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# Lowest-cost Abatement in Light of the EU ETS and Renewable Feed-in Tariffs in the Electricity Sector in Bulgaria

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*The European Union (EU) climate and energy package has laid the ground for factoring in the costs of externalities from economic activities. Bulgaria has implemented the package with its competing policy instruments – emissions trading and renewable feed-in tariffs. Considering that these incentives to foster carbon abatement have created a playing field for investments in clean technologies, any lack of coordination may produce unintended consequences. There are indications that the main principle underpinning the EU emissions trading scheme (EU ETS), which is to allow emission reductions to take place in a cost-effective manner, has been disregarded under the pressure to adopt feed-in tariffs.*

Prior to the inception of environmental regulation, the use of the environment had not been viewed as a production cost on industry's balance sheet of manufacturing in addition to labour, capital and infrastructure.[1] There is no economic reason for a polluter to incorporate the costs of its emissions, 'unless policy intervenes' to correct the wrong. Accordingly, policy-makers must struggle to persuade industry to abandon

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1 N Johnstone, 'International Trade and Environmental Quality' in T Swanson, *The Economics of Environmental Degradation: Tragedy of Commons?* (Cheltenham: Edward Elgar, 1996), 143.

the view that it can use the environment at no cost. However, coordination between incentive mechanisms to decarbonise the economy is only vaguely provided for under European legislation.[2]

The underlying aim of this article is to question the wisdom of providing for the auctioning of $CO_2$ allowances under the European Union Emissions Trading Scheme (EU ETS) at the same time as providing other incentives. Is it possible to reconcile these twin policies with the concept of least-cost carbon abatement? Auctioning in the electricity sector post-2013 and the overlapping of a market-based mechanism (EU ETS) with a non-market-based mechanism (renewable feed-in tariffs) will be assessed through the lens of the Bulgarian experience.

The article begins with an overview of Bulgaria's electricity industry. The energy mix, key stakeholders, the degree of liberalisation and low-carbon policy instruments comprise the backdrop for analysis of the lowest-cost principle. Particular attention will be paid to the institutional capacity in Bulgaria, which led to the suspension of its eligibility to participate in the flexibility mechanisms under the Kyoto Protocol.[3] The core of the article will examine the method for allocation of $CO_2$ allowances in Phase III of the EU ETS (post-2013), as auctioning may be unable to deliver deeper carbon abatement at lowest cost without further regulatory intervention. The focus will then switch to the challenges for the renewable energy industry in Bulgaria, which is about to reach the optimal limits of its deployment. The article will conclude with an analysis of the lowest-cost abatement principle, which has turned into somewhat of an illusion.

## Electricity outlook in Bulgaria

Historically, coal has been the most common and secure natural resource for the purposes of power generation in Bulgaria. Local deposits of gas, oil and uranium are limited.[4] The richest coal field is the East-Maritsa coal basin, located in south-east Bulgaria. It contains lignite coal reserves adequate for 50 years' supply.[5] Bulgaria's mountainous terrains provide promise

2 Recital 44 of Council Directive 2009/29/EC of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community OJ 2009 L 140/63.

3 Article 6 (Joint Implementation), Article 12 (Clean Development Mechanism) and Article 17 (Emissions Trading) of the Kyoto Protocol (adopted 11 December 1997, entered into force 16 February 2005) 2303 UNTS 148.

4 See www.mi.government.bg/energy/energy.html.

5 'The status of the energy mix in Bulgaria in 2007', Ministry of the Economy, Energy and Tourism, p 1, www.mee.government.bg/energy/energy_doc/Energy_mix_2007.pdf and for an English text see http://ec.europa.eu/energy/energy_policy/doc/factsheets/mix/mix_bg_en.pdf.

for additional hydrological capacity. Figures for 2004 show that Bulgaria's primary energy supply comprised 36 per cent coal/lignite, 22 per cent oil, 22 per cent nuclear, 13 per cent natural gas, five per cent renewables and two per cent other.[6] On the other hand, Bulgaria's dependence on energy imports is close to the European average. The Russian Federation is Bulgaria's main trading partner.[7]

Demand for electricity is met predominantly by thermal power plants and nuclear power. The base load of electricity generation is supplied by the Kozloduy Nuclear Power Plant, which also allowed Bulgaria to become a net exporter of electricity to the rest of the Balkans.[8] Mid-merit and peaking generation is provided by a number of coal power plants scattered around the country, the most powerful of which is Maritsa East II Thermal Power Plant (TPP), supplying approximately 18 per cent of total power generation.[9] TPPs have recently gained a lager share in the power generation mix. This increase is mainly a result of the commitments Bulgaria undertook prior to its accession to the EU to decommission and close down Units 1, 2, 3 and 4 of Kozloduy NPP.[10] Large-scale pumped storage and hydropower plants provide additional sources, although their share is relatively small and hydro capacity is often dispatched in order to balance the electricity system.[11] Wind and solar power are still lagging behind in the energy mix compared to other sources despite the fact that the renewable energy sector has been expanding at an unprecedented pace in recent years.[12]

The organisation of the Bulgarian electricity system was substantially influenced by the privatisation of distribution companies in 2004, as well as by the provisions of the 'third legislative package' on electricity market liberalisation in the EU.[13] A fundamental component of the system is the high-voltage transmission grid, owned by the National Electricity Company

6 *Ibid.*

7 At Georgiev, 'How Local Lignite Coal and Nuclear is Important for Bulgaria' ('За България са важни местните лигнитни въглища и ядрената енергетика') *Utilities Magazine* (Sofia, Bulgaria, 1 January 2008).

8 Bulgaria has 13 interconnection lines (440 kV) with each one of its neighbours.

9 Statistics are available on the website of the Ministry of the Economy, Energy and Tourism, www.mi.government.bg/energy/energy/docs.html?id=270836.

10 See *Negotiations for Accession to the EU*, Chapter 14 – Energy, available at www.europe.bg/en/htmls/page.php?category=136; see also 'Nuclear Regulatory Agency (Bulgaria) – the exact dates of shutting down the units of Kozloduy NPP' at www.bnsa.bas.bg/en/nuclear-facilitie/kozloduy.

11 See www.nek.bg/cgi?d=1000.

12 J Wilkens, 'Wind in Power: 2009 European Statistics' (February 2010) EWEA, available at www.ewea.org/fileadmin/ewea_documents/documents/statistics/100401_General_Stats_2009.pdf.

