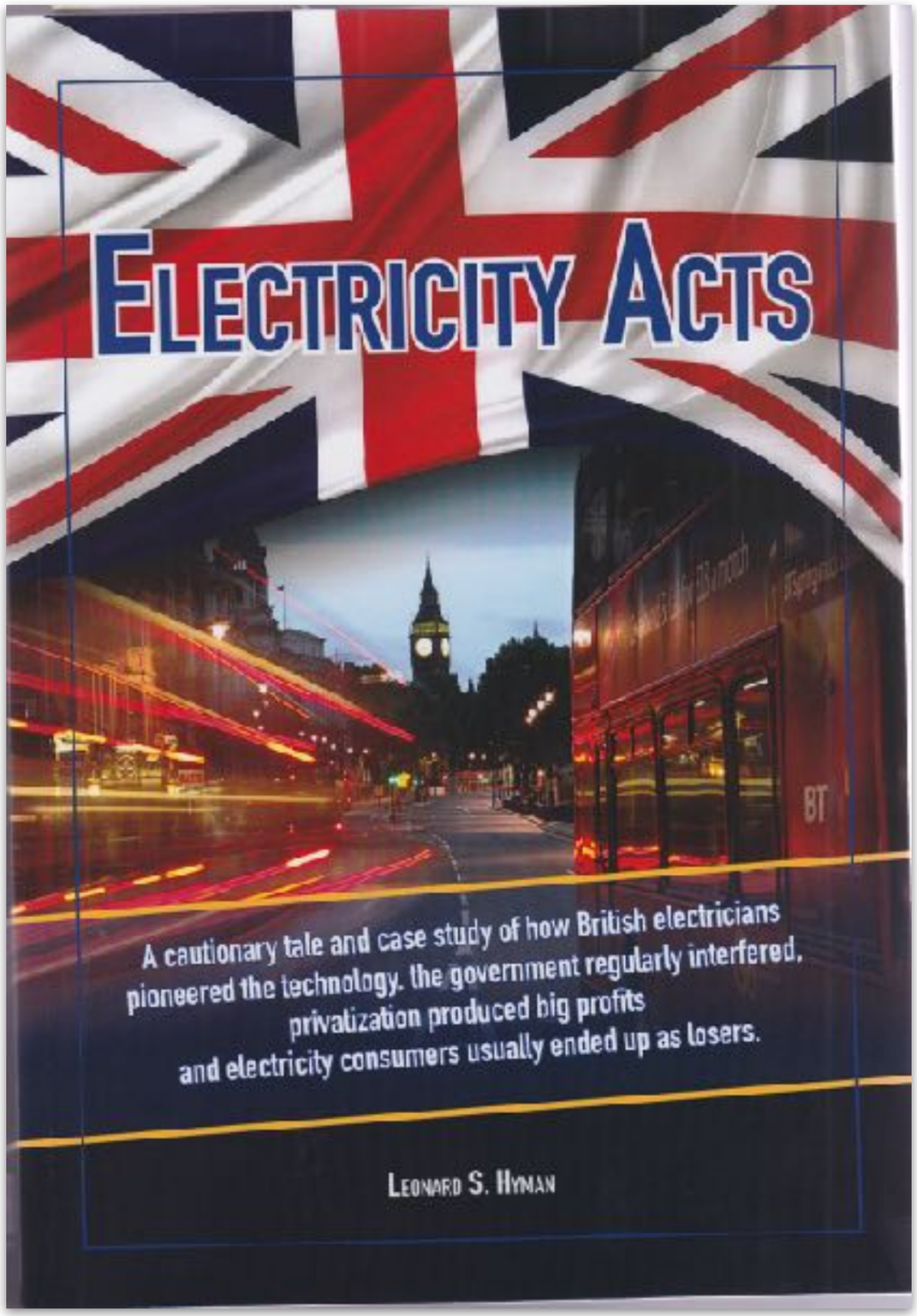


A History of British Electricity: Industry, Regulation and Restructuring

(Summary and Discussion Notes)

Chapter 1— 1800-1887
British invent key components of electric supply, have ample financing capacity and gas industry as model for organization and regulation, but soon fall behind

- **Technology** — government meddling hinders development

- **Gas industry** — model for central station production distributed through network, metering, regulation

- **Regulation**— profit limited by lid on dividend, with adjustments upward if prices are lowered. Franchises have limited duration and unfavorable expiration terms

Chapter 2— 1888-1909

Can an industry that is supposedly local in nature and competitive with no need for government-imposed standardization, achieve economies of scale?

- **1888 Act** — hampers technology, favors small utilities, discourages uniform offerings and sets franchise terms that deter investors

- **Contrasts**— London discourages scale, has small service areas and a confusion of offerings. Regional utility in Northeast runs big generators, makes uniform offerings and solicits industrial consumers

- **Market**—manufacturers cannot mass produce equipment and appliances due to multiplicity of offerings. Electric light is expensive. Industrialists unsure how to use electricity and utilities how to attract off peak business and diversify load

- **Regulatory dilemmas**— should laws protect incumbents, favor municipal utilities, and protect original investors even when consumers would benefit from new entrants?

Chapter 3— 1909-1926

International comparisons show the UK way behind in electrification and manufacturing so the government has to do something

- **1909 Act** — pro municipal ownership, lets municipal suppliers buy from each other and loosens restrictions on wholesale power generators

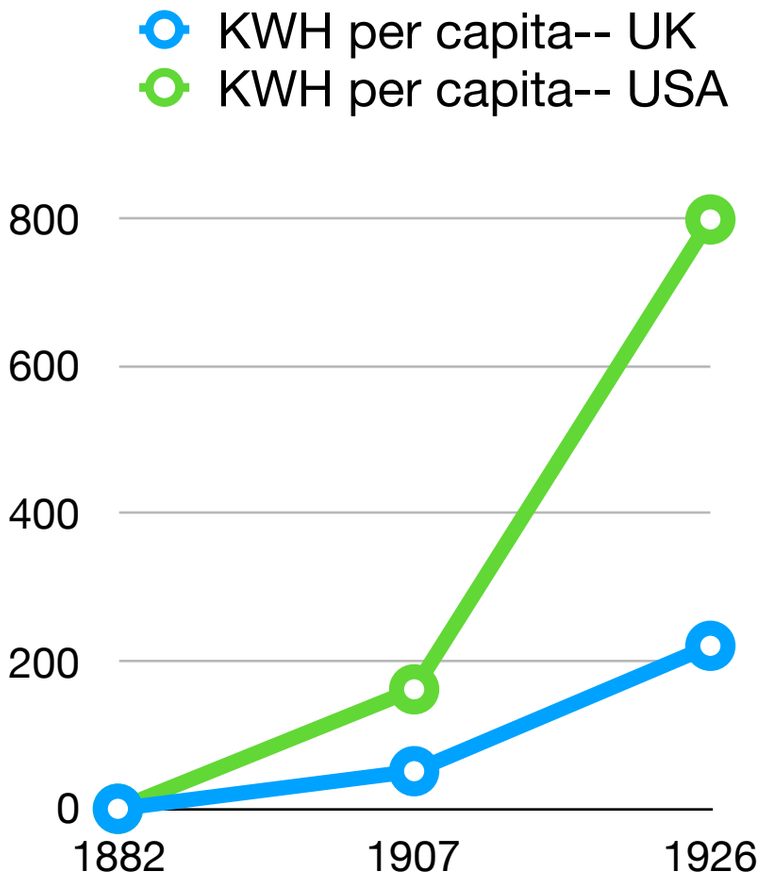
- **No economies of scale** — London has 65 utilities, 70 generating plants, 49 types of supply, 32 transmission voltages, 24 distribution voltages and 70 pricing schedules

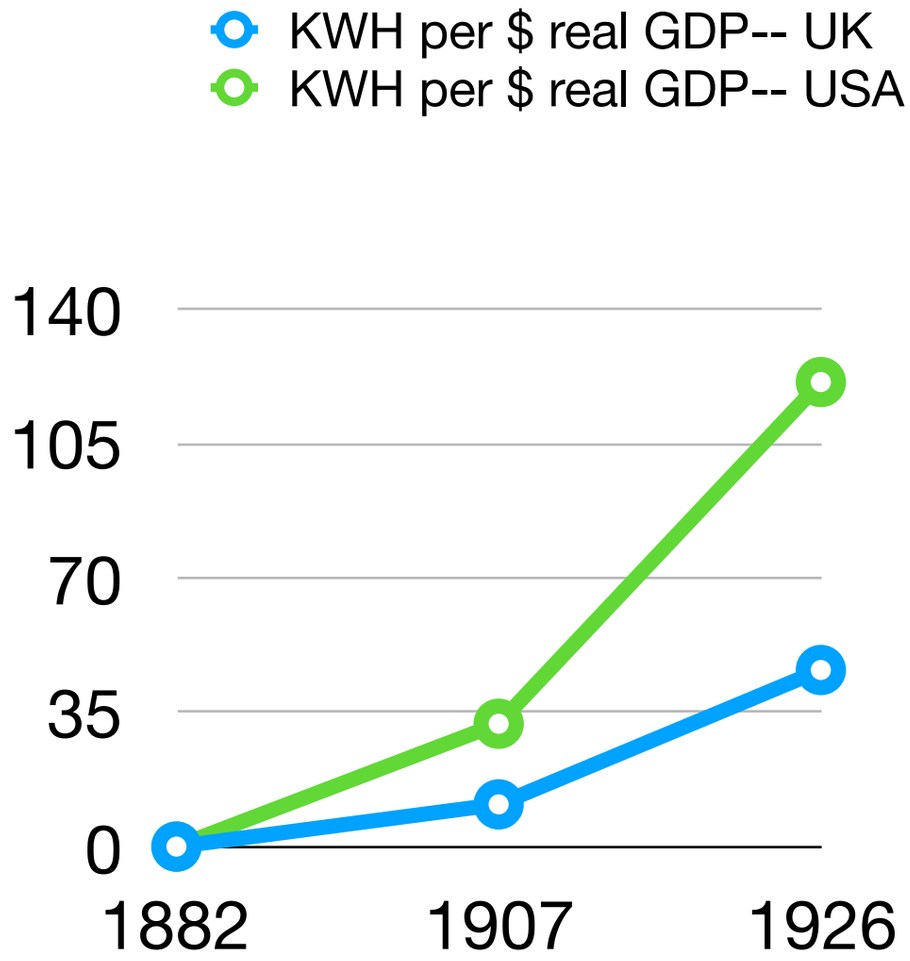
- **Post war concern**— an inadequate electricity system will dampen UK post war recovery and efforts by electrical manufacturers to offer globally competitive products, so what should the government do?

