Economic and Energy Alternatives for coal industrial regions in Bulgaria

REPORT

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List of Acronyms and Abbreviations

BEH	Bulgarian Energy Holding EAD
ENTSO-e	European Network of Transmission System Operators for electricity
EU	European Union
GDP	Gross Domestic Product
GW	Gigawatt, equals 1 billion Watts
HPP	Hydro power plants
MEE	Ministry of Economy an Energy
MOEW	Ministry of Environment and Water
MW	Megawatt, equals 1 million Watts
NEC	National Electric Company
NPP	Nuclear power plant
PSHPP	Pumped-storage hydro power plants
RES	Renewable energy sources
SEWRC	State Energy and Water Regulatory Commission
TPP	Thermal power plant
TW	Terawatt, equals 1 trillion Watts

PART ONE

Introduction

In 1890, almost imperceptibly, our world took a turn that led contemporary human civilization headlong into economic growth, laying the basis for the consumer society. According to energy analyst Vaclav Smil, in 1890 humankind used primarily biomass to generate the power needed for social and economic activities. Today, biomass constitutes less than 50% of the energy mix, while the rest is provided by fossil fuels as the primary energy source. Back then, the world needed about 600 GW of energy; today we need over 12 TW, marking a twenty-fold increase for just 123 years.

Since the Industrial Revolution took off, the minerals and raw materials industry has become the conventional basis for all other economic sectors, due to the energy and resources it supplies. In the conditions of a carbon-dependent economy, the coal industry and affiliated energy sectors, provide the necessary raw materials to generate power for the manufacture of products in practically every economic sector.

Coincidentally, 76% of coal in Bulgaria is consumed by the energy sector. Approximately 13 000 people are employed in the Bulgarian coal extraction sector. There is no information about the number of people employed in power generation from coal, however there is data which shows that approximately 16 000 people work in electricity generation from all types of energy carriers.

Coal combustion is one of the key factors contributing to climate change, due to the physical and chemical characteristics of the combustion process, during which carbon dioxide is released in order to obtain thermal energy. In 2010 43% of global carbon dioxide emissions were associated with coal use and this share is projected to continue growing.

Although the market price of electricity produced from coal is relatively low, it far from includes the environmental and health damages incurred, both with respect to coal sector employees, and with respect to the regions around large coal-fired power plants. In 2009 the annual costs for health care induced by air pollution from Bulgarian thermal power plants were to the tune of 4.63 million Euro.

The lack of transparency in decision making characteristic of Bulgarian state administration is especially strictly applied with respect to the energy sector and the related activities of the mineral and raw materials sector. Access to public information about the energy sector is difficult and it must be noted that for certain topics it is practically impossible.

As audit report No. 213 of the Chamber of Accounts from 12.09.2013 emphasizes, the adoption of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market, makes promoting the use of electricity from renewable sources an exceptionally important priority for the Community. The reasons for that relate to the security and diversification of energy supplies, protection of the environment, social and economic cohesion, and the development of a single competitive energy market. However, frequently actions in support of any one of these priorities impact negatively the implementation of the rest. For example, **the use of local reserves of lignite coal has a positive effect on energy security, but entails risks for the environment**.

The above-mentioned report, commissioned by the Parliament of the Republic of Bulgaria, emphasizes that the introduction of new capacities using coal as a main

resource for electricity generation is not expected. This comes at odds with media publications and public announcements by government officials, referring to plans for an additional capacity of 560 MW in the Maritsa Basin by the TPP Maritsa Iztok 2 (units 9-10) company, with capital investment of 50 000 BGN. At the same time, Enemona AD company is planning an additional 400 MW capacity in the Lom coal basin (220-240 million tonnes). In addition to those nearly 1000 MW, the company "NPP Kozlodui – New capacities" plans an additional 1000 MW. These three projects contradict EU sustainable development policies and will considerably reduce the share of RES in the total power generation and consumption in Bulgaria.

According to article 3 of the Energy Act, state policies in the energy sector are carried out by the Parliament and the Council of Ministers. If those two institutions carry out contradictory plans and actions regarding the development of this sector of great strategic importance for the economy and the environment, the long-term consequences for the country, for those employed in the coal extraction and coal-fired power generation sectors, for the related economic sectors, directly and indirectly for all Bulgarian citizens, remain unclear.

1. Research objectives

This report aims to:

1.1 Present an independent analysis, objective evaluation and recommendations for economic and energy alternatives for Bulgarian coal industrial regions.

1.2 Provide support to Bulgarian State and local authorities in coal industrial regions by pointing out weaknesses and presenting recommendations for a more sustainable development path for those regions and for improving governance, in keeping with a dynamically changing environment.

1.3 Shed light on key problems and outline possible mid-term crises in the economic sectors related to coal extraction, in order to prepare stakeholders for the likely scenarios.