13 Council Directive (EC) 2003/54/EC of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC, OJ 2003 L 176/37.

(NEC).[14] Most of the power plants are directly connected to the transmission grid. At lower-voltage levels, the territory of Bulgaria has been divided into three distinct subregions.[15] In each of these regions, distribution networks deliver medium- and low-voltage electricity to electricity customers in the retail market. Distribution networks are operated by CEZ Distribution Bulgaria, E.On Bulgaria Grids and EVN Bulgaria Distribution.[16]

CEZ, E.On and EVN also function as electricity end suppliers and electricity traders through separate subsidiaries specifically licensed as end suppliers or traders. These activities have been separated (unbundled) from distribution operations but each of the distribution system operators, suppliers and traders remains vertically integrated within a single corporate group – CEZ, EVN or E.On.[17]

An independent electricity system operator (ESO), complemented by the operators of the respective distribution grids, is responsible for the operational planning, balancing and control of the electricity system.[18] As the Energy Act prescribes, power generators, suppliers, traders, consumers and grid operators form 'a single electricity system under an uninterrupted operational regime for generation, transmission, distribution and consumption of electricity'.[19] To this end, all companies involved in the electricity sector, including the ESO, are licensed for their respective activities by the energy regulator – the State Water and Energy Regulatory Commission (SEWRC).[20]

While the ESO and NEC are separate legal entities they are also constituents of a vertically integrated energy group – Bulgarian Energy Holding. The group has remained a state-owned enterprise managed by the Ministry of the Economy, Energy and Tourism. Bulgarian Energy Holding also includes the largest power generators under its umbrella: the Kozloduy NPP, Maritsa East II TPP as well as other stakeholders in the gas market.[21] It is questionable how effective unbundling has been, since, as noted above, distribution operators and end suppliers, the transmission owner, power generators and the system operator are still subsidiaries of a vertically integrated entity.

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14 See www.nek.bg/cgi?d=1000.

15 The capacity of transmission power lines is 110 kV, 220 kV and 400 kV; distribution lines are up to 110 kV.

16 For CEZ visit www.cez.bg/en/home.html; for EVN visit www.evn.bg; and for E.On Bulgaria visit www.eon-bulgaria.com/bulgarian/index.htm.

17 In this regard, see recitals 9 and 10 of Council Directive 2009/72/EC of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, OJ 2009 L 211/55.

18 See www.tso.bg/default.aspx/en; see also Article 108 of the Energy Act (Bulgaria).

19 Article 82 of the Energy Act (Bulgaria), promulgated and last amended in *State Gazette* No 97, 10 December 2010.

20 See www.dker.bg/index_en.htm.

21 See the structure of the holding at www.bgenh.com/en/index.php.

There are two segments to electricity trading arrangements in Bulgaria: the regulated and the deregulated (liberalised) segment.[22] Near-term prospects for the market envisage the latter segment gradually to outstrip the former until complete liberalisation becomes a reality. To this end, the energy watchdog (SEWRC) adopted new Rules on Electricity Trading in August 2010, whose operational trial is scheduled to begin on 1 July 2011 and finish on 30 June 2012.[23] Pursuant to the new rules, the electricity market will allow for trading by means of bilateral contracts for delivery on an hourly basis, a day-ahead market, a balancing market, reserve capacity, an ancillary services market and a market for granting interconnection capability (capacity) between systems.[24]

In both segments of the market, participants can execute bilateral trading agreements for delivery. Parties to agreements in the regulated segment must be power generators on the one side and the NEC the other. The scope of these contracts is limited to quantities determined by the SEWRC (wholesale regulated market). Thereafter, NEC in its capacity as a public supplier (as well as owner of the transmission grid) contracts the distribution companies and end suppliers (the respective subsidiary of CEZ, E.On and EVN). Finally, end suppliers deliver electricity to their customers in the retail market.[25]

Alternatively, power generators, electricity traders, customers registered on the free market and the public supplier may also trade and/or provide ancillary services in the deregulated (liberalised) segment of the market.[26] In addition, operators eligible to participate in the liberalised segment may trade in the 'day-ahead' market, organised by the ESO. The ESO collects the bids for delivery, strikes the market equilibrium price (clearing price) and determines the quantities to be delivered on an hourly basis, taking into account the demand and supply curves.[27] Electricity trading is expected to take place via a power exchange in Bulgaria as early as 2012.[28]

In light of the above, the Bulgarian electricity sector remains heavily regulated as approximately 70 per cent of the total electricity generated is

22 Articles 91–105 of the Energy Act, note 19 above.

23 New Rules on Electricity Trading, adopted by SEWRC with Protocol No 94, 25 June 2010 and promulgated in *State Gazette* No 64, 17 August 2010 (Bulgaria); for a detailed schedule on different stages of the trial period, please visit www.eso.bg/default.aspx/podgotovka-i-test-na-novite-ptee/bg.

24 *Ibid*, Article 2.

25 Retail customers are household customers and small enterprises with less than 50 employees and with an annual turnover not exceeding approximately €10 million.

26 See Articles 2–10 and 15 of the new Rules on Electricity Trading, note 23 above.

27 *Ibid*, Article 44.

28 'Draft on Bulgaria's Strategy for reliable, efficient and cleaner energy up to 2020' (January 2011), Ministry of Economy, Energy and Tourism, 29, available in Bulgarian at www.mee.government.bg/doc_vop/ENERGY.STRATEGY.-FINISH-FINISH-14.01.2011.pdf.

traded in the regulated segment of the market at this stage.[29] Furthermore, workable competition has yet to be observed in the deregulated market either. Kozloduy NPP has enjoyed a dominant position by far.[30] Overall, the protection of the public interests rests in the hands of the SEWRC for as long as the market continues to be substantially concentrated – vertical integration has spanned power generation, transmission, distribution and supply. These structural characteristics of the Bulgarian electricity market require the SEWRC to guarantee reasonable prices and protect the public interest of final customers. The overarching function of the SEWRC is the enforcement of the Energy Act, its regulations and other rules, falling within the regulator's supervisory remit. Some of the most prominent powers of the SEWRC include: the regulation of electricity prices between power generators; transmission and distribution system operators; imposition of obligations on public and end suppliers; and preferential feed-in tariffs.[31]

In the context of low-carbon generation, Bulgaria adopted its first preferential purchase price (feed-in tariff) for electricity produced from renewable sources and combined heating in 2005.[32] Preferential purchase prices have been fully institutionalised and determined annually by the energy regulator since Bulgaria's accession to the EU.[33] Bulgaria has an assigned target of 16 per cent renewable energy in final consumption by 2020 as part of the implementation of Council Directive 2009/28/EC.[34]

The incentives envisaged in domestic legislation (Renewable and Alternative Energy Sources and Biofuels Act) transposing this Directive include: priority interconnection of renewable power plants to the transmission or distribution grid;[35] power purchase obligation imposed on

29 St Nachev, 'Liberalization of the Bulgarian Electricity Market' ('Либерализацич на българскич електроенергиен пазар') *Utilities Magazine* (Sofia, Bulgaria, August 2008).

30 V Popovska, 'The Market in 2008' ('Пазарът през 2008 г.') *Utilities Magazine* (Sofia, Bulgaria, August 2008).

31 Articles 21–22 of the Energy Act (Bulgaria), note 19 above.

32 Regulator's Decision No 94, item 7 on 22 August 2005, www.dker.bg/resolutions_05.htm accessed 29 December 2010.

33 Council Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable energy sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, OJ 2009 L 140/16; the Directive has been transposed into the Renewable and Alternative Energy Sources and Biofuels Act promulgated in *State Gazette* No 49, 14 June 2007, last amended on 22 December 2009.