Chapter 4— (1882-1926)

The richest nation in the world lags electrically in part because a centralized government with definite ideas about industry organization and markets diverts electricity supply industry from paths dictated by technology and business opportunities

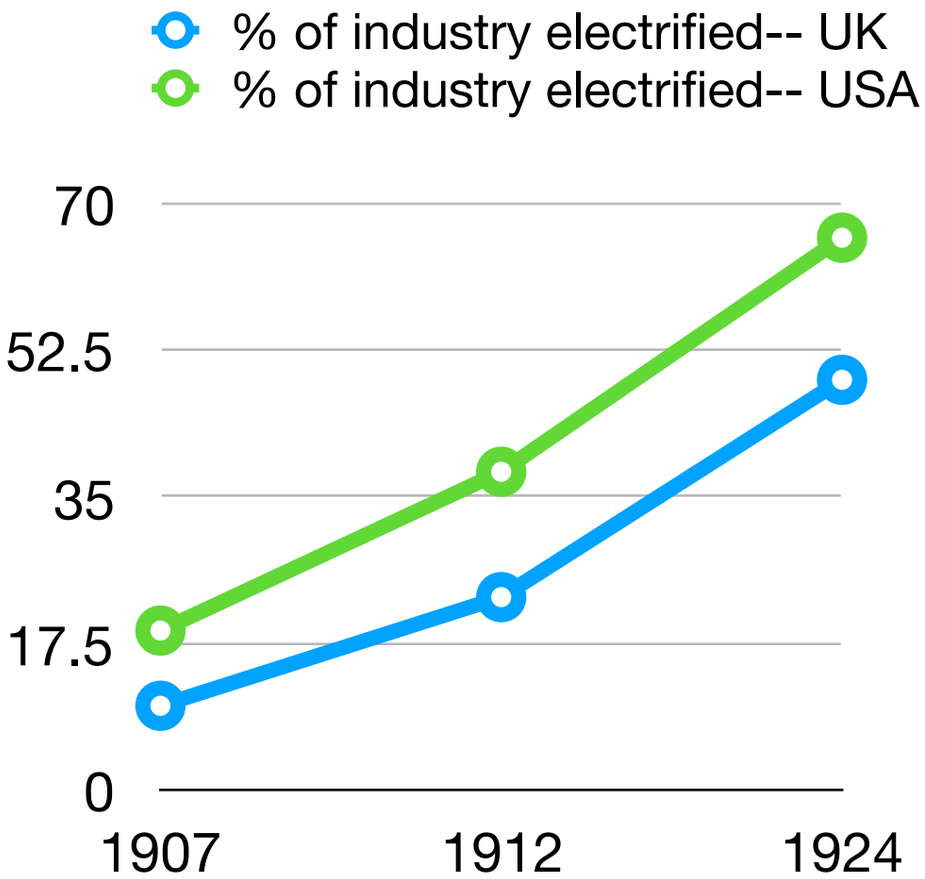
Usage levels low

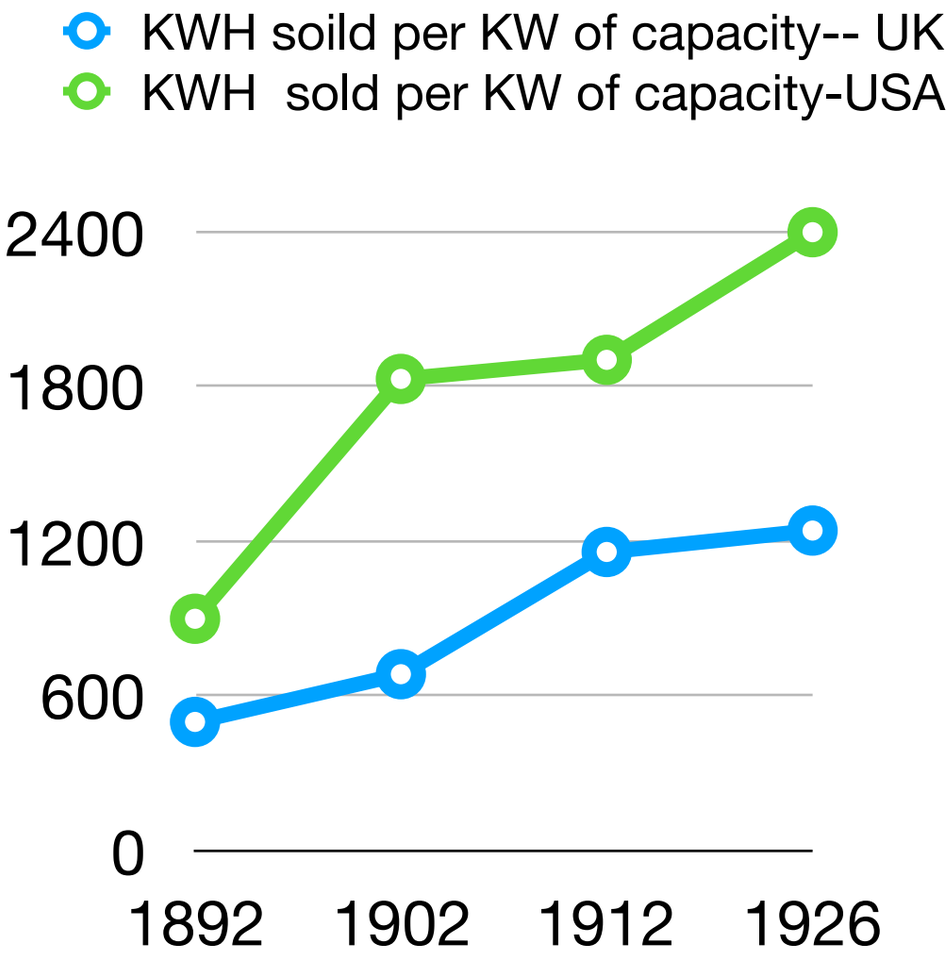




Chapter 4 (continued)

British manufacturers are slow to electrify and British utilities make inadequate use of assets





Discussion questions

1. Explain the concept of natural monopoly. Does it make sense? Is a natural monopoly also a franchised monopoly?

2. Explain the relatively slow progress of British electrification compared to elsewhere?

3. Should the government protect existing utility investors against competitors who can offer lower prices to consumers? Is there a downside to not offering protection?

4. Does operating on a network change the competitive picture?

Chapter 5— 1926-1933
Britain needs low cost electricity and a standard service in the home market to build its industrial base and the government finally acts

- **Weir report**— panel calls for standardize services, a national transmission grid and closure of uneconomic power stations

- **Electricity Act 1926**— establishes Central Electricity Board (CEB) to build transmission network (National Grid), act as central power wholesaler, finance standardization of electricity supply and set profit levels for generators

- **Compromises**—to mollify owners, the CEB keeps uneconomic stations open, and to get support of private power interests, the CEGB pays them for bogus costs, so substantial savings to consumers are lost to insiders

Chapter 6— 1933-1942
New structure brings rapid electrification and lower prices as networks standardize and integrate and production shifts to lowest cost generators, but franchise expiration still threatens industry

- **Rapid electrification** — home appliances multiply, service areas expand and from 1933 to 1938 electricity sales rise 81%, customer count 66%, real prices drop 26% and real cost per KWH falls 38%

- **Too many utilities**— half of utilities are small and charge twice the price of bigger firms, a problem that might worsen when the franchises of big utilities expire

- **WW II**— halts industry restructuring and capital improvements and that leads to postwar shortages

Chapter 7-1885-1943
Hydroelectric resources offer opportunity to develop poor region in northern Scotland along lines similar to New Deal's Tennessee Valley Authority (TVA)

- **Hydro in Scotland**— water resources attract aluminum industry but development pits outdoors enthusiasts and coal interests against dam builders

- **Role of CEB**—large scale projects become economic when CEB agrees to buy output for its system

- **North of Scotland Hydro**— set up in 1943 as a public agency to develop hydro and serve the thinly populated north with economically priced power — a precursor to national ownership of the electric industry

Chapter 8— 1942-1947

With demand up, capacity inadequate and franchises due to expire, the electric industry faces shortages and fragmentation, all of which the government resolves by taking over the industry

- N**eed to restructure**— Ministry of Fuel says that bogus costs victimize consumers and calls for national ownership of generation and reduction in number of local distributors

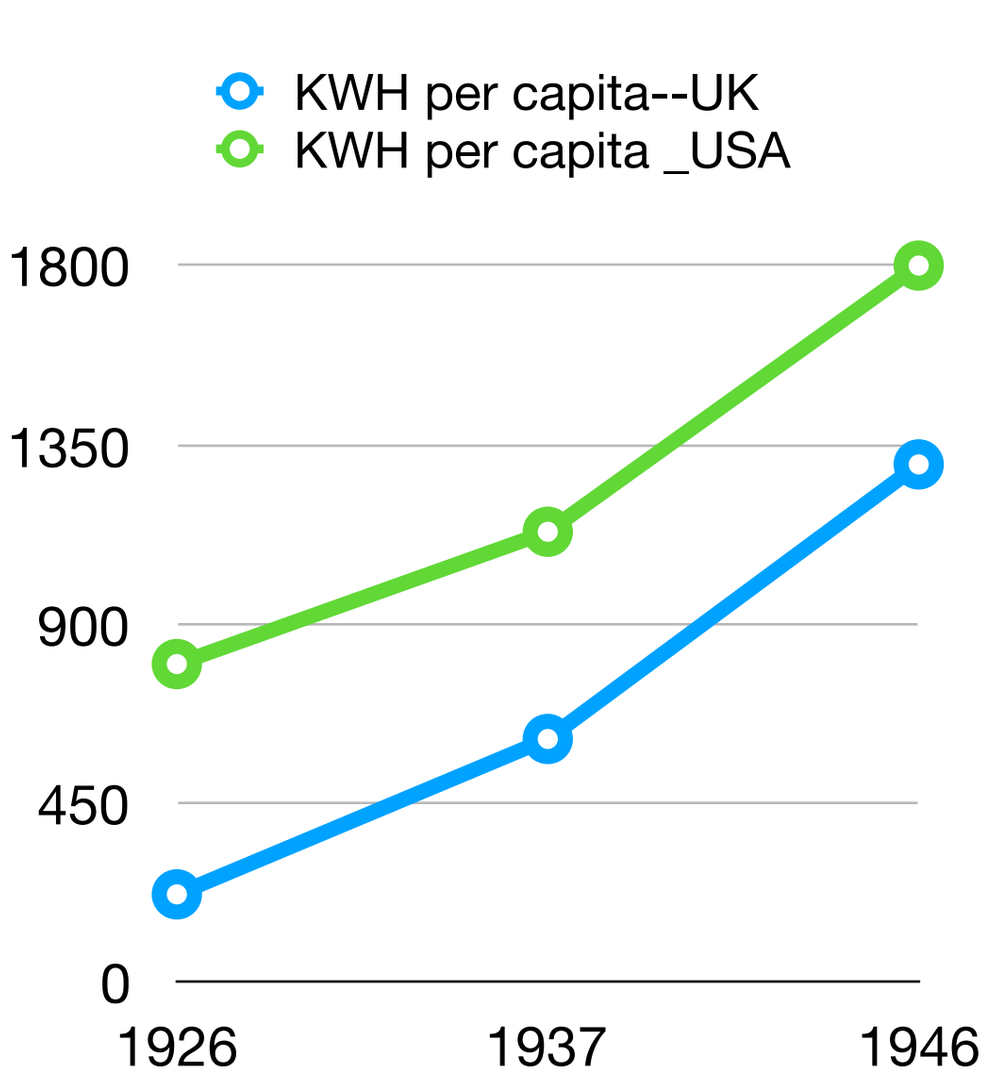
- **Labor platform**— the Labor Party, advocate of public ownership of coal mines and utilities since 1918, wins the 1945 election