1.4 Focus public attention by putting on the agenda important issues related to an economic sector that has traditionally been non-transparent and polluting.

2. Methodology

For the purposes of this research, the following methods for data gathering and analysis of the information were used: analytical procedures, verification of references and official information requests based on the Access to Public Information Act, review and verification of published reports, analysis and comparison of publicly available data and reports, structuring of data, information and knowledge.

PART TWO

Findings

1. Analysis of power generated from coal

1.1 A brief overview of coal extraction in Bulgaria

Theoretical coal reserves on the territory of the Republic of Bulgaria amount to approximately 2 billion tonnes, of which slightly more than 1.7 billion tonnes are currently being exploited. Lignite coal is dominant, comprising 93% of the coal mix, followed by brown coal (7%) and black coal (0.02%). The geological and technological conditions for most of the lignite coal reserves allow open mining.

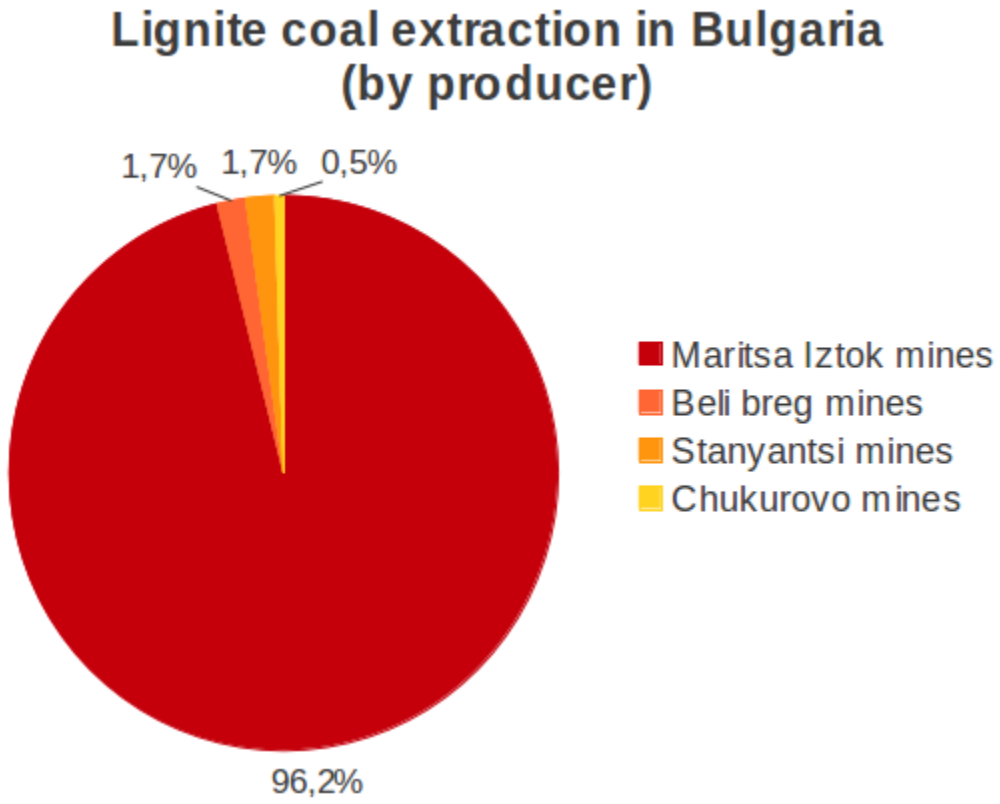

Figure 1. Lignite coal extraction in Bulgaria (by producer)

Lignite coal extraction totals 31 million tonnes, the chief producer being the Maritsa Iztok mines (96.2%). Other lignite coal producers include Beli breg mines (1.7 %), Stanyantsi mines (1.7 %) and Chukurovo mines (0.5 %).

Brown coal extraction totals 2.3 million tonnes, coming mainly from the Bobovdol (0.97 million tonnes) and Pernik (1.09 million tonnes). Black coal extraction totals merely 7 200 tonnes, realized by Balkan 2000 EAD mines.

According the Ministry of Economy an Energy (MEE) coal consumption in Bulgaria is almost exclusively focused on electric and thermal power generation (97.4%), the rest going for briquettes production (1.4%), own needs and other users (0,7%), while domestic heating uses just 0.5% of all coal produced.