34 See Annex 1 of Directive 2009/28/EC, note 33 above.

35 According to Article 16 of the Additional Provisions of Renewable and Alternative Energy Sources and Biofuels Act, promulgated and last amended in *State Gazette* No 102, 22 December 2009, preferential feed-in tariffs do not apply to hydropower plants with capacity above 10 MW. Section 1, item 1 of the same Act defines 'renewable energy sources as energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases'.

the public supplier (NEC) or end supplier (CEZ, EVN or E.ON); long-term power purchase agreements;[36] simplified administrative procedures; and feed-in tariffs.

The essential structure of the feed-in tariff is fairly easy to explain. Tariffs consist exclusively of two components: first, they are equal to at least 80 per cent of the average price charged by the public and end suppliers; and secondly, an additional premium specific to each type of renewable technology is incorporated thereto. The additional premium cannot be set to less than 95 per cent of the premium for the previous year.[37] The regulator SEWRC enjoys a very small margin of appreciation in determining the feed-in tariffs on an annual basis.[38]

Looking at the other side of the power line, feed-in costs are to be recovered from final customers in full. The public obligations to buy renewable energy at preferential prices, which the public and end suppliers have forcefully been committed to, should be shouldered equally by retail customers of electricity.[39] Concerns have been expressed that currently the costs are not fully recovered from customers, because the SEWRC struggles to mitigate cost impacts.

From a much broader perspective, renewable energy incentives are the most effective and specifically targeted stimulus to decarbonise the economy in numerous Member States of the EU. Further to its accession to the EU, Bulgaria has also joined the EU ETS – the most far-reaching EU policy to reduce carbon emissions. The emissions trading scheme and the feed-in tariff provide the focus of this article.[40]

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36 The validity of the long-term power purchase agreements is 25 years for solar and geothermal power, and 15 years for all other sources.

37 Article 21 of the Renewable and Alternative Energy Sources and Biofuels Act, note 35 above.

38 The SEWRC has set the feed-in tariffs for the period April 2010–April 2011 at the following rates, VAT exclusive: hydro up to 10 MW – 110.79 per MWh; wind – from 190.59 to 148.79 Bulgarian lev (BGN) per MWh (depending on working hours/capacity); small solar – BGN 792.89 per MWh; large solar – BGN 728.29; small biomass – BGN 217.19 per MWh, etc.

39 Methodology for compensation of the costs of the public and end suppliers, stemming from the imposed public obligations to purchase generated power from renewable energy and highly efficient cogeneration at preferential prices, issued and last amended by the SEWRC with Resolution No 94 of 25 May 2010, www.dker.bg/rules/rule_el_26.pdf.

40 For a short introduction, please visit http://ec.europa.eu/clima/policies/ets/index_en.htm.

## Options for lowest-cost abatement

In theory, 'economic incentive mechanisms', such as emissions trading, are flexible measures designed to stimulate polluters to go 'beyond compliance'.[41] Recognising that emissions reductions entail different cost implications for polluters, emissions trading became the principal choice of the EU. Emissions trading mandates an overall cap on emissions, while leaving the regulated entities the flexibility to decide how to curb their emissions. The EU ETS is founded on the concept that emissions reductions should take place in 'a cost-effective and economically efficient manner'.[42] Emissions cuts are expected to occur where they are cheapest, provided that the overall cap is observed. This principle has been articulated as 'lowest-cost abatement'.[43]

Economists advocate that the costs of mitigation are affordable, especially given 'opportunities with negative costs'.[44] Carbon abatement may not necessarily require a massive transformation of the economic system, at least not until 2020, by which time the EU has pledged to have reduced its emissions by 20 per cent.

In this context, economists report the potential for approximately 35 per cent of emissions reductions through the implementation of energy efficiency measures by 2020 (compared to 2005 as a baseline year). What is peculiar to these reductions is that they could be accomplished at no net cost without the need for incentives. Initial investment costs in all kinds of efficiency will be paid off by accruing energy savings. For instance, numerous 'cheap' options to abate in the electricity sector can be utilised, such as fuel-switching, improving operational efficiency and co-firing coal with biomass. Whereas conventional energies will remain dominant sources of electricity in the short term, there is plenty of room for cheap measures to enhance the efficiency of coal power plants. Analyses underline that costs to refurbish air heaters to boost boiler efficiency and to upgrade

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41 Maria Lee, *EU Environmental Law: Challenges, Change and Decision-making* (Oxford and Portland, Oregon: Hart Publishing, 2005), 199.

42 Article 1 of Council Directive 2003/87/EC of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, OJ 2003 L275/32.

43 R Baldwin, *Regulation Lite: the Rise of Emissions Trading* (2008) LSE Law, Society & Economy Working Papers, 3–9 and 12, available at www.lse.ac.uk/collections/law/wps/WPS2008-03_Baldwin.pdf.

44 Bert Metz, 'The Climate Financing Problem: Funds Needed for Global Climate Change Mitigation Vastly Exceeds the Funds Currently Available' in R Steward, B Kingsbury and B Rudyk, *Climate Finance: Regulatory and Funding Strategies for Climate Change and Global Development* (New York: New York University Press, 2009).

pulverisers and steam turbines 'are reported as being negative'.[45] These options account for significant carbon reductions at lowest cost,[46] without the need to resort to state subsidies or feed-in tariffs for bringing 'capital-intensive technologies' on stream, which is the case for renewable energy.[47] Furthermore, at a price of just under €20/t/$CO_2$e, economists see potential for another 50 per cent of reductions.[48]

The pertinent question, therefore, is why this potential, which is in full conformity with the concept of lowest-cost abatement, has not been captured so far. Such a question is especially important for Bulgaria – a country deeply embedded in an energy mix, which cannot be easily changed. Its coal technologies are mature and dominant, providing affordable and fairly secure supplies for its energy needs.

As economists have noted, there are certain barriers to implementing efficiency measures, the most common one of which is the magnitude of the required initial investments. In order to reap the benefits of efficiency, upfront costs inevitably soar, irrespective of the fact that these will be offset in the longer term.[49]

At this stage, various incentive mechanisms – such as the EU ETS – come into play but it became obvious that this policy alone was going to fall short in encouraging the necessary low-carbon investments. This led to recommendations for supplementary measures – predominantly feed-in tariffs – which were widely adopted across the EU.[50]

Generally, all types of incentive mechanisms create a playing field for investments. Incentive instruments are perceived as opportunities to maximise profits, offering varying rates of capital return. This puts different technologies into competition with each other for capital in the pursuit of highest returns. The problem with supplementary or overlapping incentive mechanisms is that

45 W Blyth, 'The Economics of Transition in the Power Sector' (OECD/IEA, January 2010), 13, www.oecd-ilibrary.org/energy/the-economics-of-transition-in-the-power-sector_5kmh3njfk8vf-en.