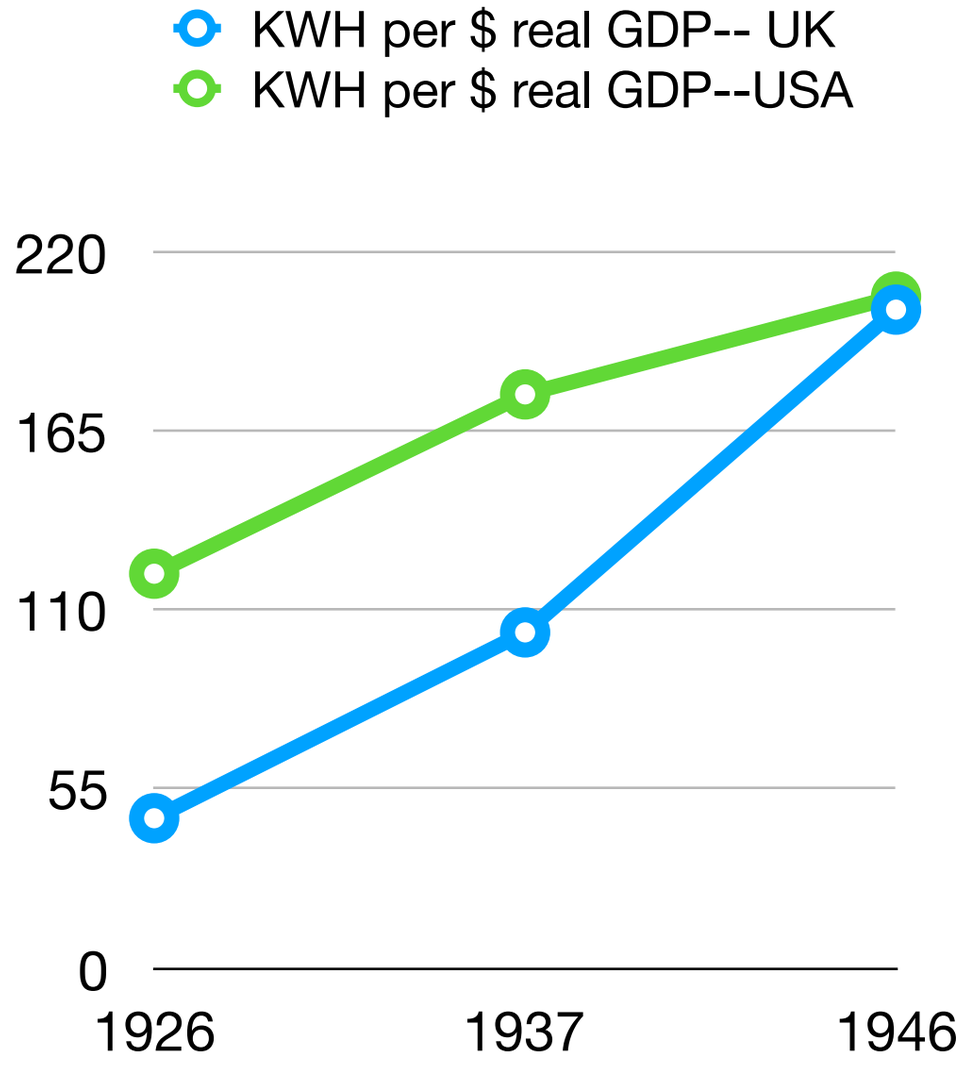
- **Nationalization** — Labor centralizes generation and transmission ownership, creates 14 local distributors (from the 600+ then operating) and anticipates lower costs and profitability

- **Postwar shortages**— industry unable to meet demand due to coal shortages, late delivery of equipment, and low electricity prices that encourage demand

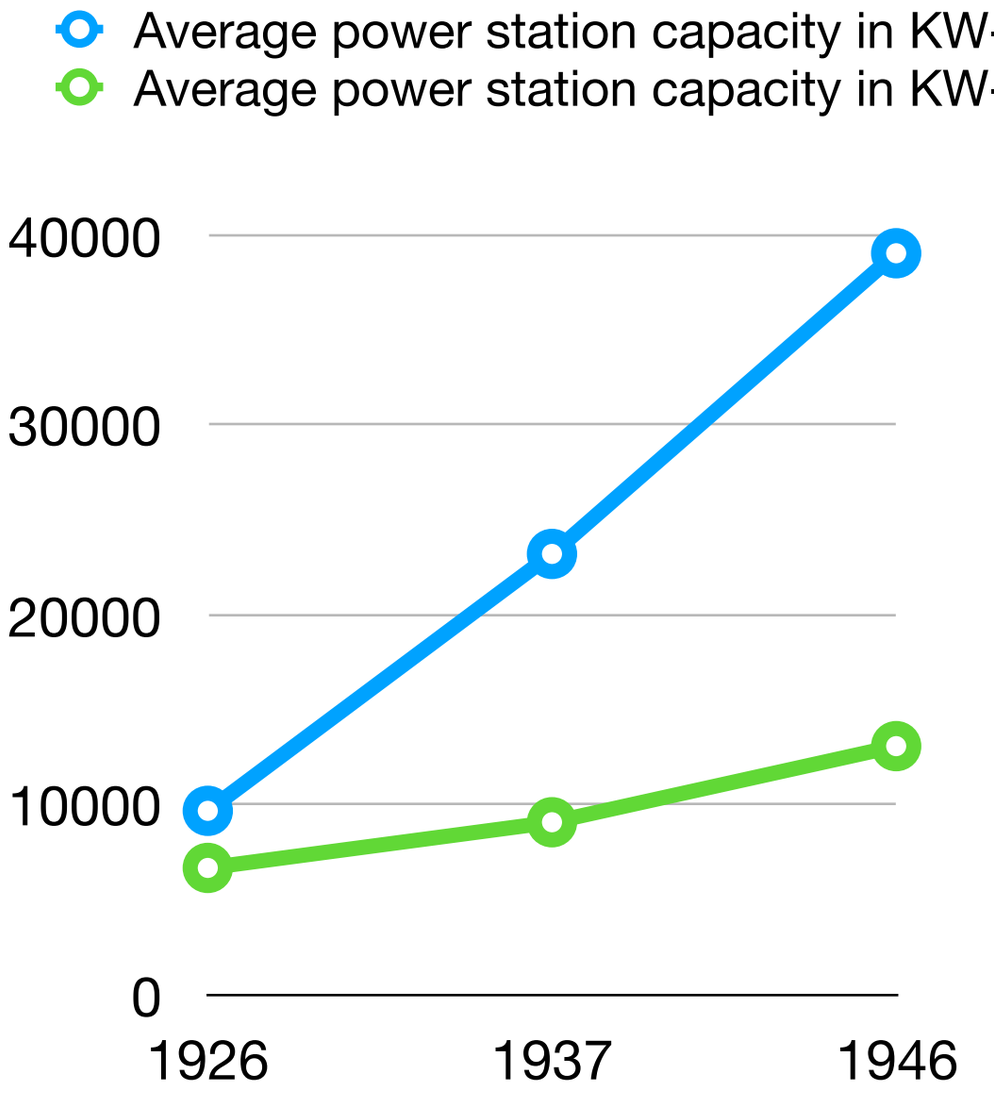
Chapter 9-1927-1946
Reforms lead to improvements at a rapid rate, with all parties seeing benefits

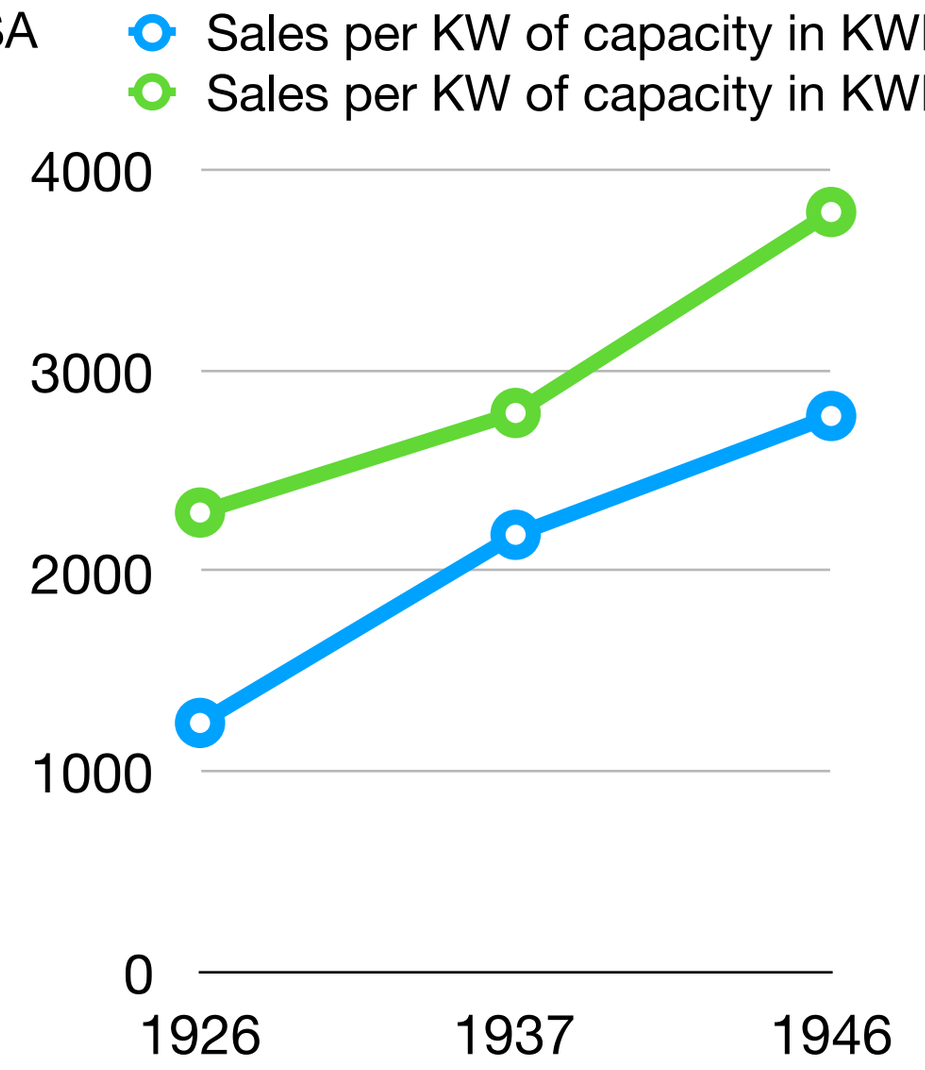
Consumers respond to lower prices, greater availability of electricity





Power plant size and operating efficiency rise





Discussion questions

1. How did CEB facilitate economies and enlarge the market?

2. Why and how did CEB leave savings unrealized?

3. What accounts for the desire to nationalize the industry? What were the anticipated benefits?

4. Did nationalization seriously change the structure of the industry or the product offered?

Chapter 10—1947-1957

Nationalized industry raises scale and standardizes, although engineering is conservative, and government still calls the shots

- **Industry structure**— British Electric Authority (BEA) owns generation, transmission and 14 area boards (North of Scotland not included). BEA reports to the minister but has autonomy

- **Economics**— pricing initially encourages usage despite power shortages. Need to change pricing causes uproar within industry. Nationalized industry is supposed to lower prices and make a profit.