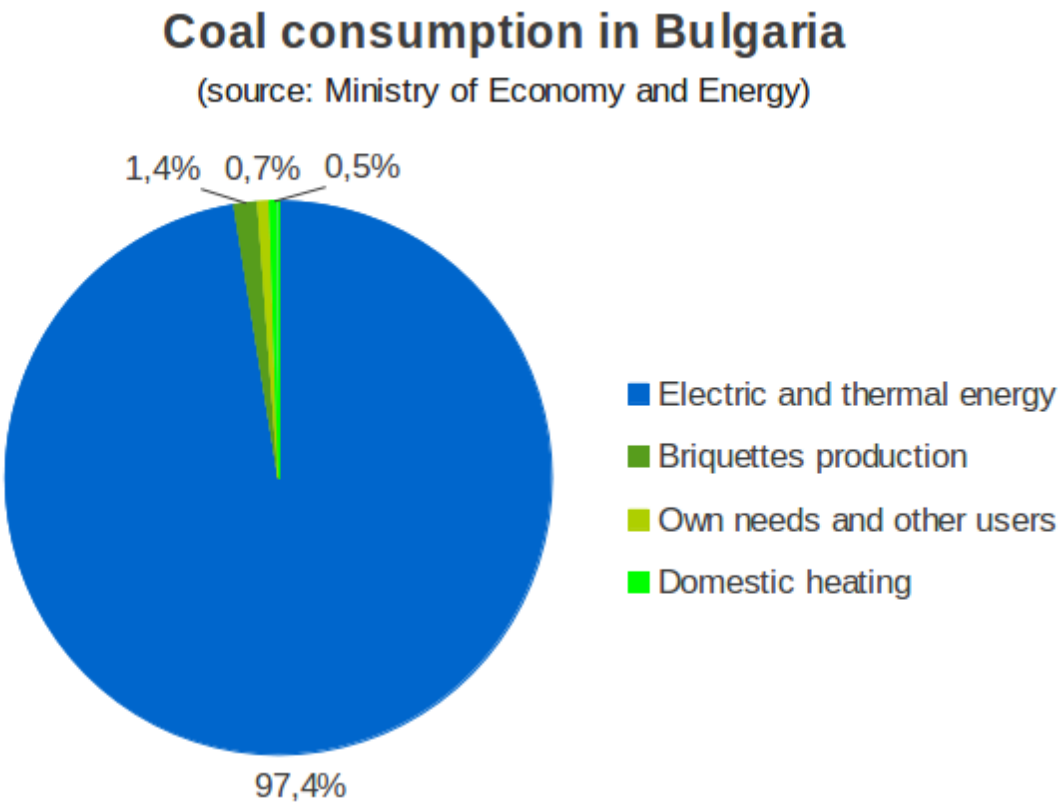

Figure 2. Coal consumption in Bulgaria *(source: MEE)*

Thermal power plants (TPPs) in the country use a variety of fossil fuels (lignite, anthracite, brown coal, natural gas) as the main resource for electricity and thermal power generation. At the same time, over 90% of the total TPP capacity in Bulgaria (around 6.3 GW) use coal as the chief resource for electricity generation (over 5.7 GW), while just 30% use coal for thermal power generation (around 1.8 GW).

Bulgaria maintains a diverse mix of electricity generation capacity, including nuclear, thermal and renewable energy sources (RES): hydro power plants, pumped-storage hydro power plants, wind and solar power. Electric power generation is realized by power plants, detached from the National Electric Company (NEC) in 2000, that, with the exception of private power plants, are now part of the Bulgarian Energy Holding EAD (BEH EAD).

NPP Kozlodui EAD with 2000 MW of installed capacity (units 5 and 6) and TPP Mariza Iztok 2 EAD with 1587 MW of installed capacity are 100% owned by state-owned BEH EAD. TPP Varna EAD (1260 MW), TPP Contour Global Operations Bulgaria (908 MW), substitute capacity on site of AES-3C Maritsa Iztok 1 (700 MW), TPP Maritsa 3 Dimitrovgrad (120 MW), TPP Ruse (220 MW) and TPP Bobov dol (630 MW) are entirely or predominantly privately-owned. Small HPPs have been privatized, while the larger HPPs and PSHPP are owned by NEC EAD.

Figure 3 shows the quotas provided via decisions of the State Energy and Water Regulatory Committee (SEWRC) that allow condensing power plants to make contracts with the wholesale supplier (ordered by half-year periods, starting from the first half of 2007 and going on until the first half of 2013). It can be clearly seen that the volume of quotas for TPP Varna (running on brown coal) has been significantly reduced after 2008

– a change qualified by the authors as a positive development.

At the same time, it must be noted that the growth of quotas allowed to TPP Maritsa 3 EAD since the start of 2012 goes towards entrenching the ill-conceived state policy to provide both open and hidden support for coal-fired condensation power plants.