46 OECD/IEA, 'Energy Technology Perspectives 2010: Scenarios and Strategies to 2050' (France: Soregraph, July 2010), 115 and 202.

47 S Krohn, P Morthorst and S Awerbuch, *The Economics of Wind Energy: A Report by the European Wind Energy Association* (EWEA, March 2009), www.ewea.org/fileadmin/ewea_documents/documents/publications/reports/Economics_of_Wind_Main_Report_FINAL-lr.pdf, 115.

48 McKinsey and Company, 'Pathways to a Low Carbon Economy' (2008), http://solutions.mckinsey.com/climatedesk/cms/default.aspx, 39.

49 OECD/IEA, note 46 above.

50 House of Commons Environmental Audit Committee, *The role of carbon markets in preventing dangerous climate change*, Fourth Report of Session 2009–2010, Stationery Office Limited 2010, 31; see also R Steward, B Kingsbury and B Rudyk, 'Climate Finance for Limiting Emissions and Proposing Green Development: Mechanisms, Regulation and Governance' in R Steward, note 44 above, 14.

they neglect to take into account the competition for investments. Financiers have suggested that additional incentives (such as feed-in tariffs for renewable energy), which offer higher returns than those available through the EU ETS, will tend to corner all the investments in the electricity sector. This approach departs from the concept of lowest-cost abatement in the electricity sector since investors seek profit maximisation and secure returns.[51]

On the other hand, policy-makers are primarily concerned with the lack of progress in reducing emissions. Since no one questions the fact that recourse to renewable energy is essential to achieve significant carbon abatement, additional incentives (feed-in tariffs) are required to supplement the EU ETS. Whereas, in principle, administering renewable support schemes is a widely employed approach in the EEA,[52] the ultimate question is how to harness investments and channel them in the most optimal and efficient way so as to effect the deepest carbon savings at lowest costs avoiding any distortions of competition for investment. Otherwise, the incentives when doubled may be diluted if the administration of non-market-based incentives runs contrary to the concept of lowest-cost abatement. Faced with a choice between a guaranteed feed-in tariff versus the uncertainty of future carbon prices it is obvious which way investors will go.

## Institutional capacity

This section provides a short account of how the EU ETS has been administered so far in Bulgaria. From an EU-wide perspective, the EU ETS has been praised as an 'administrative success'[53] in its first phase for having established the necessary institutional arrangements.[54] Unfortunately, the institutional aspect of emissions trading in Bulgaria has been further complicated as the state administration failed to ensure proper and timely measures for Bulgaria's participation in the EU ETS.

After a long delay, the Bulgarian National Allocation Plan (NAP) for the period 2008–2012 was approved by the European Commission in 2010. The plan was originally submitted by the Bulgarian Government in 2007 and rejected twice by the European Commission. The present NAP allocates 42,433,833 $CO_2$ allowances annually. The allocation of allowances to installations has been based on verified emissions according to reports for 2007 and 2008 of the operators of installations participating in the EU ETS.[55]

51 House of Commons Environmental Audit Committee, note 50 above, 32.

52 Germany, Denmark, Spain, France and Switzerland administer feed-in tariffs.

53 House of Commons Environmental Audit Committee, note 50 above, 5.

54 F Harvey, 'Carbon Markets failing, say MPs', *Financial Times* (London, 8 February 2010).

55 National Plan for allocation of allowances for greenhouse gas emissions trading for Bulgaria's participation in the European Union Emissions Trading Scheme for the period 2008–2012, www.moew.government.bg/recent_doc/climate/NAP_2008-2012-V_3.doc.

Several weeks after the European Commission had approved the long-delayed and troubled NAP in April 2010, Bulgaria's participation in the Kyoto Protocol mechanisms was suspended (June 2010). The sanction was imposed on the grounds that Bulgaria had been found to be in non-compliance with 'the Guidelines for national systems for the estimation of anthropogenic greenhouse gas emissions by sources and removals by sinks under Article 5, paragraph 1, of the Kyoto Protocol'.[56] The decision of the United Nations Compliance Committee under the Kyoto Protocol effectively suspended Bulgaria from trading in $CO_2$ allowances. The suspension was imposed after UN probes had shown that Bulgaria's national system for recording greenhouse gas emissions – the cornerstone for ensuring compliance under the Kyoto Protocol – was not transparent and trustworthy 'due to a lack of financial and human resources', as the Bulgarian authorities have themselves acknowledged.[57]

The effect of the suspension was that transfers of $CO_2$ allowances could not be registered with the Bulgarian National Registry (the 'BG ETS Registry'). This directly impeded spot trading in $CO_2$ allowances between Bulgarian companies since allowances could not be delivered. As a result, 132 Bulgarian companies, which had waited for over two years to begin trading under the EU ETS, were only able to trade nationally with Bulgarian counterparties. The Bulgarian Government was also unable to trade its own allowances.

An inspection carried out by experts of the Compliance Committee of the Kyoto Protocol gave a positive assessment of the measures undertaken by Bulgaria to improve the National System for Evaluation of the Greenhouse Gas Emissions. On 4 February 2011, the enforcement branch of the Compliance Committee decided to reinstate Bulgaria's eligibility to participate in the flexibility mechanisms.[58] Bulgaria's accreditation for emissions trading has now been fully restored, thus allowing the BG ETS Registry to resume its proper functioning.

For these reasons, the implementation of the trading system in Bulgaria has been anything but a success. Institutional capacity provides an important 'enabling environment' for a climate action and in its absence the hurdles to

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56 Compliance Committee of the Kyoto Protocol 'Preliminary findings' (12 May 2010) CC-2010-1-6/Bulgaria/EB, http://unfccc.int/files/kyoto_protocol/compliance/questions_of_implementation/application/pdf/cc-2010-1-6_bulgaria_eb_preliminary_finding.pdf, paragraph 19.

57 *Ibid*, paragraph 15; see also Compliance Committee of the Kyoto Protocol 'Final Decision' (28 June 2010) CC-2010-1-8/Bugaria/EB, http://unfccc.int/files/kyoto_protocol/compliance/questions_of_implementation/application/pdf/cc-2010-1-8-bulgaria-eb_final_decision.pdf.

58 See http://unfccc.int/files/kyoto_protocol/compliance/questions_of_implementation/application/pdf/bgr_update_to_informal_information_note_after_reinstatement_20110204.pdf.

lowest-cost abatement could be greater than ever.[59] Any reduction in the scope of emissions trading deprives operators from abatement opportunities and subverts the concept of lowest-cost abatement.[60] This problem goes beyond mismanagement of national registries (which has occurred in other countries as well) and extends to the political will to take the necessary measures to dedicate government funding, and build expertise and knowledge for such an interdisciplinary issue as climate change.