- **Nuclear**— Conservatives return to office in 1952, promote nuclear power, predict a coal shortage, insist on a British design for civilian and military uses, and expect to it. BEA managers resist because nuclear is uneconomical

- **New structure**— 1957 Act creates a toothless Electricity Council to supervise, a Central Electricity Generating Board (CEGB) to own generation and transmission, regional distribution boards remain and chairman of CEGB dominates the show

Chapter 11— 1957-1970
Catch up with demand and promote nuclear power

- **Conservative agenda**— install a pro nuclear boss at CEGB, change tariffs to reflect costs, and try to shove Scotland under the CEGB umbrella

- **Nuclear**— government proposes to solve electricity shortages with vast nuclear generation program, which, incompetently executed, goes way over budget

- **Market growth** — from 1948 to 1969, sales per customer triple, and home appliance saturation rockets

- **Operations**— industry achieves radical improvements in load factor, efficiency and plant size. Staffing per MW of capacity falls 60% and staffing per KWH sold 74%

Chapter 12-1970-1990
Gas competes, nuclear program is costly, coal strikes paralyze the UK and Thatcher sells electricity industry

- **Competition**— gas takes market after North Sea discoveries, Electric prices rise faster than gas. Attempts to introduce competitive generation fail.

- **Operations**— ratios improve, but not as fast as before. Continued purchase of expensive British coal (from nationalized mines), raises electric bill.

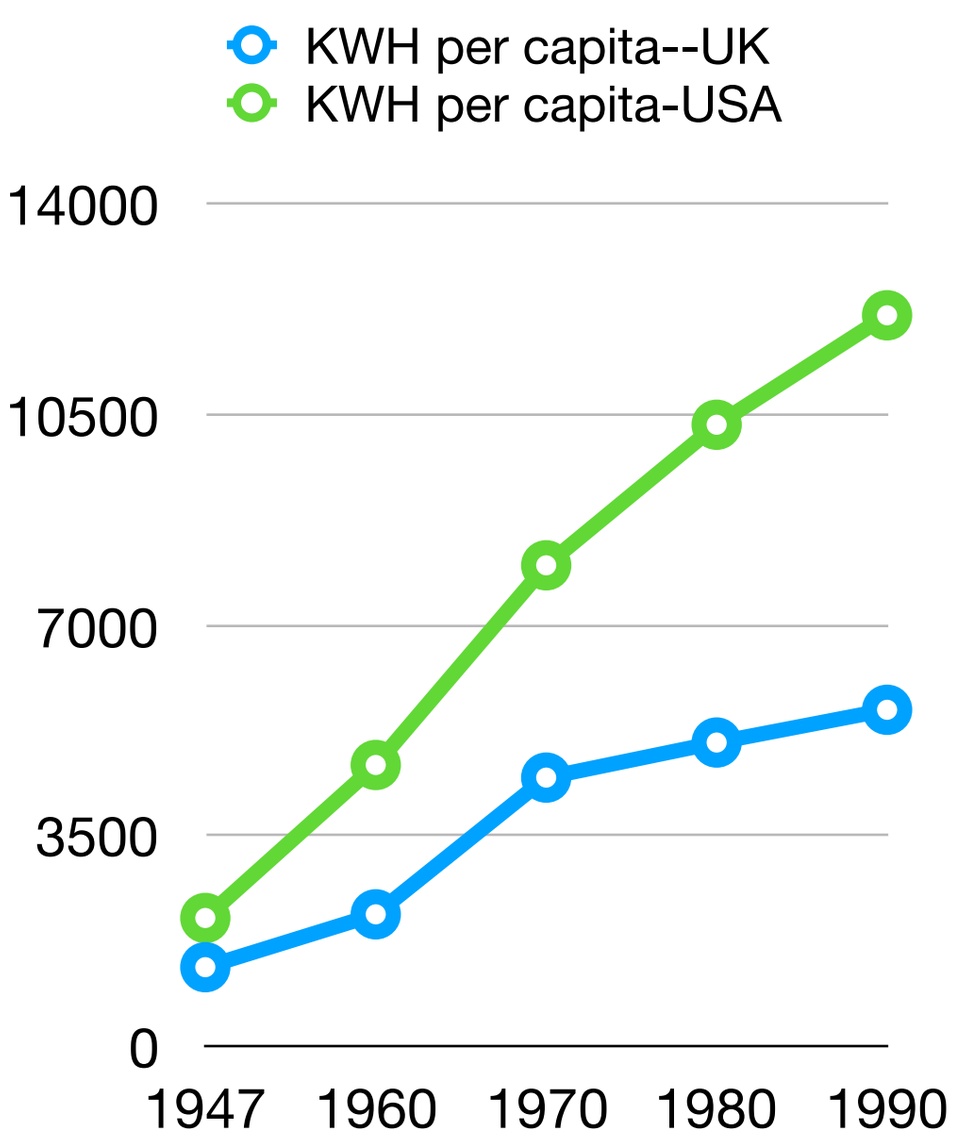
- **Thatcher government**— wants out of electric business. Coal strikes reinforce pro nuclear stance. Public benefits of sale of industry assumed, not calculated

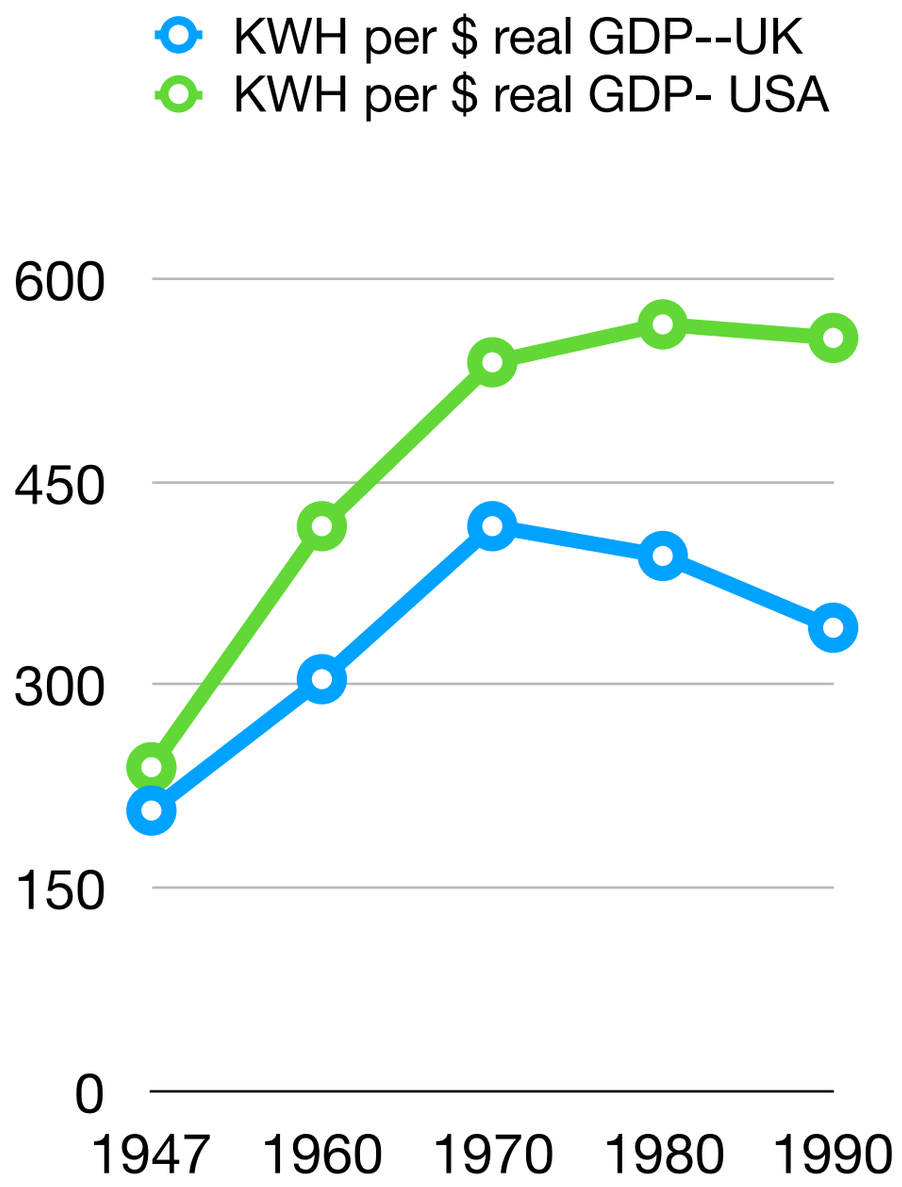
- **Regulation and competition**— UK regulator to focus on price and efficiency not rate of return. Competition to discipline deregulated generation and direct sale to consumers), force them to reduce costs and prices in order to keep customers

- **Privatization**— government sells 12 regional distributors (also owners of transmission company), 2 integrated Scottish utilities, 2 large generators (unregulated). (Northern Ireland later. Nuclear company retained, considered unsaleable.) All companies may engage in unregulated sales to consumers.

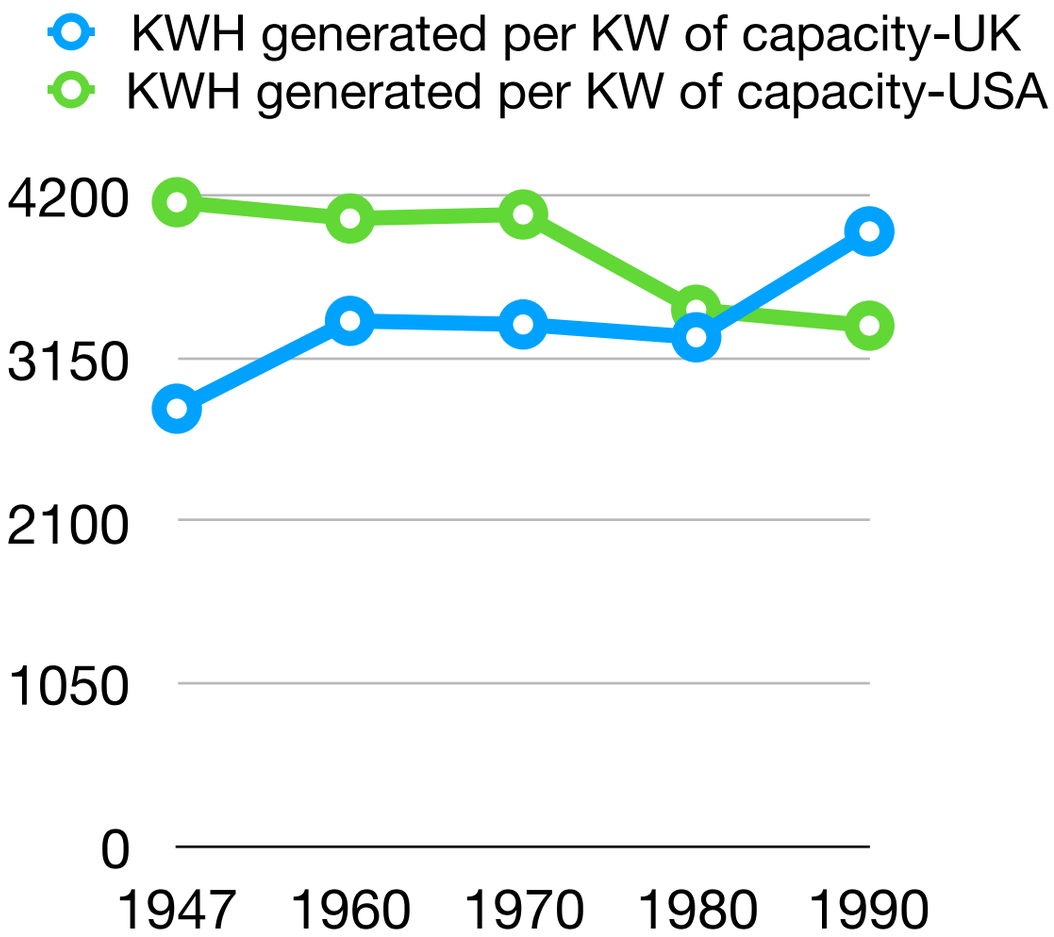
Chapter 13—1947-1990
Nationalized industry reduces costs, raises efficiency and sales despite expensive British coal and nuclear power