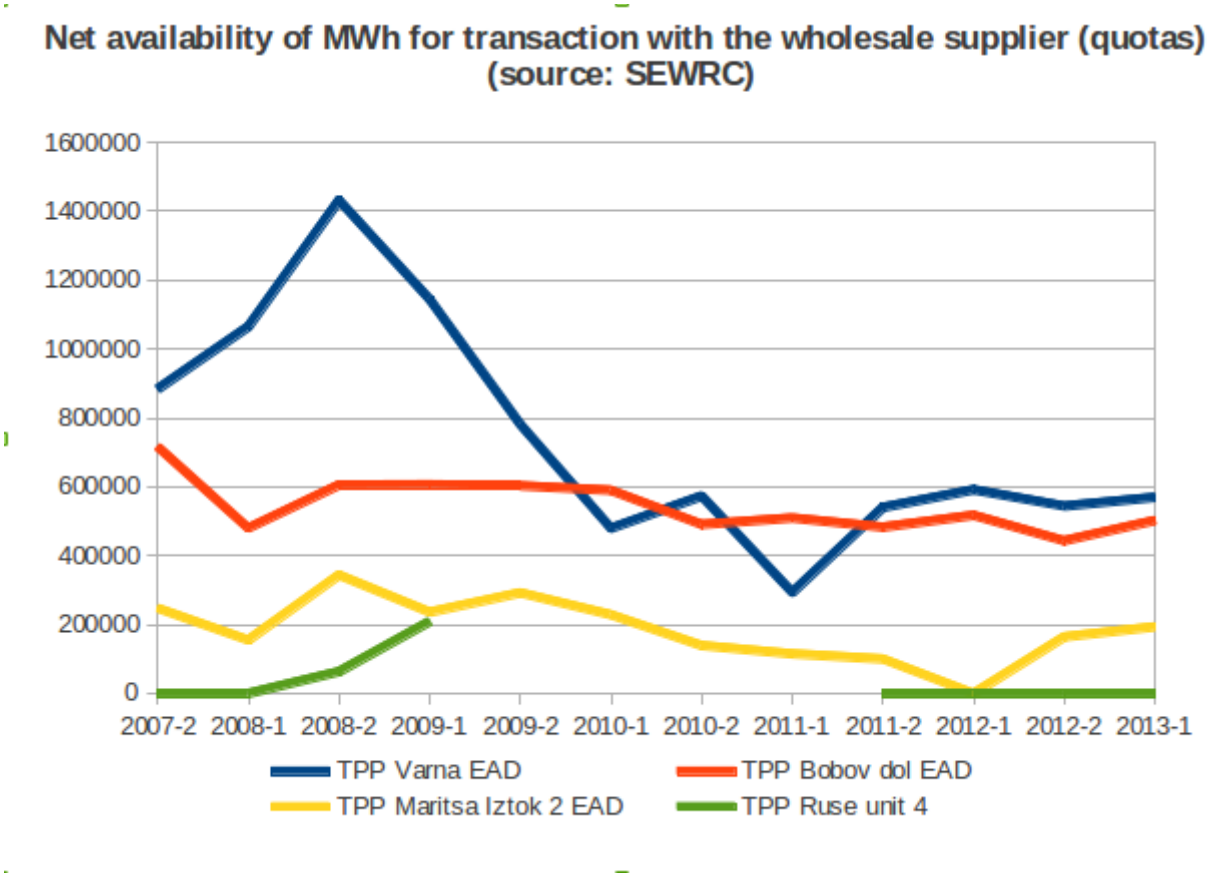

Figure 3. Net availability of MWh for transaction with the wholesale supplier (quotas) *(source SEWRC)*

Inexpedient and conservative actions by the state regarding mineral resources related to energy generation is further illustrated by the plan to construct condensation power plants, based on lignite coal, with capacity of about 960 MW. This fact is of particular significance for the following reasons:

1) since 2003 national electricity consumption has been following a pronounced downward trend;
2) coal extraction in Bulgaria in 2012 amounts to 33.4 million tonnes, which is 9.4% less than that in 2011.

1.2 Plans and strategies for coal sector development

The Energy Strategy forms the basis for national energy policies, approved by the Council of Ministers and adopted by the Parliament. Bulgaria's Energy Strategy by 2020 deals at length with the coal extraction sector, because of its the practical connection with the Bulgarian energy sector. The deliverables expected as a result of the Strategy's implementation by 2013 include:

- Reduce the energy intensity of GDP by 50%;

- Increase the share of RES to 16% in total final energy consumption;
- Increase the share of freely negotiated quantities of electricity on the internal market;
- Establishment of Electricity Exchange;
- Ensure better-quality power supply at accessible and predictable prices;
- National legislation is fully aligned with the European Union's Third liberalization legislative package;
- Transmission system operators are autonomous from power generation and supply;
- Effective and independent regulatory control;
- Provide for the energy needs of consumers and protect their interests, including improved social protection for energy needs.

An audit by the SEWRC, commissioned by the Bulgarian Parliament, shows that, regardless of the existence of Bulgaria's Energy Strategy by 2020:

- Operational plans for implementing the strategy have not been put into place;
- No reporting on implementation of the envisioned measures is available;
- The third legislative package of the EU for the energy sector, in force since March 3rd, 2011, has not been fully transposed and implemented in Bulgaria.

