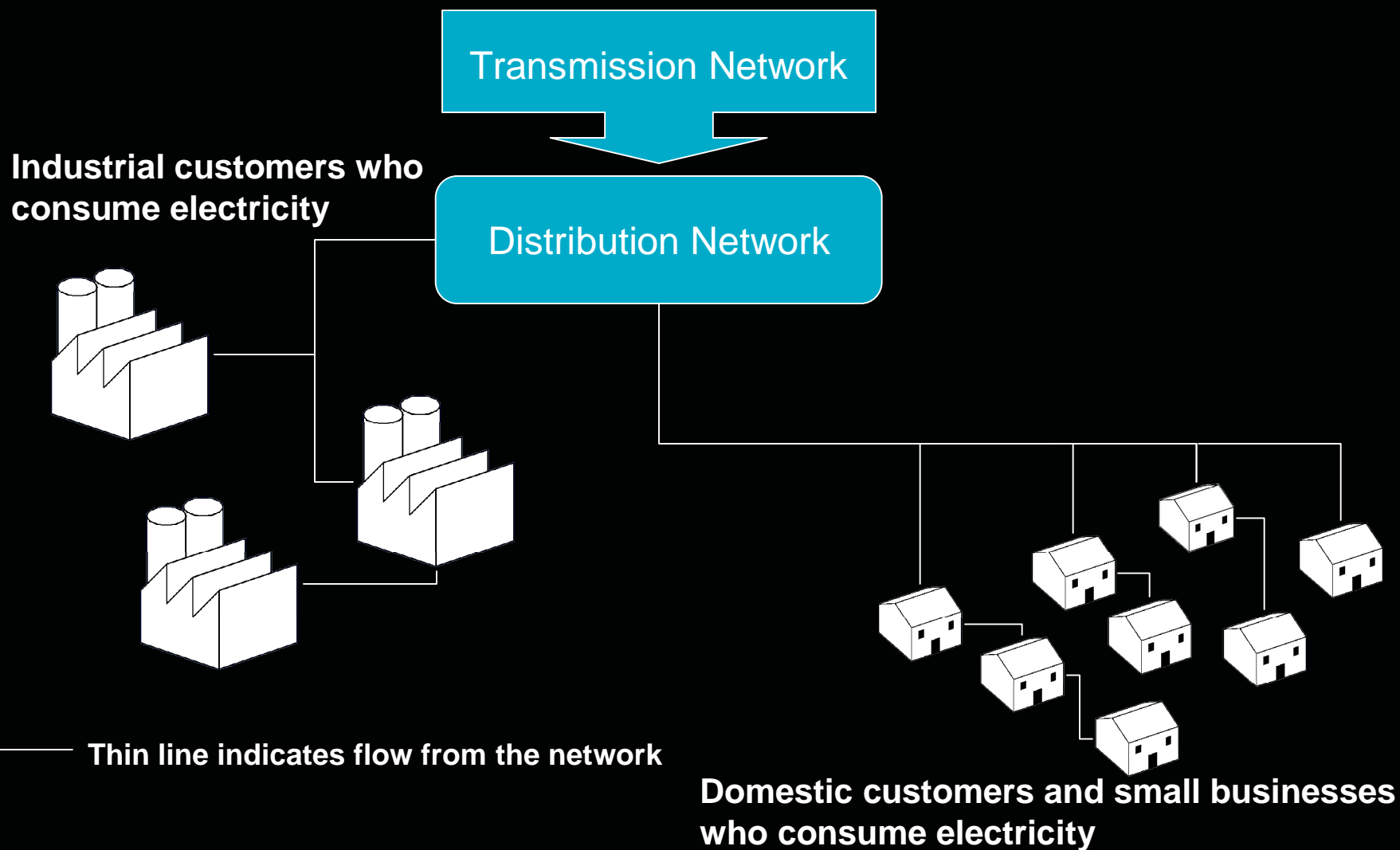
+ Fuel cells

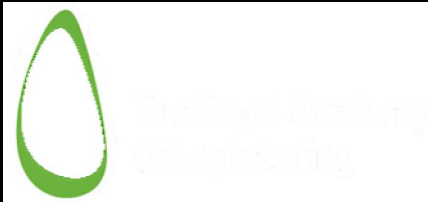
+ Carbon Sequestration





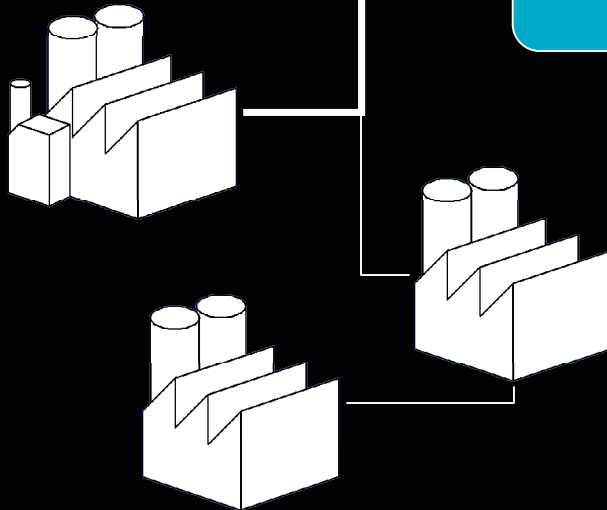
# Distributed network - conventional





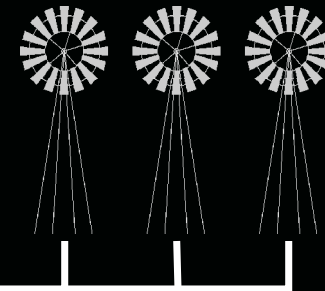
# Distributed network – with distributed generation

Industrial customers who consume electricity



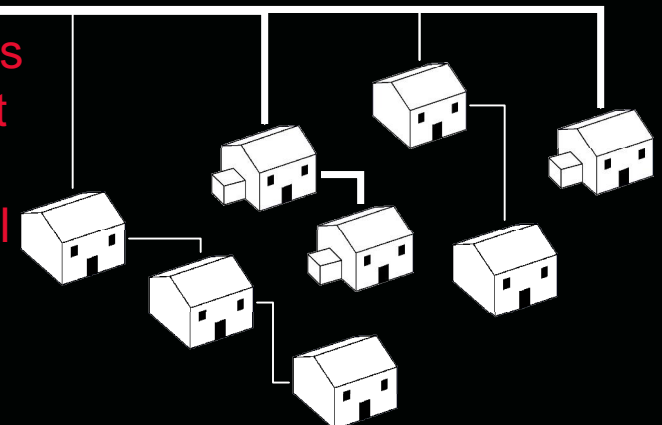
Transmission Network

Distribution Network



Embedded generators eg wind turbines

An active network is needed to account for customers generating, as well as consuming, electricity



Domestic customers and small businesses who consume electricity

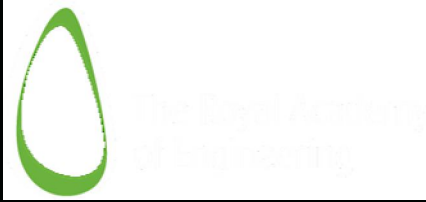
- Thin line indicates flow from the network
- Thick line indicates flow from, and to, the network





## Invention Innovation and Market Acceptance

Product	Invention	Market acceptance	Difference (years)
Ballpoint pen	1888	1946	58
Continuous steel casting	1927	1952	25
Flourescent lighting	1901	1938	37
Helicopter	1904	1936	32
Zip fastener	1891	1923	32



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