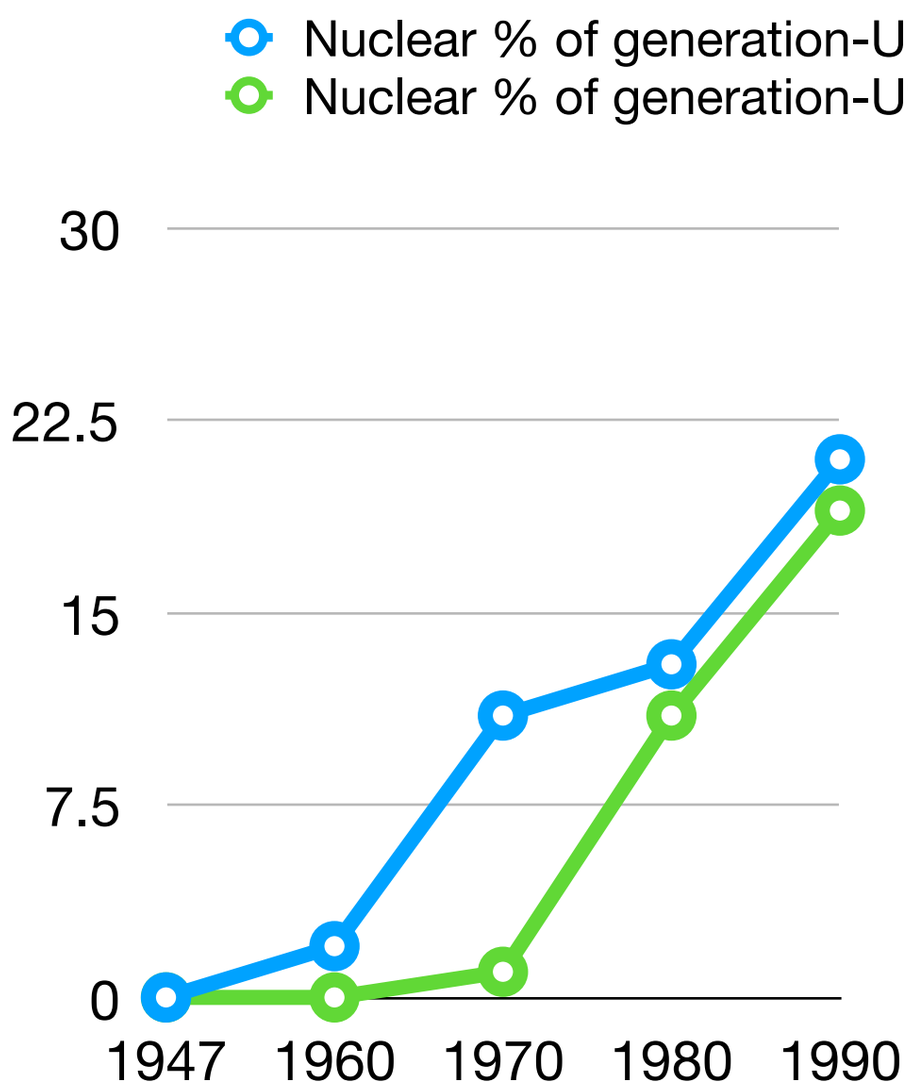
Sales slow markedly due to increased competition from gas, higher prices, de-industrialization and energy savings after Energy Crisis of 1970s





Plant utilization rises and nuclear power adds to generation





Discussion questions

1. Distinguish between privatization and deregulation? Do they have different goals?

2.What did the nationalized industry do that was substantially different than the previous industry under mixed ownership?

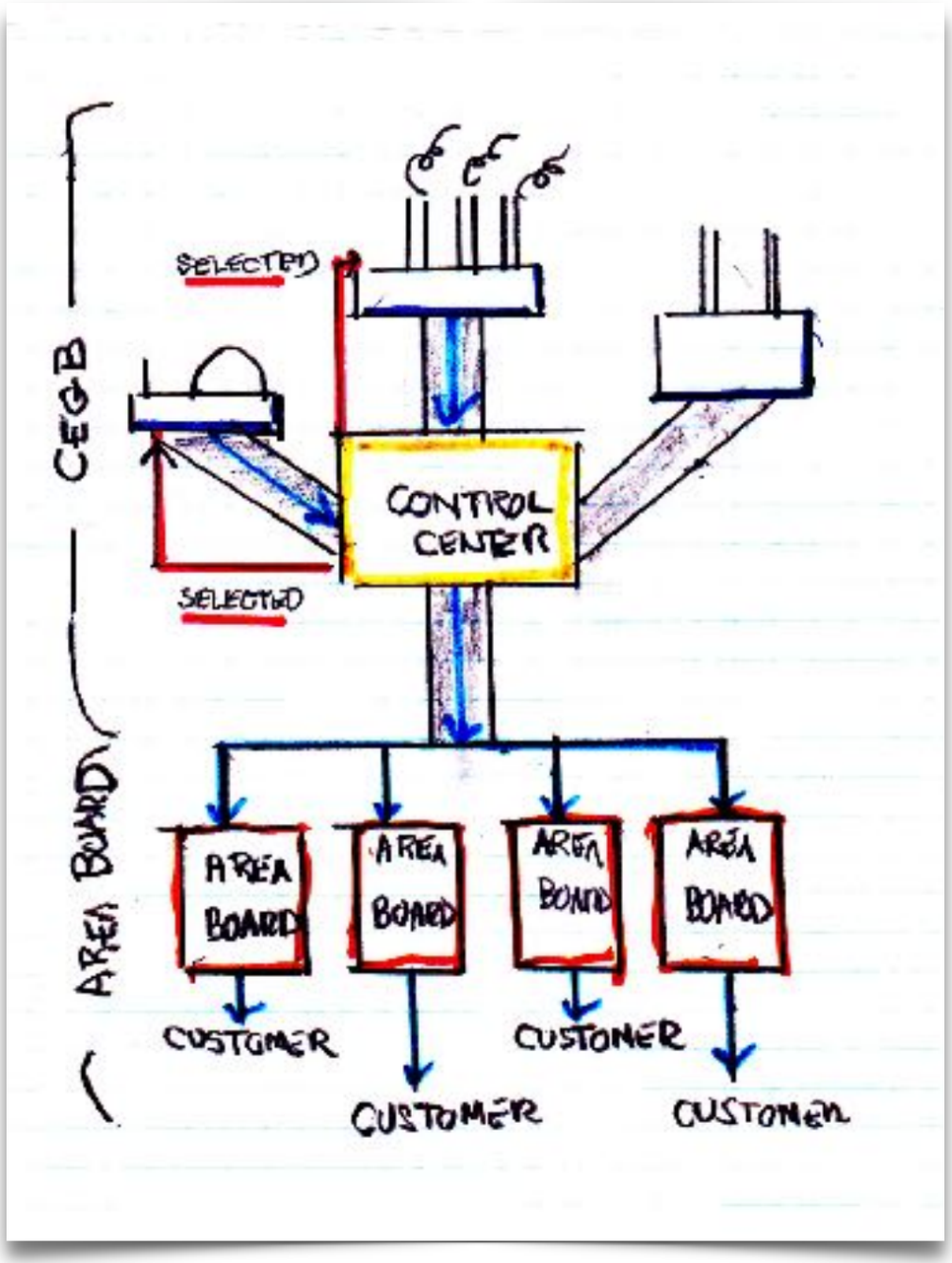
3. Could major problems of nationalized industry have been corrected without privatization?

4. What is the goal of a business enterprise and how did nationalized industry support of British coal and nuclear power help achieve that goal? Or are utilities different from other business enterprises?

Chapter 14-1990-1991

After selling steel, oil, banking, airports, gas, telecom and water industries, the government puts 17 electric companies on the block

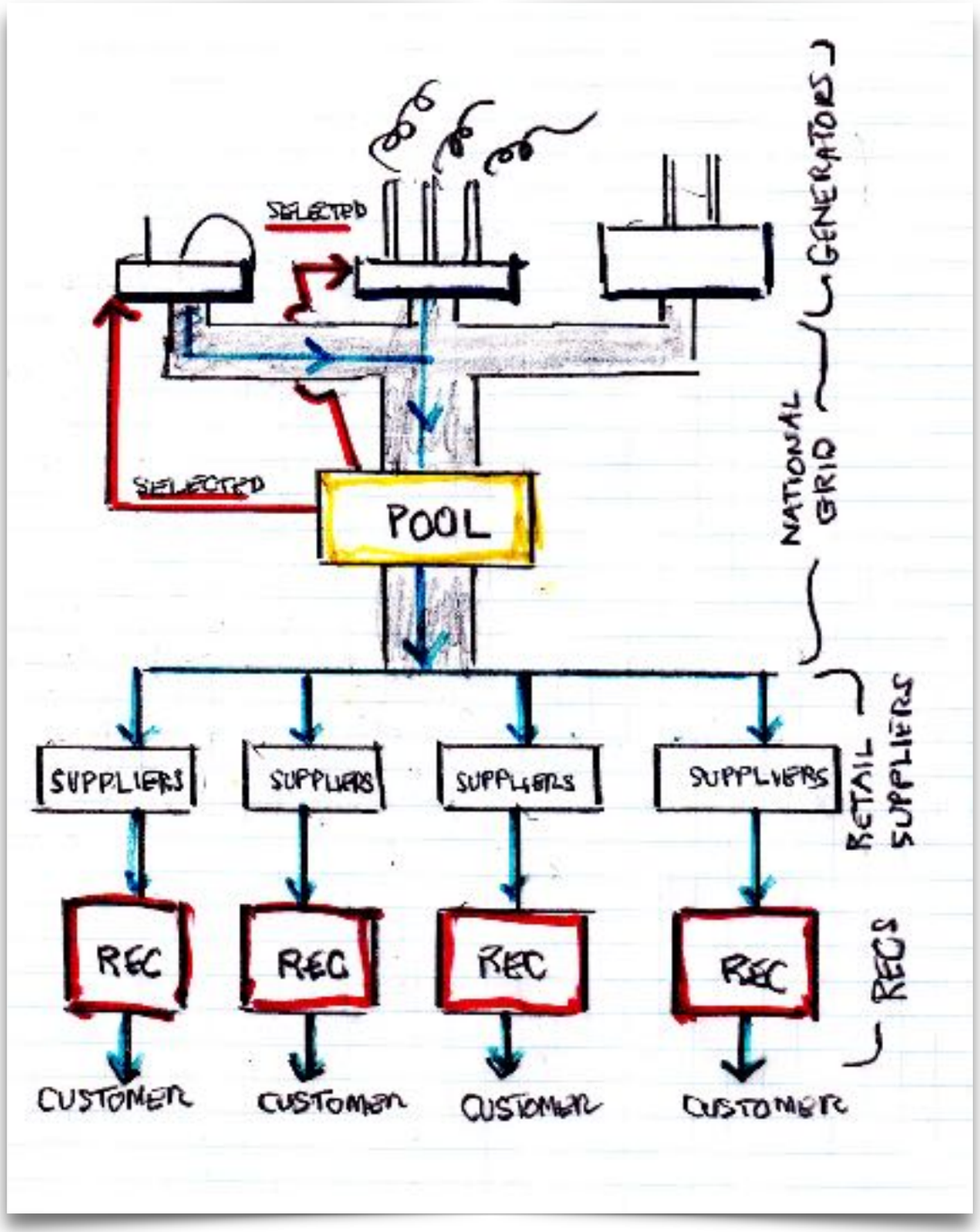
- **Old industry structure—** CEGB owns all generation and transmission in England and Wales . It selects which generating plant will operate each day on basis of operating cost (merit order). The 12 electricity boards, which buy power from CEGB, own local distribution. and sell power to consumers. Two utilities in Scotland and one in Northern Ireland generate, transmit and distribute in their territories.