The only aims of the strategy that have been fulfilled concern the share of RES in final power consumption, **a fact that casts serious doubt over the role of the strategy as the basis for long-term development of the energy sector**.

The development of national strategies for various socio-economic sectors and activities was particularly intensified in the past few years, especially during the pre-accession period, as well as after Bulgaria's accession to full membership in the European Union (EU). A great number of documents were hastily developed, largely of dubious concept and content, with questionable goals and obscure steps for their attainment.

The strategies for the energy and coal sectors also follow the same not-so-wholesome model. This fact is of considerable importance for several reasons:

1) **Energy is a strategically important sector,** providing vital power for the economy and supplying energy for all social and economic activities carried out in the country. Any misjudged action in this sector could accrue damages throughout the entire socio-economic fabric of the country;
2) **Hidden state support for fossil-fueled combustion plants,** interwoven in national strategic documents and further obscured by vague and often contradicting positions of Parliament and Government, is an important indicator for disjointed and inconsistent intentions regarding the direction of development for the coal and energy sectors;
3) **Public opinion on the energy sector is extremely negative,** however, there is no noticeable political will or action towards clearing the long-accumulated unsolved issues in the spheres of generation, transmission, distribution and delivery of electric and thermal power;
4) According to energy analyst Vaclav Smil, ***"Energy forecasts are not worth even the cost of the cheapest acid paper on which they get printed".*** Most forecasts deviate from reality within a decade, although sometimes it takes just several months for this to happen. This phenomenon remains beyond the attention of the

State, while it formally fulfills EU requirements for having certain strategic documents in place.

Other existing plans and strategies for the development of the coal extraction sector include:

- Draft of a National strategy for development of the mining (mineral resources) industry;
- National strategy for the low-carbon energy sector;
- National investment plan for the period 2013-2020.

1.3 Sanctions

Bulgaria is threatened by a number of EU sanctions in relation to breaches of environmental legislation, to which the coal sector has contributed considerably. These penalties are paid in solidarity by all citizens of the state, although this is not done directly through their electricity bills.

The penalties Bulgaria faces for non-compliance with the maximum permitted levels of particulate matter (PM) in the EU are expected to amount to 120 million Euro per year.

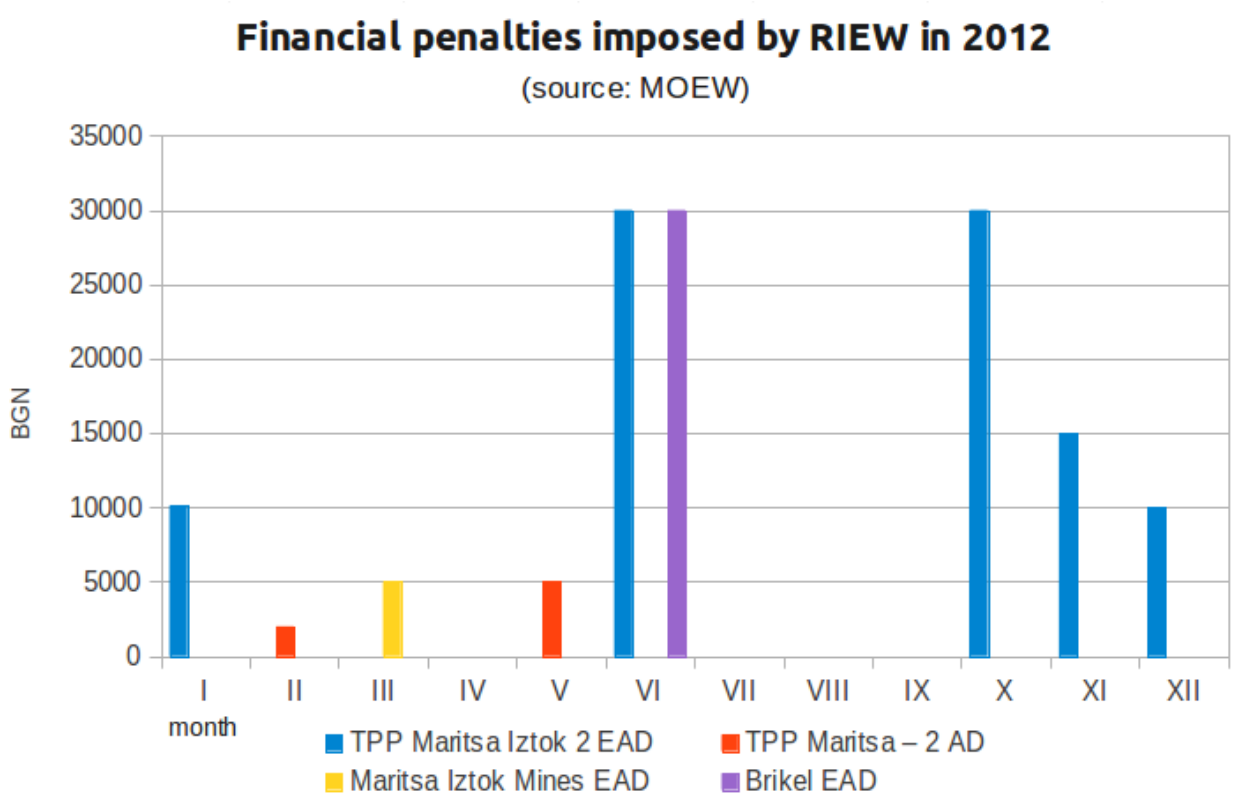

Figure 4. Financial penalties imposed by Regional Inspectorate for Environment and Water (RIEW). *Source: The Ministry of Environment and Water*

