**J2 H2 Economics**

**The Energy Market**

**Extract 1: US electricity industry's use of coal fell to historic low in 2015**

America’s use of coal for electricity dropped to its lowest point (just 34% of US electricity generation) in the historical record in 2015. Prices crashed, thousands of miners were laid off and big coalmining companies went bankrupt.

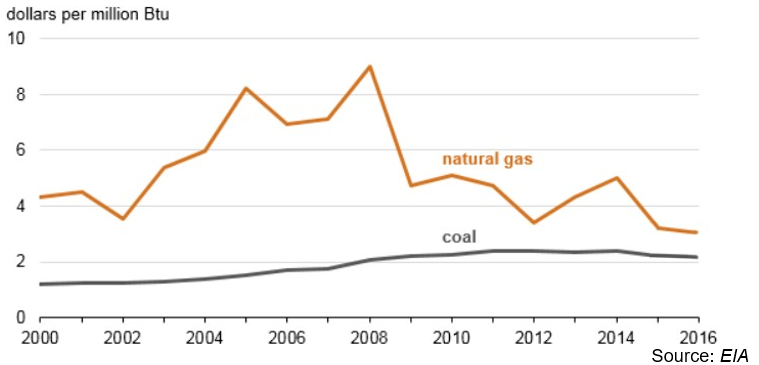
The biggest threat to coal last year remained cheap natural gas. There was also a spike in new wind and solar power. By the end of last year, wind and solar accounted for 5.4% of the energy mix, up slightly from 2014.

Some power companies opted to shut down old, coal-fired power plants, in advance of the clean power plant rules. These shutdowns represented about 5% of the entire fleet.

Source: The Guardian, 4 February 2016

**Figure 1: Cost of coal and natural gas for**

**electric generating plants in the US (2000-2016)**



**Extract 2: Are energy regulations hurting economic growth?**

Energy is essential for economic development. Increasing its production by any means will boost the economy, and limiting it in any way, as through emission controls will hurt it. This is however wrong. Thanks to decades of innovation, smart regulation, and technology investment, the nation can grow and decarbonise at once. The key is to accelerate the move to low-carbon technology by strengthening not eliminating the rules and technology investments that are driving it.

Far from being a prohibitive drag on economic growth, decarbonisation, or making the way that we get energy less dependent on burning fossil fuels that release carbon emissions, has gone hand-in-hand with output growth in most of the United States, according to research by the Brookings Institution. From 2000 to 2015, US Gross Domestic Product grew by 30% though emissions declined by 10%.

The reduction in emissions has more to do with innovation-driven technology change, market forces, and industry restructuring. A recent Energy Information Administration analysis concludes that more than two-thirds of the country’s and individual states’ emissions reductions between 2005 and 2015 were due to fuel-use changes in the power sector - changes that reflect decades of government research and commercialization focus on low- carbon technologies.

Most notably, the nation’s recent ‘decoupling’ owes heavily to the advent of cheap natural gas, as well as to the plummeting prices of renewables. Innovation policies have expanded low-carbon energy options, pushed wholesale electricity prices to record lows, and accelerated the retirement of America’s aging coal plants. The Brookings analysis shows that coal plants’ share of state electricity generation declined in more than 43 states, thanks to technology change.

All of this makes obvious the best way forward. The government should increase low-carbon research and development and accelerate the development of new technologies that can allow further growth. For example, new grid scale energy storage technologies could enable intermittent renewable energy sources like wind and solar to take a greater share in the power generation mix by delivering their electricity to the grid even when the sun is not shining and the wind is not blowing. An era of abundant and inexpensive clean energy awaits.

Source: The Washington Post, 21 December 2016

**Extract 3: British doctors and health professionals call for rapid coal phase-out**

Air pollution from coal plants causes many serious health conditions including stroke, coronary heart disease and lung cancer. It disproportionally affects children and kills more people than road accidents. In the UK, burning coal is linked to 1,600 premature deaths, 68,000 additional days of medication, 363,266 working days lost and more than 1 million incidents of lower respiratory symptoms. The monetary cost is as much as £3.1bn each year in human health impacts.