Chapter 14 (continued)

- **New industry structure—**

Big Two generators own most fossil-fueled generation in England and Wales. One nuclear generator (still government owned) operates all nuclear plants in Great Britain. All electricity is sold on an unregulated basis in the Pool (operated by National Grid) to suppliers that resell it to consumers. The Pool selects power plants to operate based on the price offered by the plants . Power is delivered over National Grid's transmission system to local distributors, the regional electricity companies (RECs) that deliver it to consumers. Nuclear generator paid a subsidy over Pool price. Price for transmission and distribution services is regulated.



Chapter 14— (continued)

- **How the Pool works**— Pool requires 100 KWH in half hour 2:00-2:30 PM tomorrow. Bids requested. Generators A -G bid to supply, specifying price and volume offered. Totals offered add up to 150 KWH. Pool selects A-E. Price per KWH required to get sufficient supply is 6 pence. All selected generators collect 6 pence if they produce as scheduled.

Generato	Price	Volume	Cumulativ
A	0	25	25
B	2	10	35
C	3	30	65
D	3	30	95
E	**6**	5	**100**
F	7	20	120
G	8	30	150

Chapter 14(continued)

- **Contracts for differences**- Investors might shun firms whose profitability depends on an uncertain Pool price. Too risky. Solution: the contract for differences. Buyer (supplier) and seller (generator) make deal on price and volume. If Pool price exceeds strike price, generator pays the difference to buyer. If strike price exceeds Pool price falls, buyer pays the difference to generator.

- **Pool strategy**— Generator only collects agreed price if it is selected. It sets bid price for Pool to gain selection, knowing that revenue is determined by contracts.

Chapter 14 (continued)

- **USA utility regulation** — price covers all expenses plus a fair profit on invested capital. Inefficient utility charges more due to higher costs. Regulators adjust prices and fair profit after hearings. Critics argue that US regulation does not incentivize efficient operations and encourages too much investment

- **UK utility regulation** — price covers projected expenses plus fair return on invested capital for five year period. Price rises with the retail price index (RPI), less a productivity (X) factor. The utility that beats the productivity target keeps the extra savings until the end of the five years. The inefficient utility may earn less than the fair return. Proponents argue that UK regulation provides incentives to encourage efficiency and gives consumers greater price certainty

- **Competitive sector**— Competitive generators and suppliers operate without a guaranteed price and have no obligation to serve the public other than to adhere to network operating and Pool rules. Competitive generators and suppliers account for about two thirds of electricity bill

Chapter 15-1991-1994

After privatization, mid course corrections are required

- **Regulated utilities thrive**— RECs and National Grid earn high returns. Due to underestimate of inefficiencies, lax regulation or both?

- **Coal**— competitive generators opt for gas. The Big Two sign fuel contracts to protect the nationalized coal industry, temporarily, in return for lower prices. The future looks grim for coal mines.

- **Pool flaws**— a few firms acting in a one- price- for- all market can manipulate prices. The Big Two that set prices in the Pool learned fast. They needed more competition.

- **Consumer benefits**— customer savings come mainly from pass - throughs of lower coal and staffing costs required by the regulatory process. Any other savings go into pockets of companies.

Chapter 16-1995-1997
Outsiders buy electric companies and the government privatizes the nuclear generator

- **Competition and regulation**— Regulator under pressure for seemingly generous rulings and inability to curb the generation duopoly. Even after selling power plants, Big Two still set prices

- **RECs and National Grid**— Extraordinary REC profitability attracts predators, especially US firms seeking a new market. National Grid becomes a stand-alone firm when the RECs sell their shares in it

- **Nuclear**— The government finally privatizes the nuclear generator despite uncertain prospects and imaginative accounting

- **Labor threats**— Labor Party threatens to crack down, levy windfall profits tax on utilities if it wins the next election. Labor wins

Chapter 17-1990-1997
British electric companies cut costs, replace old and dirty power plants with new and clean ones, UK restructuring is the envy of the world but who collects the benefits?

- **Prices fall but costs fall more**— electric companies cut costs, run plants better, but two fifths of price reduction is from lower coal price mandated by government and passed on to consumers. Profits rise

- **Profitability**— return on assets exceed those of normal businesses and electric stock returns beat those on far riskier investments

- **Regulation and competition**— regulator attacked for not reducing profitability of utilities before the end of the five year period. Sale of generating plant does not reduce Big Two control of market. Supply companies have thin margins, leaving little room to compete

Chapter 18- 1997-2001
Labor wins election, wants to tax utilities, reform regulation, lower prices, protect environment, help coal miners and get rid of Pool

- **New goals**— first tax excess profits caused by bad deal Conservatives made when selling utilities. Argue that gas generation is unreliable. Do not license new gas generators. Centralize energy regulation, install a tougher regulator, break up duopoly that controls the market.

- **Eliminate the Pool**— let buyers and sellers directly negotiate price, create a two-sided market, reduce the ability of a few generators to control prices

- **Customer choice**— customers seem unenthusiastic about ability to switch suppliers, and price cuts to them directly traceable to competition (as opposed to regulation) maybe 4% of bill

Chapter 19-2001-2011
Big merger activity, nuclear crashes, renewables take spotlight and Pool is eliminated

- **British Electricity Trading and Transmission Arrangement** (**BETTA)**— replaces Pool. Less price manipulation, more competition. expected. Buyers and sellers make deals for next day, inform system coordinator. Those buying more than or generating less than promised pay stiff penalties. Big Two sell plants at top before BETTA starts. Prices then fall

- **Connect with customers**— generators unable to sell in Pool need customers and suppliers unable to buy in Pool need to generation. Oligopoly of six generator-suppliers (Big Six) forms and controls prices

- **Nuclear**— nuclear firm, British Energy, almost fails when power prices fall, government bails it out , eventually sells it to French government utility, EDF

- **Environment**— switch from coal to gas generation yields 30% drop in CO_2 emissions (1990 and 2011). Climate Change Act of 2008 seeks further reductions. Regulator says that the market does not send signals that raise capital to build new capacity and meet environmental and security obligations

Chapter 20-2010-2015
Conservative / Liberal Coalition seeks lower CO_2 emissions, renewables and nuclear power and upends electricity market

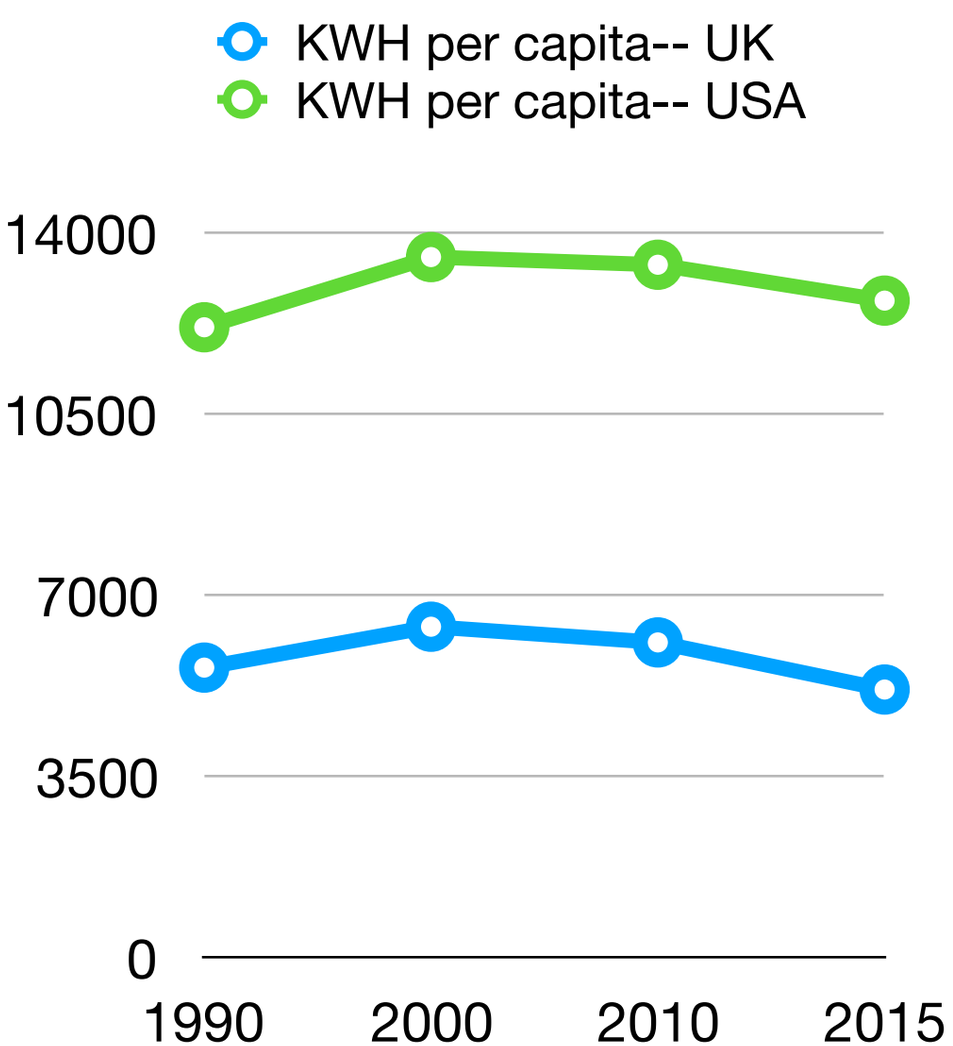
- **New policy**— reduce CO_2 emissions. Regulator wants networks able to deliver renewables, doubts that existing rules attract needed investment. Energy Act (2013) limits emissions, gives more power to government, subsidizes renewables and nuclear by forcing suppliers to buy via contracts for differences