Figure 4 is based on twelve monthly reports by the Regional Inspectorates for Environment and Water (RIEW) for their activities in 2012 and clearly illustrtates the regularity of violations throughout the year. The graph only shows the value of financial penalties, although the offending TPPs receive scores of additional instructions and orders. These concern mainly exceeding of the legal norms for flue gas and particle emissions into the atmosphere, and operating over the limit of permitted hours per year without desulfurization equipment. This is a recurrent offense that deserves more

attention than what it currently receives.

The development of a market for carbon emission quotas represents an added risk for coal-fired power plants in Bulgaria. Given price levels of over 10 Euro per tonne of emissions, if such prices should occur on the European market, part of the Bulgarian coal-fired power generation facilities may have to discontinue electricity generation from coal.

2. Alternatives to coal-generated power

2.1 Energy consumption and forecasts

Gross electric power production in Bulgaria in 2012 was 47.3 TWh (according to ENTSO-e, net power generation was 41.9 TWh), which is **6.7% less** than that sgenerated in 2011. Commercial exports of electric power total 8.3 TWh, or 17.6% of gross production. Electric power generation is **dominated by coal-fired TPPs**, followed by the nuclear power plant (NPP) Kozlodui.

Electricity generated by wind turbines in 2012 totals 1.2 TWh, constituting a **45.7% increase** from 2011, while comprising 23.4% of gross electricity generation from RES in the country. For comparison, electricity produced by photo voltaic power stations in 2012 totals 0.8 TWh.

The share of local energy carriers invested in the generation of electric power in 2012 is 89.9%, while that of imported energy carriers is 10.2%. **Nuclear energy is erroneously accounted for as a local energy carrier**, even though there is no information of an operational uranium mine in the country, nor of production of heat-releasing elements and shrouds for fueling a nuclear reactor of the VVER-1000 type - the kind used in the only operational NPP in Bulgaria.

In 2012 final consumption of electricity in Bulgaria was 32.5 TWh, or 2.3% less than consumption in 2011. Economic and public sectors take up 62.8% of final consumption of electricity, while the domestic sector holds 37.2%. Electricity purchased by final suppliers amounts to 26.3% TWh, or 11.1% less than that in 2011. Electric power sales on the free market in Bulgaria in 2012 total 5.1 TWh or about 17% of the electricity sold to final consumers in the country.

The 2013 investment and maintenance program of the Bulgarian Energy Holding's companies reveals the following distribution of resources for public companies in the coal extraction sector and the associated coal power generation sector:

Table 1. Distribution of investment and maintenance resources for public companies

Company	Maintenance program [in millions of BGN]	Investment program [in millions of BGN]
TPP Maritsa Iztok 2 EAD	39 042	95 514
Maritsa Iztok Mines EAD	81 984	100 297

Meanwhile, the owner of TPP Varna – CEZ a.s. announced in 2013 the beginning of a two-year long process of ecologization of units 4, 5 and 5 of the TPP, worth some 200 million BGN of investment. The preliminary design developed by Atomtoploproekt plans to extend the exploitation term of the three TPP units until 2023, in fulfillment of EU requirements for decreasing emissions of sulfur, nitrogen and particulate matter.

It should be noted that the 195.8 million BGN included in the investment program of BEH companies could be invested in the sector of the renewable energy sources. Such an investment would create not just new opportunities for generators and traders, but also new green jobs. A basis for such a reallocation of public funds is provided by export and domestic consumption of electricity data. They reveal that while consumption follows a consistent downward trend, electricity export has the opposite trend. This conclusion, in combination with international agreements in EU context, is a serious argument in favor of the development of alternative energy generation models, while

being also in line with the national goals laid down in the Energy strategy of Bulgaria.