## Auctioning of $CO_2$ allowances

The experience of Phases I and II of the EU ETS led the European Commission to conclude that amendments were necessary to avoid 'windfall profits', 'distributional impacts' and 'rent seeking'.[61] The amendments will provide that auctioning and free allocation based on *ex ante* benchmarking will be the primary methods for allocation.[62] Success depends on the stringency of these measures to achieve an adequate carbon price that will incentivise the deployment of cleaner technologies.

Auctioning of $CO_2$ allowances will be the only method for allocation to the power sector.[63] The rationale for auctioning is to ensure that the 'scheme operates with the highest possible degree of economic efficiency'.[64] Auctioning will also ensure 'transparency and simplicity' of the Community scheme, preventing distortion of competition between installations. The harmonisation of allocation conditions will provide certainty and pave the way for more investments in low-carbon technology as power generators will have to pay in advance to obtain the needed $CO_2$ allowances.[65] Thus, auctioning will prevent 'windfall profits' as power generators will no longer be able to incorporate the opportunity cost of the $CO_2$ allowances into final electricity prices. In this respect, power generators are expected to take full advantage of every possible abatement option under the strain of advance payments for $CO_2$ allowances. Accordingly, least-cost efficiency potential is expected to be captured first.

59 S Willems and K Baumert, 'Institutional Capacity and Climate Actions' (OECD/IEA-COM/ENV/EPOC/IEA/SLT(2003)5, www.oecd.org/dataoecd/46/46/21018790.pdf, 11.

60 Argument from recital 8 of Council Directive 2009/29/EC, note 2 above.

61 P Zapfel, 'A Brief But Lively Chapter in EU Climate Policy: the Commission's Perspective' in A Ellerman, B Buchner and C Carraro, *Allocation in the European Emissions Trading Scheme* (Cambridge: CUP, 2007), 28–31.

62 Article 10a of Council Directive 2009/29/EC, note 2 above.

63 *Ibid*, Article 10a(3).

64 *Ibid*, Recital 15.

65 European Commission, 'Emissions Trading: Questions and Answers on the EU ETS Auctioning Regulation' (Memo/10/338, Brussels, 16 July 2010), http://ec.europa.eu/clima/policies/ets/docs/qa_final.pdf.

## Outstanding issues: allocation unresolved

On the other hand, it is somehow expected that power generators will pass on the actual costs of $CO_2$ allowances, as the Preamble of Directive 2009/29/EC itself suggests.[66] The problem is rooted in the fact that under certain conditions the electricity sector can pass on the $CO_2$ allowances costs whether allocated for free or auctioned. This, by itself, is sufficient to reduce the incentives for greenhouse gas abatement in the power sector. The burden of $CO_2$ allowances costs can be transferred to electricity consumers.[67]

Therefore, auctioning on its own is unable to guarantee abatement. Policy-makers have to rely on additional factors or instruments to trigger abatement in combination with this method of allocation. For example, auctioning should be effectively coupled either with competitive constraints in deregulated markets or regulation of electricity prices where markets are still not fully liberalised. However, this implies a shift of the problem from one place to another – from the allocation method to the auxiliary factors pertinent to regulated and deregulated electricity markets. In Bulgaria, neither of the two could operate without a great deal of difficulty considering the transitional stage of its liberalisation reforms.

If there was a high pass-through rate (PTR) of $CO_2$ allowances costs into electricity prices, the power generators could transfer most of this burden onto the consumer, thus avoiding any abatement action and remaining compliant with the scheme at the same time. If there was a low PTR of $CO_2$ allowances costs, power plants would be much more likely to undertake emission abatement measures in order to retain the margin of their profits. Therefore, the most crucial issue to be examined is the PTR of $CO_2$ allowances costs, which power generators apply. Theoretical and empirical analyses lead to the conclusion that the PTR depends on the electricity market structure: whether it is competitive (unregulated, liberalised) or a regulated market.[68]

Empirical analyses support the above arguments by concluding that since the EU ETS has become operational electricity prices have risen significantly. Nevertheless, the exact PTR in deregulated markets is difficult to determine.[69] A sharp political reaction followed the commencement of the scheme. In

66 Recital 19 of Directive 2009/29/EC, note 2 above.

67 Commission Decision 2010/2/EU of 24 December 2009 determining pursuant to Directive 2003/87/EC a list of sectors and sub-sectors which are deemed to be exposed to a significant risk of carbon leakage, OJ 2010 L 1/10.

68 *Ibid.*

69 J Sijm, S Hers and B Wetzelaer, 'Options to Address Concerns Regarding EU-ETS Induced Increases in Power Prices and Generators' Profits' in Francesco Gulli, *Markets for Carbon and Power Pricing in Europe: Theoretical Issues and Empirical Analyses* (UK: Edward Elgar Publishing, 2008), 101.

its first phase, when $CO_2$ allowances were granted for free, power generators included the 'opportunity costs'[70] of the carbon credits in the final prices resulting in 'windfall profits'.[71] Substantial price increases were detected in the wholesale electricity markets in Germany and the Netherlands. Price increases could be attributed exclusively to the $CO_2$ allowances opportunity costs, irrespective of other factors, such as fuel prices, currency exchange rates and demand.[72]

Although there are certain constraints on the PTR in deregulated markets, such as elasticity of demand for electricity ('peak and non-peak hours'), 'load period' (available capacity) and carbon prices, power generators have been including the opportunity costs in the range of 60 to 100 per cent, as some of them prefer to increase their market share instead of passing on the full accounting value of $CO_2$ allowances.[73] However, costs for power generators are about to change their character and become a real liability on the balance sheet rather than an accounting entry. The PTR should be expected to lean towards 100 per cent, once allowances are auctioned instead of being allocated for free.

In deregulated markets, the question of how to induce abatement in the power sector remains open. Competitive constraints may exert pressure on the PTR, but could also have far-reaching implications on the merit order in which power plants are dispatched, and respectively on the total generation mix. Competition dynamics may prove insufficient to constrain the PTR of $CO_2$ allowance costs especially if the $CO_2$ allowance price remains at lower levels.

By contrast, market surveillance authorities in regulated markets – energy regulators – will determine the PTR component as part of the regulated power prices for generation, wholesale and/or retail sale of electricity. By way of regulation, determining the PTR of $CO_2$ allowance costs may prove a very convenient solution for imposing limits on the costs transferred to final customers.

Bulgaria provides a case in point. The electricity market has a regulated and deregulated segment. As noted above, most of the transactions between energy market participants take place within the dominant regulated segment of the market. The methods employed in price setting include rate of return on capital investments and a ceiling on prices, or returns. The SEWRC is bound to ensure transparency, non-discrimination, reimbursement of acceptable costs, ensuring an adequate rate of capital return and fixing the

70 The opportunity to sell allowances on the secondary carbon market instead of surrendering it.
71 Recitals 15 and 19 of Council Directive 2009/29/EC, note 2 above.
72 J Sijm, S Hers and B Wetzelaer, note 70 above.
73 Sijm, Neuhoff and Chen, 'CO2 costs pass-through and windfall profits in the power sector', *Climate Policy* 6, 2006, 61.