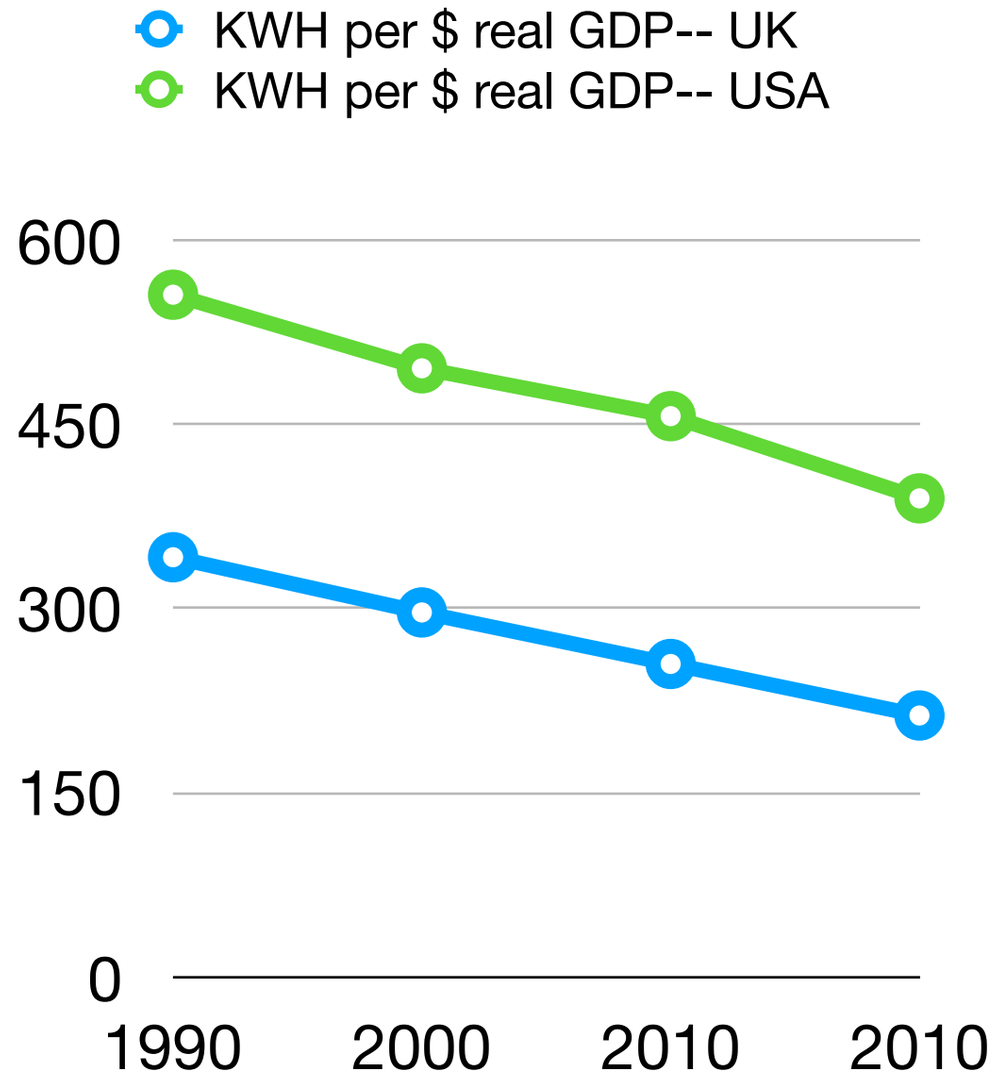
- **Nuclear** — government desperately wants nuclear construction, attempts to attract Chinese money, makes all out effort to convince EDF to build plant (using untried design), and implements above market long term contracts to entice investors

- **Prices and politics**— Treasury opposes decarbonization if it disadvantages British industry, government claims prices will go up but less with its policies, politicians attack suppliers when margins rise, call for price caps on deregulated sector, regulators say market is not competitive, capacity shortages loom

- **Policy consequences**— regulation becomes more detailed and intrusive, government tells industry how to meet goals, politicians lose patience with market and dictate solutions. Coalition ditches neo-liberal philosophy (never fully implemented) of keeping the government out of the picture, light handed regulation and let the market take its course . Government is unapologetically back in charge

Chapter 21-1990-2015
Quarter century of privatization /deregulation, markets weaken, renewables skyrocket and consumers in similar position as before: where did all the savings go?





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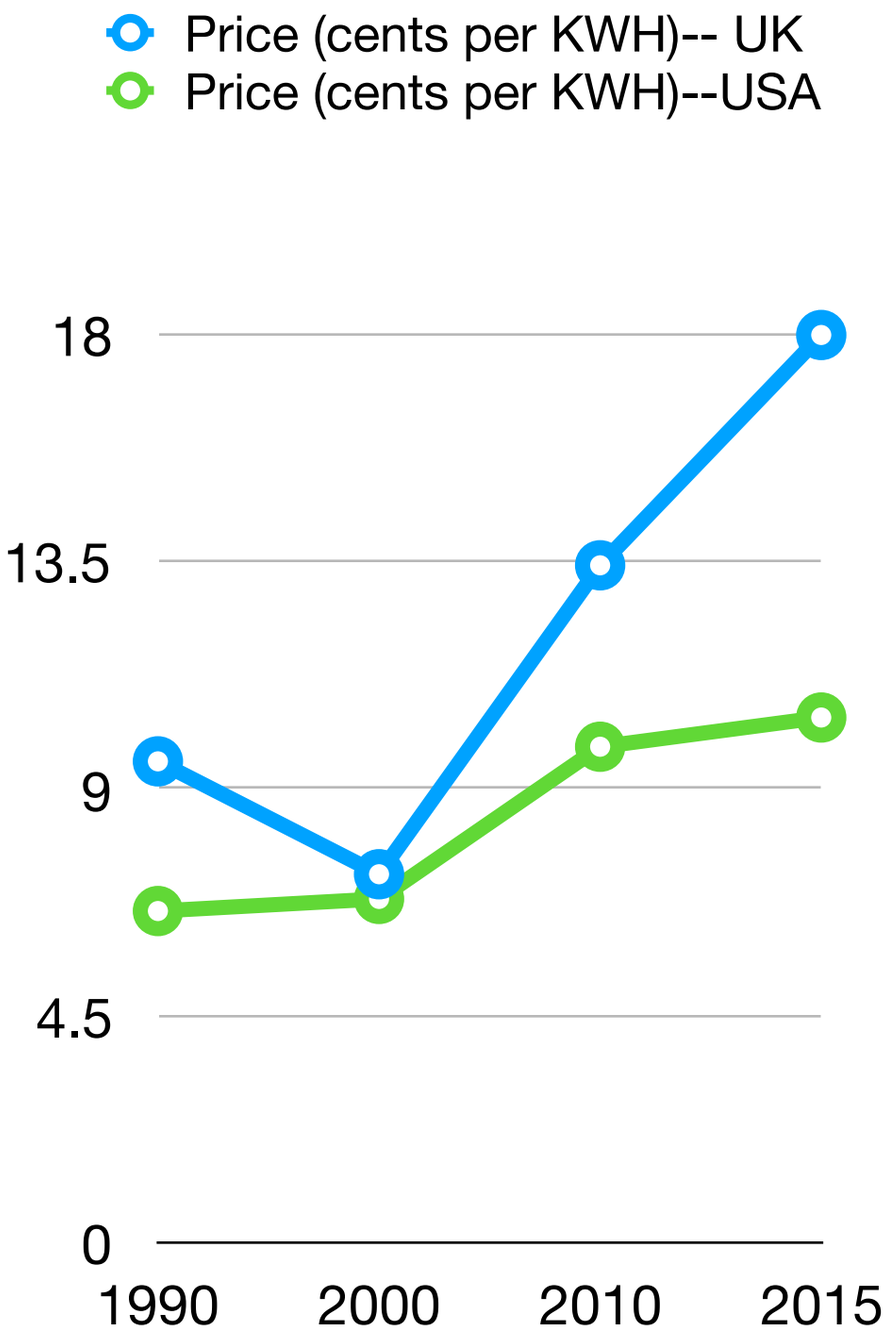