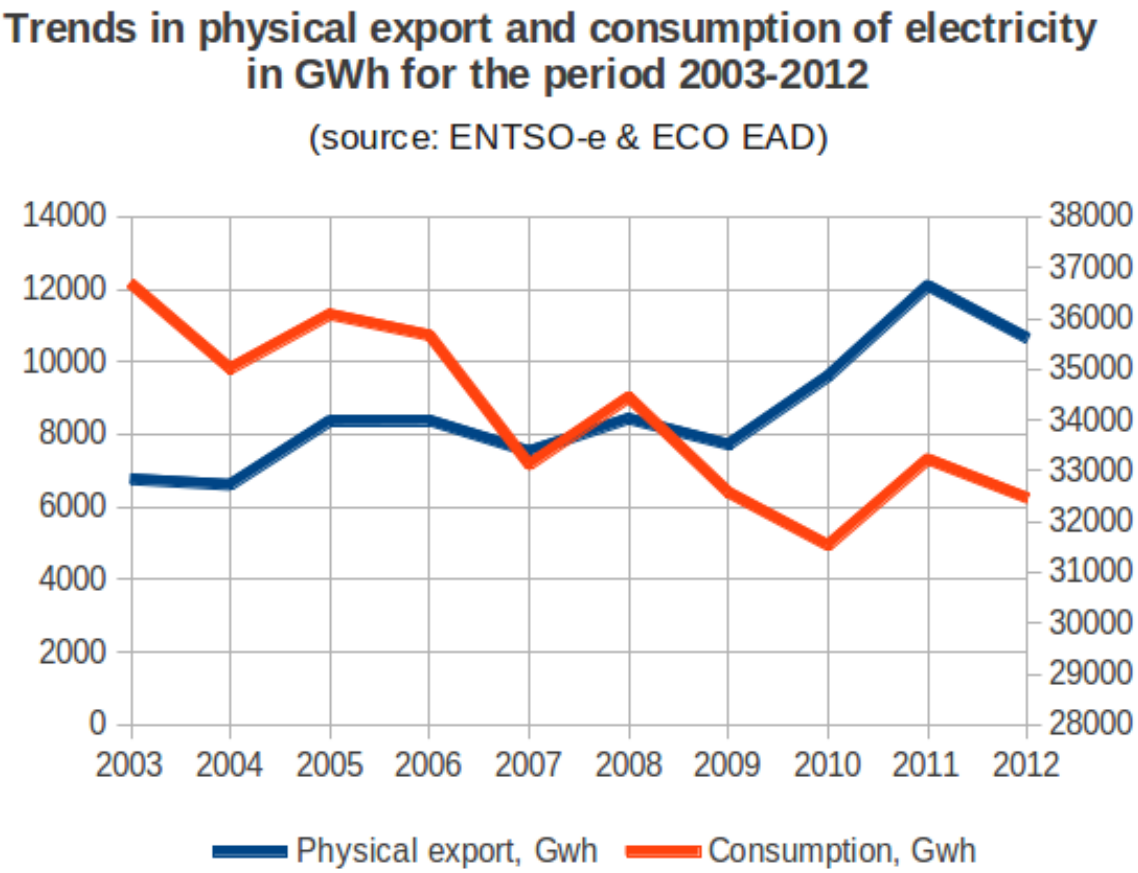

Figure 5. Trends in physical export and consumption of electricity in GWh for the period 2003-2012. *Source: ENTSO-e & ECO EAD*

2.2 The potential of energy efficiency measures

Bulgaria is obliged to implement a consistent policy for increasing energy efficiency and utilizing its energy savings potential. Bulgaria's Energy strategy by 2020 sets goals for 50% reduction of the energy intensity of GDP by 2020, which implies approximately 25% improvement in energy efficiency.

The Energy Efficiency Act (EEA) is the primary law regulating energy efficiency activities. An Act modifying and supplementing the EEA was adopted in March 2013 in order to harmonize Bulgarian legislation with Directive 2010/31/EU on the energy performance of buildings. At present, associated legislation is being analyzed and recast in order to transpose the European requirements for the energy performance of buildings.

Energy intensity is a key indicator for the efficiency of energy use. The implementation report of the Second national action plan on energy efficiency in 2012 emphasizes the fact that the aggravated efficiency of the energy sector in 2011 exceeds the effect of aggravated efficiency in final consumption – as illustrated by Eurostat data visualized in Figure 6.