PTR of the feed-in premium for renewable energy. Energy companies may also request additional compensation for incurring higher costs related to compliance with environmental regulation, which is also passed on into final prices.[74] Therefore, the SEWRC determines price components reflecting the electricity cost structure in the regulated segment of the electricity market.

The solution for Bulgaria may be found in regulating the PTR of both the carbon price and abatement costs. In view of the electricity market structure, such an approach could prove effective and easy to implement on paper. Establishing a low PTR of $CO_2$ allowances and a higher rate of compensation for carbon abatement could stimulate the implementation of abatement measures. Now, when free allocation is no longer applicable to the electricity sector, which is subject to 100 per cent auctioning, the determination of the PTR of $CO_2$ costs becomes crucial. Power generators will be deprived of incentives to undertake any abatement action, provided that no distinction is drawn and differentiated rates accordingly applied for passing on $CO_2$ allowances costs and passing on abatement costs.

Accordingly, the PTR of the $CO_2$ allowances costs and PTR of abatement costs should be set in such proportion as to lend an unquestionable preference to abatement actions. In other words, the PTR of $CO_2$ allowance costs should always be substantially lower than that of abatement action. From the consumers' point of view, nothing will change. Environmental benefits will accumulate for the whole society, which is the ultimate objective of the mechanism. Nevertheless, we should be under no illusions as to how difficult this will be to implement. This approach will be opposed by strong lobbying from power generators, which the state administration must resist. This brings us back to the question of institutional capacity.

## Outcome: back to reality

From a European perspective, the EU ETS has had very little impact on investment patterns intended to deliver carbon savings.[75] It has not been very supportive in capturing the efficiency potential for carbon abatement, as it has bred continuously perverse incentives. In March 2010, a survey of the secondary carbon market revealed that EU ETS participants, which enjoy the advantage of holding surplus $CO_2$ allowances and expect to retain their 'long positions' in the future, were readily able to market their allowances

74 Articles 31–36 of the Energy Act (Bulgaria); see also Ordinance on Regulation of Electricity Prices (Bulgaria), pursuant to Article 36(3) of the Energy Act (Bulgaria), note 19 above.

75 A Ellerman, F Convery and Ch Perthuis, *Pricing Carbon: The European Union Emissions Trading Scheme* (Cambridge: CUP, 2010), 191.

in return for an attractive carbon price or to provide cash flows. Other companies acquired allowances mainly for the purpose of banking them into Phase III. Most commonly, power operators used the opportunity to hedge their positions post-2013 when they will be subject to mandatory auctioning of all their allowance requirements.[76]

Bulgaria is no exception. It is a country of surplus as its industries seem well stocked with $CO_2$ allowances. Pollution reports by Bulgarian industrial plants show that their combined output of greenhouse gas emissions has recently dropped; thus, almost all of them will have excess allowances, which they can trade within the EU when the administrative problems are resolved. Meanwhile, other installations will only be able to comply with their obligations. The Maritsa East II TPP, the installation with the largest number of allowances in the electricity sector,[77] holds nine million allowances on average per annum but this still falls short of its actual emissions.[78]

However, any shortfall of allowances in the electricity sector will not be a cause for concern. Bulgaria, alongside nine other Member States, is eligible to apply for derogation from the mandatory auctioning of allowances, starting in 2013.[79] Bulgaria's eligibility is based mainly on the ground that more than 30 per cent of its electricity was produced from coal.[80] Accordingly, power generators will be given a 'transitional free allocation'. The limit on such allocation will be set at '70 per cent of the annual average verified emissions in 2005–2007', which will be reduced gradually until completely phased out in 2020.[81] But while power generators will not receive all their allowance requirements for free, the transitional period will not put much strain on emissions reductions anyway.

Bulgarian participants will look on the EU ETS predominantly as an opportunity to obtain an asset for free to boost competitiveness or just remain afloat in the market. Those for whom this strategy will not work (TPPs for example) will rely on the PTR of the $CO_2$ allowance costs into the final prices of their products. In either case, carbon abatement is simply wishful thinking, unless the regulator intervenes.

76 E Tvinnereim and K Røine, 'Carbon 2010 – Return of the Sovereign' (March 2010, Point Carbon), www.pointcarbon.com, 8.

77 See www.tpp2.com. Maritsa East II has 1,576 MW of installed capacity.

78 M Enchev 'ЕК пусна България на европейския въглероден пазар' ('EC admitted Bulgaria to the European Carbon Market') *Dnevnik Newspaper* (Sofia, 22 April 2010).

79 'Draft on Bulgaria's Strategy for reliable, efficient and cleaner energy up to 2020', note 28 above; other Member States eligible to apply for derogation are Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland and Romania.

80 Article 10c(1)(c) of Directive 2009/29/EC, note 2 above. Overall power and heat generation in 2008 was based on 38.1 per cent domestic coal and 16.0 per cent imported coal in the overall energy mix, see 'Draft on Bulgaria's Strategy for reliable, efficient and cleaner energy up to 2020', note 28 above.

81 Article 10c of Directive 2009/29/EC, note 2 above.

We must therefore look to specific incentives targeting a particular mode of abatement (renewable technologies) in order to maintain the momentum for emissions reductions. Some Member States have already acknowledged that reliance on a single incentive mechanism will not be effective. Emphasis should be placed on a more varied approach that integrates different solutions. Instead of seeking a 'silver bullet' it would be more effective to design a 'silver buckshot' strategy.[82] A carbon price floor, tax breaks, state subsidies and regulation, including renewable incentives, form part of the different interventionist options to uphold the carbon price. However, the latter approach will shift the focus away from cheaper abatement solutions, such as fuel switching, co-firing of biomass and implementation of operational efficiency measures, which contribute substantially to emissions reduction at 'either a negative or close to a zero net total costs'.[83]

## Renewable energy in Bulgaria: costs out of all proportion

It is generally accepted that subsidies represent an appropriate stimulus at the initial stages of a breakthrough technology. Attractive feed-in tariffs will stimulate investment given that the bulk of costs for commissioning renewable power plants are well known in advance.[84] But the deployment of renewable technologies is also constrained by certain country-specific limits, such as access to natural resources, grid infrastructure and balancing capacity.

Insofar as 'balancing needs' are concerned, the intermittency of some renewable energy sources, such as wind, entails substantial costs.[85] To the extent that wind energy expands drastically as one of the most mature and relatively more efficient technologies for electricity generation, it will necessitate additional balancing capacity. The cost associated with this becomes particularly acute when long-term variations in the renewable resource occur – weekly or even monthly peaks, and lows.[86] Should balancing capacity prove insufficient, power plants available for cold reserve (available capacity) may become critical to integrating renewable energy. This may require other generators on the grid to operate in a spinning standby mode

82 A Brohe, N Eyre, N Howarth and N Stern, *Carbon Markets: An International Business Guide* (UK: Earthscan Ltd, 2009), 39.