Groups representing Britain’s 600,000 doctors and health professionals say it is ‘imperative’ to phase out coal rapidly to improve health and reduce National Health Service costs.

Source: The Guardian, 19 October 2016

**Extract 4: UK-wide carbon tax would have 'little impact' on consumers**

A ‘modest’ uniform carbon tax of £20 a tonne would have a negligible impact on consumer prices (increase by up to just 0.9%) according to a new study that attempts to make the case for wider adoption of carbon pricing policies.

However, the true cost impact on consumers is likely to be even lower, given the manner in which the carbon tax would incentivise green behaviour change, drive business innovation, and provide the Treasury with revenues that it could recycle back into the economy.

Opponents of carbon taxes argue they would impose costs on consumers and undermine the competitiveness of carbon intensive industries such as the Big Six electricity generators (British Gas, EDF Energy, E.ON, Npower, Scottish Power, and SSE). Last year the government moved to ease these concerns, exempting a raft of energy intensive industries such as steel and concrete manufacturing from existing carbon taxes and ‘green levies’.

Source: The Guardian, 11 January 2016

**Extract 5: Ways to reduce the usage of energy**

Traditional vehicles and energy sources will continue to hold a competitive edge against greener alternatives due to the vast amounts of subsidies they receive. Though subsidies are also provided to electric vehicles, they aren’t equal to the applied subsidies of gasoline vehicles. This weakens the economic forces in transition to sustainable transport and energy. Educating the public on climate issues will be essential.

Another way is by tradable permits used by some European countries. The Emissions Trading Scheme’s ‘cap and trade’ scheme creates a limited emissions market, within which 11,000 power stations and industrial plants can buy or sell allowances. It is lauded by supporters for a market-based approach that rewards greener firms with tradable credits, while encouraging dirtier firms to clean up their act, or offset their emissions by paying for accredited emissions cuts elsewhere.

Critics have raised questions about the veracity of some of these schemes, the over- allocation of free allowances to heavy polluters, and the extent to which current prices can help fuel switching.

The system does have a mechanism to gradually reduce the number of carbon credits available - and so raise prices but the note says that this will not be enough to cut emissions to at least 80% of 1990 levels by 2050, as the European Union has promised.

Source: The Guardian, 5 May and 29 Feb 2016

**Questions**

(a) Compare the cost of coal and natural gas for electric generating plants in the US between 2002 and 2016. [2]

(b) With reference to Extract 1 and using supply and demand analysis, explain the impact of cheap natural gas and the shutdown of coal-fired power plants on the market for coal. [6]

(c) With reference to Extract 2 and using a PPC diagram, explain and comment on the view that decarbonisation has gone hand-in-hand with economic growth. [8]

(d)(i) Explain two factors that a government should consider in making a rational decision to subsidise electric vehicles. [4]

(ii) Explain one possible unintended consequence of subsidising electric vehicles. [2]

(e) Extract 4 suggests that a ‘modest’ uniform carbon tax of £20 a tonne would have a negligible impact on consumer prices. Explain this claim, and comment

on whether it is valid. [7]

(f)(i) Explain how ‘the burning of coal’ results in market failure. [4]

(ii) Using Extract 5, discuss the view that the implementation of tradable permits is the best way to solve the market failure arising from ‘the burning of coal’. [12]

[Total: 45]

**Suggested Answers**

**(a) Compare the cost of coal and natural gas for electric generating plants in the US between 2002 and 2016. [2]**

Cost of natural gas rose from 2002 to 2008, and fell thereafter from 2009 to 2016 while cost of coal rose steadily from 2002 to 2016.

Cost of natural gas was higher than cost of coal throughout the entire period from 2002 to 2016.