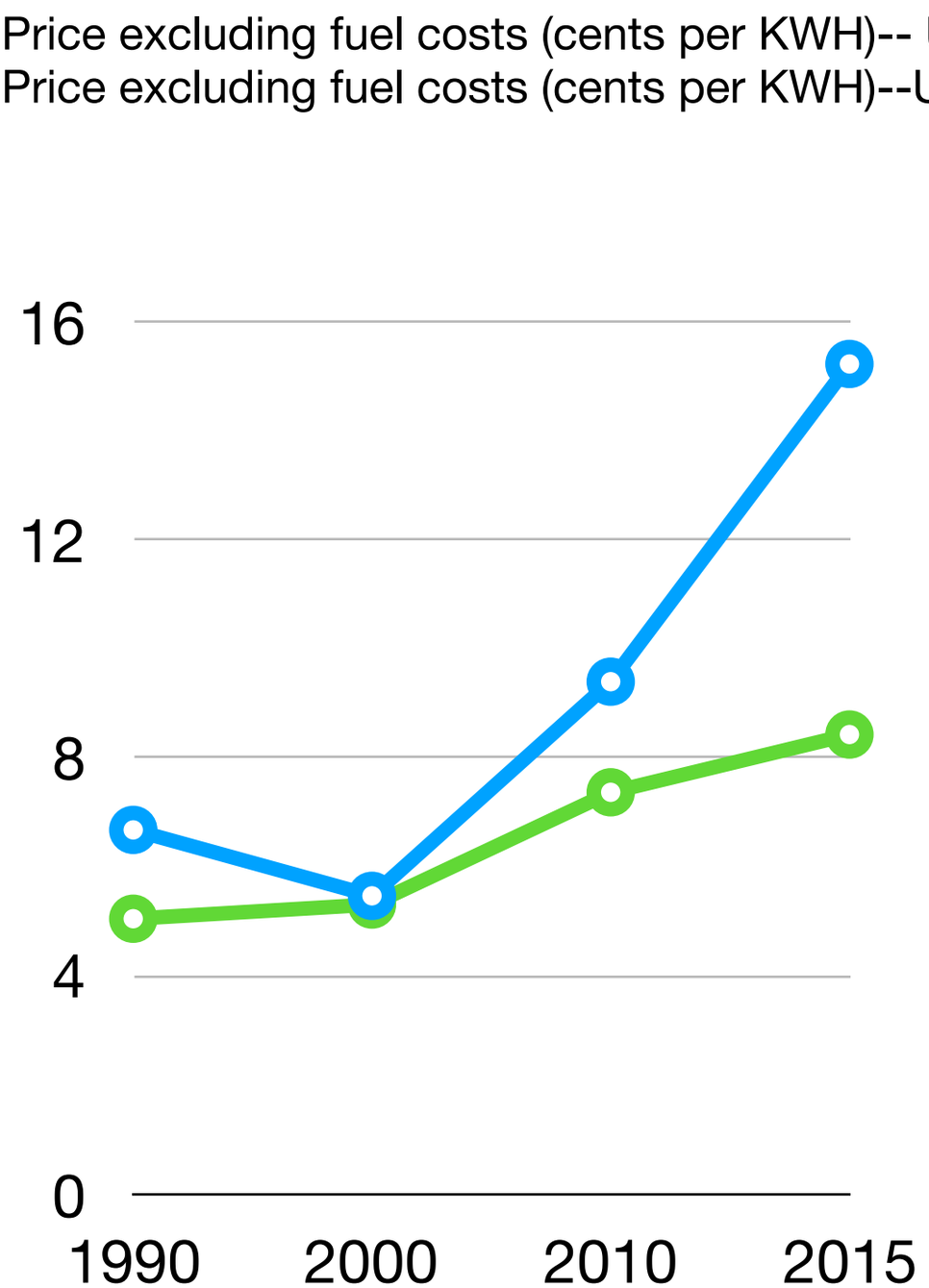

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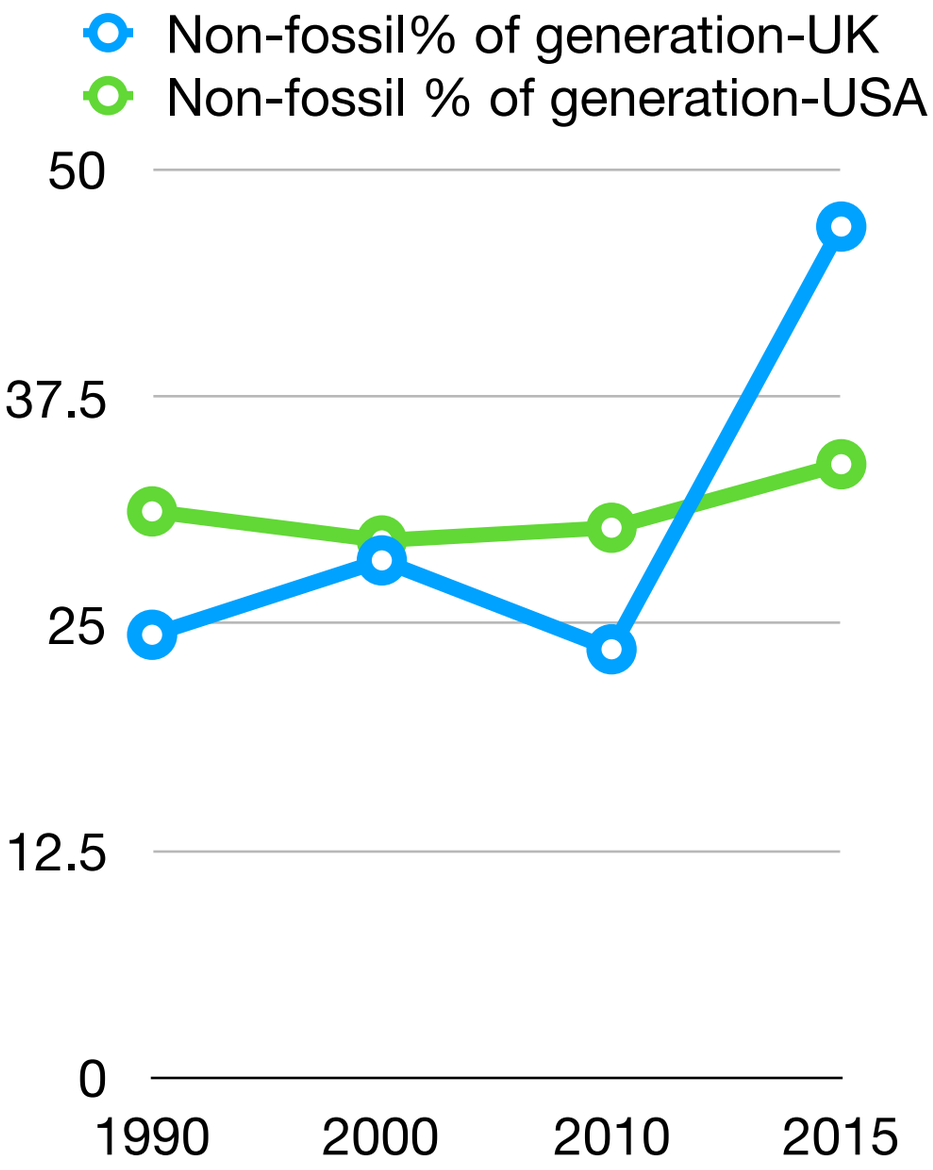

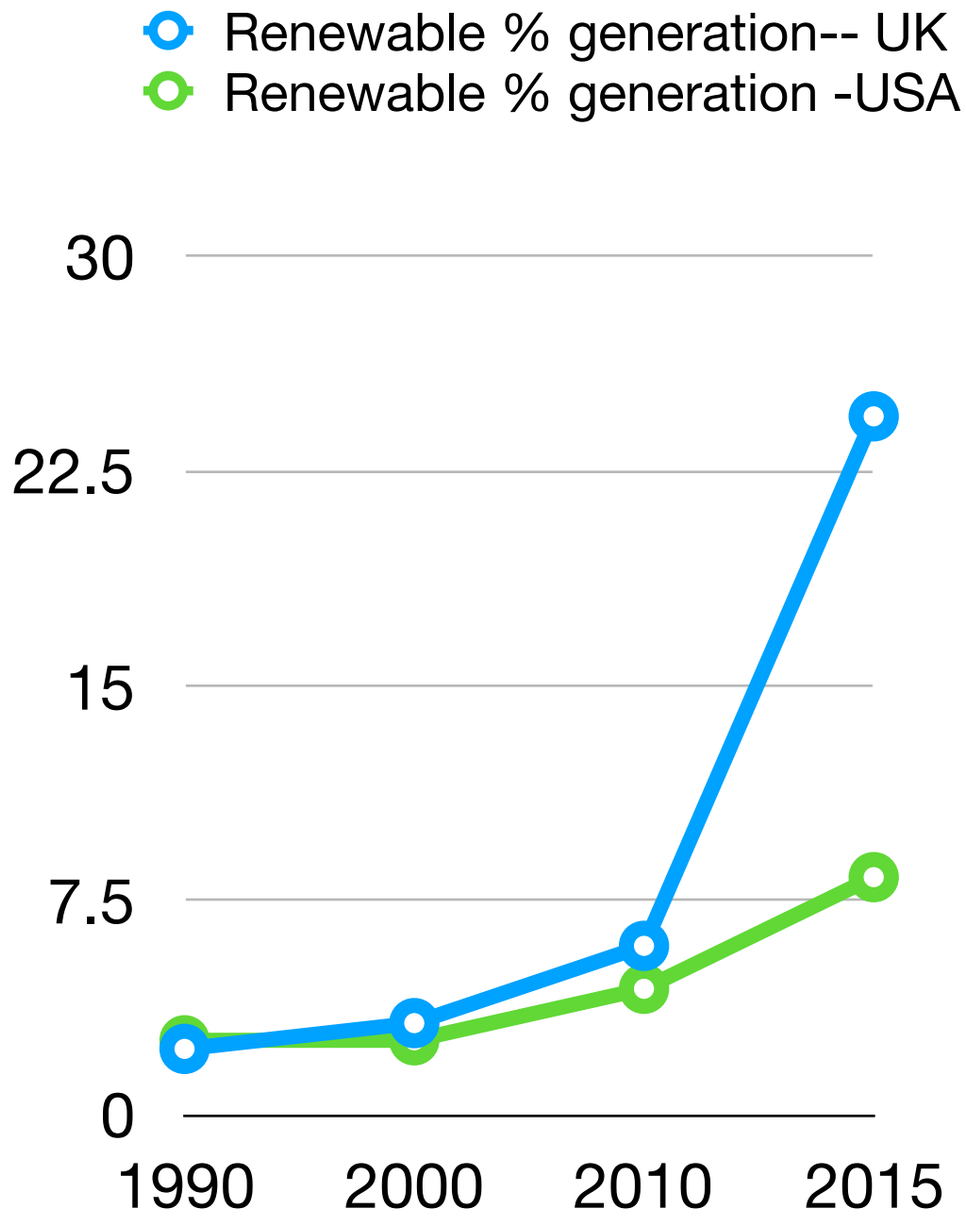

Discussion questions

1. What were the objectives of privatization and deregulation?

2. How would you measure the success of the effort? Was it successful?

3. Was the regulator and government justified in believing that the market structure would not yield the investments required for the future?

4. Renewables add to costs, raise the price of electricity, reduce the competitiveness of local industry and devalue existing generating assets so the government should promote renewable energy. Evaluate these arguments.

Chapter 22
Lessons learned

- **Customers get the leftovers**— insiders and special interest groups know how to extract more benefits than do consumers

- **Regulation never goes away**— not as long as a network is required, and electricity matters to public health and safety

- **No regulatory formula works forever**— changes required when formula no longer works under changed circumstances

- **Unilaterally contrived markets favor quick witted market gamers**— normal markets evolve over time, base rules on experience

- **Regulatory dilemma— whether or not to protect incumbents from competition— won't go away until regulation does**— they invested based on a regulatory compact. Does regulator dump them when circumstances change?

Chapter 22 (continued)

- **Politicians like to choose technologies and make consumers pay for them**— they confuse ends with means, don't trust solutions to the market

- **Nuclear power is not and never was an ordinary commercial venture—** government insures risks, protects the public, assures market for output, takes nuclear waste and determines that nuclear is in the public interest or no nuclear power

- **Beware the giant project**— complex, long duration, big projects require special skills to complete without the usual delays, cost overruns and disasters

- **Breaking up costs money**— splitting up industries to create competition also creates need for transactions whose costs could negate benefits of competition

Chapter 22 (continued)

- **Shifting risk does not make it disappear**— regulated firms keep capital costs down by shifting risk to customers while competitive firms have higher capital costs because they incur risk, but the risk never goes away

- **What is not priced is not in the market**— if the market does not provide for unpriced items, such as low carbon generation or reliability, then the government may have to mandate their supply

- **RPI-X regulation inevitably morphs into rate of return regulation** — UK's price cap regulation first focuses on costs, but after big savings achieved, regulation focuses on capital investment and return on it: rate of return regulation in disguise

- **Sometimes it pays to experiment first**— rather than rely on belief to shape market restructuring, policy makers could experiment and do limited trials, which might be cheaper than plunging forward into a nationwide policy and correcting errors afterwards

Chapter 22 (continued)

- **When they tire of competing, they merge**— competition forces firms to reduce costs and prices, but as an alternative they may merge with each other to reduce competition, which they will do if the government looks the other way

- **A nation uninterested in a domestically owned energy industry will have no trouble selling it**— foreign firms stand ready to buy. Good or bad for the country? Depends on the circumstances.

- **The regulator is the customer— the** regulator acting as surrogate for the consumer, may discourage new and disruptive products and distract management from attending to desires of real customers

Chapter 22 (continued)

- **Confuse the consumer to make a bigger profit**— complicated price schedules confuse customers, cause them to buy expensive offerings, raise profit margins

- **Innovation disrupts planning and renders investment obsolete**— big firms with no legacy electricity assets to defend are most likely toi disrupt the industry and the market

- **Read Adam Smith's other book**— real people, he argued in *The Theory of Moral Sentiments*, act for non-economic motivations. Ignoring that when constructing markets can lead to unexpected consequences

- **Inadequate competition may help consumers more than does regulation**— competitors rarely earned excess returns in the UK, despite inadequacies of the market, but regulated utilities did on a regular basis

Discussion questions

1. Peter Drucker said that predicting the future was impossible, but it paid to project the consequences of existing facts. From what you know, what shape do you expect the electric industry to take?

2. What features of UK deregulation/ privatization/ would you implement in the United States or other countries?

3. What might be the principal virtue of deregulation?

4. Maybe deregulation/privatization took our eyes off the ball, focusing us on changes that produced modest improvements, when we should have been paying attention to something big: climate change and its consequences. Might the UK experience suggest ways to reduce atmospheric carbon more effectively?