83 G Boncimino, W Stenzel and I Torrens, 'Costs and Effectiveness of Upgrading and Refurbishing Older Coal-fired Power Plants in Developing APEC Economies' (2005), APEC Energy Working Group Expert Group on Clean Fossil Energy Project EWG 04/2003T, 75, www.egcfe.ewg.apec.org/Documents/Costs%26EffectivenessofUpgradingOlderCoal-FiredPowerPlantsFina.pdf.

84 S Krohn, P Morthorst and S Awerbuch, note 47 above, 14.

85 *Ibid*, 16.

86 *Ibid*, 110.

ready to provide balancing quantities of electricity to offset power generation outages. This entails extra costs not reflected in the feed-in tariff since it is not the purpose of the tariff to incorporate such costs. However, these costs need to be taken into account in assessing lowest-cost abatement.

Approximately 60 per cent of the spare capacity reserve for balancing needs ('cold reserve') in Bulgaria is provided by the second-largest coal-fired power plant – Varna TPP.[87] A generation mix of this kind is unlikely to bring about overall carbon reductions, since the carbon savings that accrue from renewable energy will, in all likelihood, be neutralised by the spinning standby of TPPs.

Scaling renewable energy up to 20 per cent in the EU will also result in additional costs for grid infrastructure rehabilitation and expansion. Forecasts envisage the figure of €1 trillion 'by 2020 to replace obsolete capacity, modernise and adapt infrastructure' to accommodate renewable technologies.[88] In recognition of the 'feasibility' of this magnitude of investments in grid modernisation, Directive 2009/72/EC introduced a very soft obligation, or rather exhortation, that Member States should 'introduce smart grids, where appropriate' to stimulate decentralised power generation.[89]

In Bulgaria, the development of renewable energy projects is seriously impeded by the old and underdeveloped grid infrastructure. Large clusters of wind power projects are found mainly in north-east Bulgaria, which has imposed a tremendous financial strain on the transmission or distribution grid operators. For example, the transmission grid has been systemically overloaded owing to the excessive capacity of renewable power plants interconnected in the recent years to the so-called 'Dobrich Ring'.[90] Massive rehabilitation of the transmission infrastructure in this region is urgently needed, as the ESO systemically calls on power plants to discontinue generation for up to 48 hours in order to avoid grid failure. Replacement of existing power lines and transformers has been scheduled, but will nevertheless be insufficient to resolve all transmission problems. There is a pressing need for more transmission capacity to incorporate renewable sources effectively.[91]

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87 'Пуснаха студения резерв в ТЕЦ „Варна"' ('The Cold Reserve of TPP Varna has been launched'), *Monitor Newspaper* (Sofia, 21 December 2010).

88 European Commission Communication, 'Energy 2020: A strategy for competitive, sustainable and secure energy' (10 November 2010, Brussels), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0639:FIN:EN:PDF, 10.

89 Recital 27 and Article 3(11) of Council Directive 2009/72/EC of 13 July 2009 concerning common rules for the international market in electricity and repealing Directive 2003/54/EC, OJ 2009 L 211/55.

90 The 'Dobrich Ring' is part of the transmission grid in north-east Bulgaria.

91 'Operational Regime of the Electricity System of Bulgaria in the Autumn–Winter Period 2010/2011', (2010) Electro Systemic Operator (ESO), 34–36, available in Bulgarian at www.eso.bg/uploads/file/bg/regime_2010_2011_tso_bg.pdf.

The development of renewables also creates financial consequences for retail customers. Customer invoices now show an additional line on the amount charged for 'green energy' to factor in the costs of the feed-in tariffs. As of January 2011, this amount represents an incremental increase of 4.20 per cent.[92] Although such an increase may seem trivial on its own, what is striking is the share of renewable energy standing behind this figure. Statistics refer to an 8.4 per cent share of renewable energy in gross final electricity consumption for the year 2009[93] but this includes the contribution of large-scale hydropower plants. Most of these power plants, which were commissioned before 1989, remain outside the scope of renewable energy subsidised with feed-in tariffs and therefore a price increase of 4.20 per cent does not reflect their commissioning. The actual share of renewable energy advantaged by the feed-in tariffs is approximately one-quarter of the overall 8.4 per cent renewable energy share or 2.1 per cent in final electricity consumption.[94] Based on the assumption that this ratio stays constant, achieving 20 per cent of renewable energy by resorting to feed-in tariffs will require a tenfold increase of the premium in final consumer prices by 2020.

Bulgarian policy-makers have already made these calculations and agreed that such an effort would go beyond the financial strength of retail customers.[95] The rapid development of renewable energy capacity and the inability of the infrastructure to accommodate their requirements have led to a proposed Draft Bill on Energy from Renewable Sources (the 'Draft Bill').[96] The Draft Bill will substantially modify the interconnection procedure in a way that may derail efforts to expand renewable energy.

According to the Draft Bill, the SEWRC and the Minister of Economy, Energy and Tourism will coordinate and agree on the maximum capacity available for interconnection, designated zones and permissible voltage levels for interconnection. On this basis, the SEWRC will determine the total assigned capacity for interconnection within designated zones and voltage levels for interconnection.[97]

92 There is no official source for this information. The calculation is based on an invoice from CEZ Electro Bulgaria.

93 SEWRC Decision No Ц-018, 31 March 2010, 2, available in Bulgarian at www.dker.bg/resolutions/res_c018_10.pdf.

94 *Report on Achieving National Indicative Targets for Consumption of Electricity from Renewable Sources in 2009* (March 2010, Sofia) Ministry of Economy, Energy and Tourism, 12–14, available in Bulgarian at www.mee.government.bg/energy/energy_doc/Report_RES_2010.doc.

95 'Investors: The Law Should Prescribe How the Price of Green Energy Will Go Down' ('Инвеститори: В закона да пише как ще поевтинява екоенергията') *Dnevnik Newspaper* (Sofia, 31 January 2011).

96 Draft Bill on Energy from Renewable Sources (Bulgaria), www.mi.government.bg.

97 *Ibid*, Article 22.

In order to connect to the grid, power generators will have to submit applications for assigned generation capacity on an annual basis. The transmission grid operator or the distribution grid operators will sort the applications on a first come, first served basis. Whenever the overall capacity applied for by power generators exceeds the total capacity for a designated zone, as determined by the SEWRC, any further applications will be rejected.[98] This approach leaves a large margin of appreciation in the hands of the SEWRC as to the number and scale of renewable power plants to be authorised for interconnection. The SEWRC will be able to squeeze renewable generation into the current availability for interconnection and capacity of the grid. The above procedure will not apply where a power generator declares that it will not take advantage of the feed-in tariff.

Such an overhaul of renewable energy incentives speaks volumes. Renewable energy seems to be reaching the optimal limits of its deployment in Bulgaria. Even though the legislation was initially passed with the intention of encouraging renewable technologies, it has now become obvious that the renewable ambition has a flawed foundation – the costs are excessive. Even if such an assertion seems too extreme, the fact that renewable energy deployment is showing the first signs of stalling cannot be ignored.