**(b) With reference to Extract 1 and using supply and demand analysis, explain the impact of cheap natural gas and the shutdown of coal-fired power plants on the market for coal. [6]**

Cheap natural gas may incentivise consumers to switch from coal to natural gas as they are substitutes in consumption. Demand for coal falls, ceteris paribus.

Shutdown of coal-fired plants result in a fall in derived demand for coal as coal is a key factor of production used to fire the power plants, ceteris paribus. Overall, demand for coal falls.

[Explain impact on equilibrium price using PES concept – to explain why ‘prices crashed’ as stated in Extract 1]

**(c) With reference to Extract 2 and using a PPC diagram, explain and comment on the view that decarbonization has gone hand-in-hand with economic growth. [8]**

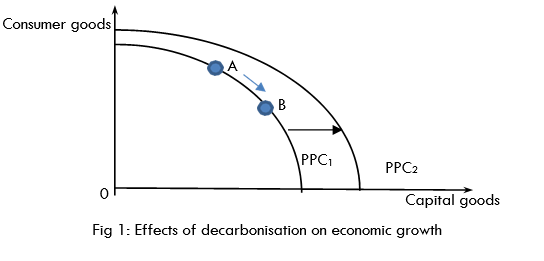
Introduction

* Define economic growth; SR growth (actual growth) vs LR growth (potential growth). Sustainable growth.
* Define PPC: The Production Possibility Curve (PPC) shows the maximum attainable combinations of two goods and services that can be produced in an economy, when all the available resources are used fully and efficiently, at a given state of technology.

Main Body

1. Explain how “decarbonization has gone hand-in-hand with economic growth using the PPC.

* “the government’s spending on low-carbon research and development (R&D) of new technologies”. - shift of PPC (potential growth)
* more production of capital goods due to the increase expenditure on R&D into new technologies will have impact on actual growth.
* Sustainable growth is also achieved as traditional energy sources like coal is a finite resource whereas solar and wind energy is infinite.



Dependent on government’s willingness and ability (budget) to engage in R&D for renewable energy.

Figure 1, the price of coal is still below that of natural gas (or if the price of coal falls due to fall in demand and becomes even cheaper), producers might be tempted to burn coal for energy.

If prices of natural gas and renewables rise in the future due to increase in demand, cost of production for many goods and services in the economy will rise, resulting in higher GPL and reducing real GDP growth.

**(d)(i) Explain two factors that a government should consider in making a rational decision to subsidize electric vehicles. [4]**

A government would have to weigh the costs and benefits while making its decision whether to subsidise electric vehicles. The benefits have to outweigh the costs for the government to decide to subsidise electric vehicles.

Benefits: Reduction in MEC from the reduction in usage of traditional vehicles and energy, more sustainable growth

Costs: Cost of financing the subsidy, opportunity cost

**(d)(ii) Explain one possible unintended consequence of subsidizing electric vehicles. [2]**

Explain the following:

* Potential incurrence of marginal external cost resulting from the usage of electric vehicles.
* Low take-up rate due to lack of information.

**(e) Extract 4 suggests that a ‘modest’ uniform carbon tax of £20 a tonne would have a negligible impact on consumer prices. Explain this claim, and comment on whether it is valid. [7]**

Imposition of carbon tax (a tax on fossil fuels) will increase cost of production for firms who burn coal in their production (generation of electricity) such as the Big Six electricity generators. Supply of goods and services will fall, ceteris paribus. Prices will increase. But it will be negligible (0.9%) as suggested in Extract 4.

This is because the carbon tax which increases cost of production and thus reduces profit margins would incentivise the firms to switch to other relatively cheaper forms of energy in their production.

Explain how the use of carbon tax achieve social efficient level of production with a diagram.

To pay less carbon tax, firms would have to reduce their usage of fossil fuels and this may drive business innovation. Cost of production may reduce and thus price may not rise by much.