Regardless of the final text of the Draft Bill, the problem of interconnections will remain one of the key obstacles to the development of renewable energy projects in Bulgaria. This is not the result that one would have expected from the implementation of Directive 2009/29/EC, which requires, among other things, that the authorisation procedures 'applied to plants and associated transmission and distribution network infrastructures' should be 'proportionate and necessary'.[99]

## Coordination between mechanisms

Evidently, the attention of investors in Europe has been concentrated primarily on the feed-in tariffs judging by the development of renewable energy technologies rather than on other forms of abatement. By implication, feed-in tariffs lead to a weak carbon price and undermine other low-carbon technologies. This is because of higher rates of return on investments, and the certainty and predictability of the feed-in tariffs.[100] This approach will tend to corner the currently scarce investments in particular types of technology in the energy sector. It creates an uneven

98 *Ibid*, Article 23.

99 Article 13 of Directive 2009/29/EC, note 2 above.

100 S Krohn, P Morthorst and S Awerbuch, note 47 above, 87.

playing field between 'capital-intensive' renewable energy technologies and negative-costs forms of abatement – efficiency improvements, co-firing and fuel switching.

The purpose of this critique is not to advocate the removal of feed-in tariffs for renewable energy, but rather to propose an optimisation of the timing and order in which incentives stimulating green technologies should be most effectively administered so as to avoid strong competition between technologies for scarce capital. Overlapping mechanisms, especially when their specific objectives and scope partially coincide, may draw available funding to the incentive mechanism offering a higher return on the investments.

Currently, the carbon price has not reached the level at which even cheap low-carbon technologies are economically viable. In all likelihood, even when the institutional capacity in Bulgaria is reinforced and becomes duly operational, the EU ETS itself will not be able to produce such a price in the foreseeable future. By contrast, feed-in tariffs provide certainty and security for investors. In particular, the tariffs take account of, inter alia, inflation, investment costs, operational and management costs and the useful lifespan of the assets. Indeed, the premium goes as far as to reflect the structure of capital, recognising that approximately 70 per cent of the capital is borrowed.[101] This incentive has provided huge advantages over the EU ETS.

Bulgaria's economy is already heavily entrenched in its current energy infrastructure and funds for expansion and transformation are insufficient, if available at all. Largely dependent on coal power plants, there is significant potential to reduce emissions in the Bulgarian electricity sector through upgrading 'air heaters, pulverisers, boilers, steam turbines or condensers'.[102] In the near term, there is also significant abatement potential to be realised by improving the existing coal technology efficiency, and co-firing of coal and biomass. Moreover, based on the assumption that fuel prices remain constant – in particular there are no spikes in natural gas prices – research has demonstrated how state-of-the-art abatement opportunities become economically viable depending on various carbon price levels. For example, at a carbon price of €24/t $CO_2$e the most efficient gas-fuelled technology (CCGT – Combined Cycle Gas Turbine), which emits approximately half the amount of $CO_2$ compared to coal, becomes cheaper than coal.[103]

101 Regulator's Decision No Ц-015 of 31 March 2008 and Decision No Ц-04 of 30 March 2009 on determination of preferential purchase price for electricity from hydropower plants, wind generators, PV modules or direct combustion of biomass (Bulgaria).

102 W Blyth, 'The Economics of Transition in the Power Sector' (OECD/IEA, January 2010), www.oecd-ilibrary.org/energy/the-economics-of-transition-in-the-power-sector_5kmh3njfk8vf-en, 12.

103 Julia Reinauld, 'Emissions Trading and Its Possible Impact On Investment Decisions in the Power Sector' (Information Paper, IEA 2008), www.iea.org/papers/2003/cop9invdec.pdf, 38.

The EU ETS has become a victim of its own scope and complexity. Based on the principle that the larger the scheme, the more cost-effective it should be, it struggles to reconcile various interests and provide a common framework for numerous stakeholders. In the current state of play, regulating the PTR of $CO_2$ allowances and abatement remains the only feasible and fairly easy policy option to implement in Bulgaria in light of the structure of its electricity market. PTR regulation holds the promise to make a big difference even if the carbon price stands at approximately €15 in the spot market at the moment. The combination of a low carbon price with no PTR will sound the alarm that it is time to reconsider power generation strategies.

In the meantime, the forthcoming changes in the renewable energy framework in Bulgaria may render the playing field for investments in renewable energy very uneven. Interconnection costs, insufficient capacity and the urgent need to rehabilitate the infrastructure will set limits on available capacity for interconnection in a designated zone, as determined by the SEWRC. Raising barriers to renewable projects may divert some attention away from the sector, but there is no guarantee that investment resources will be harnessed by the EU ETS. It is possible that Bulgaria may end up with one or two defaulting mechanisms for years to come. Neither of the two mechanisms may be capable of channelling meaningful action one way or the other. Even though it will be impossible to achieve emissions reductions in the longer term without incorporating renewable energy sources into the energy mix, from the short-term perspective, recourse to available regulatory techniques, such as PTR regulation of the $CO_2$ allowances costs, will combine environmental expediency with economic literacy.

In general, additional targeted subsidies should be provided only where absolutely necessary. These should target very expensive technology deployment such as nuclear, carbon capture and storage, and offshore renewable energy. Otherwise, feed-in tariffs or any other premium payments will divert a big slice of investments. Overall, cleaning up existing energy should become a priority before embarking on new technologies. Such an approach most accurately reflects the idea that emissions reductions should take place where it is cheapest to do so.

## Conclusion

In conclusion, incentive systems should be designed on the basis of environmental considerations through the lens of economic reality. The lowest-cost principle that emission reductions should take place where abatement is cheapest has been eroded by two factors: an inadequate carbon price and parallel incentives. To counteract higher abatement costs, a more effective approach should be adopted to curb greenhouse gas emissions via the mechanism of the EU ETS. Evidently, auctioning of $CO_2$ allowances as a method of allocation entirely depends on the PTR of allowances costs. Energy regulators should take a strong view on the issue of PTR, especially when it affects abatement opportunities.

Feed-in support schemes remain another sticking point in the general framework on environmental protection given the implications that feed-in tariffs produce when instituted in parallel to the faltering carbon price. In Bulgaria, renewable energy incentives have led to a vast expansion of power generation in recent years. The frosty response from policy-makers to the dash for renewable energy is clearly a response to the constantly rising costs associated with embarking on this option for carbon abatement. Even if Bulgaria was the first Member State to sound the alarm that carbon abatement no longer has anything to do with the least-cost principle, it certainly will not be the only one to do so. Failing to optimise incentive mechanisms may put us in the precarious position of being trapped in a mechanism in which further action on decarbonisation entails unbearable costs. The attention of policy-makers should be drawn to redesigning the mechanisms so as effectively to counteract natural market forces, which will seek to maximise profits at the expense of sustainable development.