If the government uses the revenues that they collect from the carbon tax to subsidise electricity or merit goods, these goods would be more affordable to consumers.

The extent of the increase in price depends on the relative values of the price elasticity of demand and price elasticity of supply of different goods and services. (explain with examples)

Thus, producers may pass on the carbon tax to consumers in some cases. Hence, the claim that carbon tax has a negligible impact on consumer prices may not be valid.

**Other considerations:**

**(f)(i) Explain how ‘the burning of coal’ results in market failure. [4]**

The burning of coal generates negative externalities such as “serious health conditions, 1,600 premature deaths, 68,000 additional days of medication, 363,266 working days lost and more than 1 million incidents of lower respiratory symptoms” to 3rd parties. The marginal external cost is “as much as £3.1bn each year in human health impacts”.

Due to the presence of MEC, there is a divergence between the marginal private cost (MPC) and the marginal social cost (MSC), where MSC=MPC+MEC.

Assuming that the external benefit in the private exchange of the burning of coal is negligible, then MSB=MPB+MEB and MEB=0; MPB=MSB.

Private producers will burn up to 0QP units of coal, where MPB=MPC.

However, the socially optimal level of coal would be where MSB=MSC at the level of 0QS units. The free market has resulted in an overproduction of coal by QSQP units. The additional cost to society of overproducing coal is greater than the additional benefit to society resulting in a welfare loss to society.

Draw and explain the diagram:

**(f)(ii) Using Extract 5, discuss the view that the implementation of tradable permits is the best way to solve the market failure arising from ‘the burning of coal’. [12]**

Explain how tradable permits works

The system of tradable permits is a combination of command-and-control and market-based system of resolving externalities. Each firm (Extract 5: “11,000 power stations and industrial plants) is given a permit to produce a given level of pollution. If the firm produces less pollution than what they are legally permitted to produce, the firm is given a credit. This credit can then be sold to another firm, allowing the other firm to exceed its original limit.

The main advantage of tradable permits is that the government can simply determine the total amount of permitted discharge according to the ability of the environment to absorb the pollutants; it can do this without any knowledge of the specific costs and benefits of individual firms.

Explain how tradeable permit act like a quota to achieve efficient resource allocation with a diagram.

Limitations of tradable permits

For heavy polluters, if the costs of the permits is lower than their abatement costs (costs of eliminating pollution), they would buy more permits to pollute.

Another issue of this system is deciding how to allocate the permits to firms. If there are many polluting firms, regulators would be concerned about the administrative costs.

It is also possible that one or two dominant firms may buy up permits in the market and refuse to trade them. This would then act like a barrier to entry for new firms and the permits could therefore contribute to non-competitive behaviour.

Explain how an alternative policy works Extract 5: Subsidies to green vehicles

Direct subsidies given to buyers of green vehicles will make green vehicles more affordable (lowers the price that buyers have to pay) and increase the quantity demanded, ceteris paribus.

Indirect subsidies given to producers of green vehicles will lower the cost of production and increase the supply of green vehicles, ceteris paribus. This will lower the price of green vehicles.

Price of green vehicles is relatively lower, hence consumers switch from traditional vehicles (or gasoline vehicles) to green vehicles as they are substitutes in consumption. Hence, demand for traditional/gasoline vehicles falls, ceteris paribus. Derived demand for gasoline/traditional energy falls, reducing the over-consumption of gasoline/traditional energy and reducing the welfare loss to society.

Limitations of the alternative policy

Extract 5 suggests that the subsidies given to green vehicles aren’t equal to that of gasoline vehicles which received vast amount of subsidies. This suggests that price of gasoline vehicles might still be relatively cheaper as compared to green vehicles.

Explain how one other policy works

Extract 5: Educating the public on climate issues will be essential

Limitations of other policy

Must consider the duration needed for the effects of such measures to be felt, especially if the problem of external cost is a serious one that must be dealt with in the short run.

Evaluative Conclusion

Whether the policy mentioned in the question works.