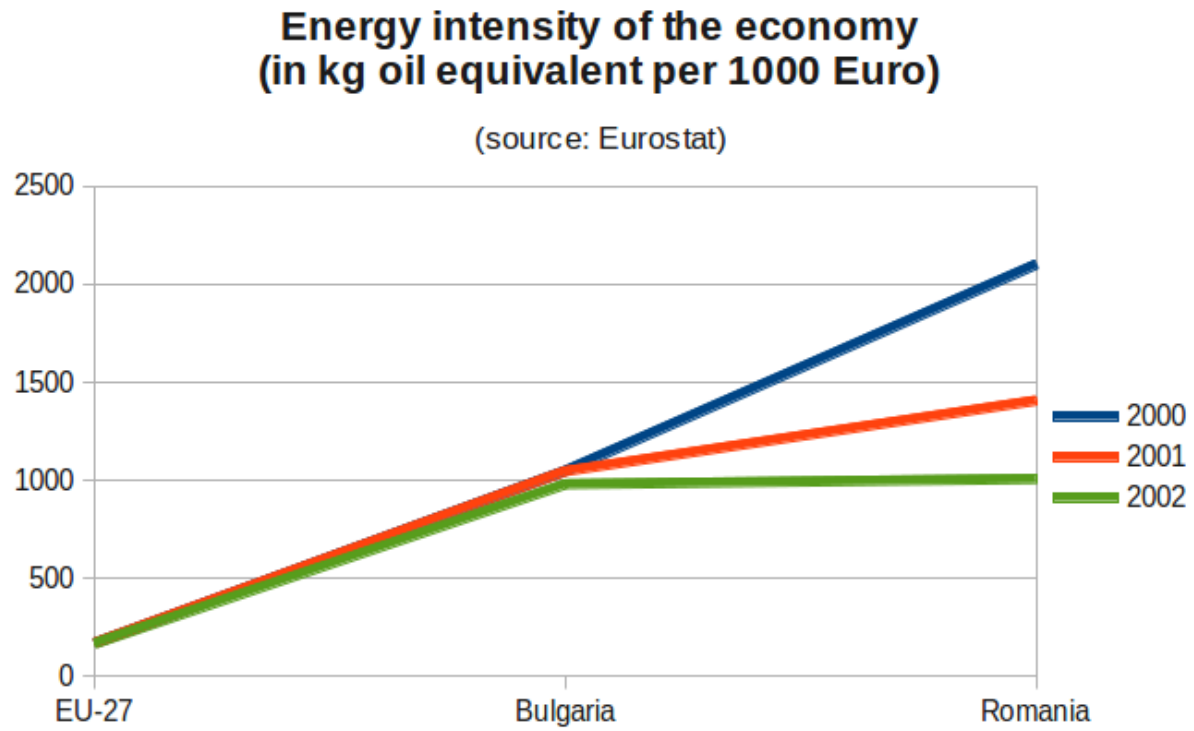

Figure 6. Energy intensity of the economy in kg of oil equivalent per 1000 Euro. *Source: Eurostat*

As can be seen from the energy intensity data presented in Figure 6, actions taken in the course of the past ten years in Bulgaria and Romania differ significantly, both in their starting points, as well as in their end results. To clarify: **with respect to energy intensity of the economy in 2013 Bulgaria is on the level that Romania was on more than a decade ago.**

Bulgaria does have some noticeable success in decreasing the energy intensity of the economy. However, instead of strictly determined state policy, this is the result of perfunctory fulfillment of EU requirements, the co-financing provided by pre-accession funds and operational programs, and partly to the good will of entrepreneurs. Since 2009 the energy intensity of Bulgaria's economy marks a U-turn, re-lapsing to the higher levels of 2007, **which comes to show that the measures implemented are not sustainable**.

The 2012 implementation report of the Second national action plan on energy efficiency evaluates 54 measures initiated in, or effective as of 2012. The indicative energy savings target is 5% of final energy consumption for the period 2008-2012, which amounts to 4 TWh/year. To date, the savings achieved total 6.4% of final energy consumption for the indicated period, or 5.2 TWh/year. The over-achievement of the national indicative target set in the action plan demonstrates that Bulgaria has a very real potentiality to fulfill the final target set for energy savings to the amount of 7.3 TWh/year in 2016.

The national energy savings target for 2020 will be determined during the development of the National action plan on energy efficiency scheduled in 2014, in line with Directive 2012/27/EU adopted in 2012. In addition, Directive 2012/27/EU puts in place new requirements regarding the energy efficiency obligation scheme, affecting also individual energy efficiency targets set for the three types of obligated parties in Bulgaria. Directive 2012/27/EU also introduces requirements regarding the calculation

and proof of achievement of the national target.

According to media statements in July and October 2013, the Minister of Energy announced that about 2500 MW of TPP capacity will be shut off from Bulgaria's energy system by 2018, including TPP Varna, TPP Bobov dol, TPP Brikel and TPP Maritsa-3.

2.3 Development of the RES sector and RES energy forecasts

The National action plan for renewable energy sources, adopted on 09 January 2013, is the document by which the State determines the development of the RES sector in Bulgaria for the period 2010-2020. The key target in the action plan is to have 16% share of energy from renewable sources in the gross final energy consumption in the country. It must be noted that “RES share in gross final energy consumption” means 'energy' in the broader sense of the term. The reason are the sectoral targets for RES energy: electric power, heating and cooling energy, and RES energy used in transportation.

According to the fuel-energy balance of the MEE, RES electricity generation in 2012 totals 5195 GWh (according to ENTSO-E data it was 5080 GWh). There is an increase of 1503 GWh, or 29%, in comparison with 2011 – a development that can be qualified as moving in the right direction.

The share of RES electricity in gross electricity consumption was 13.3% in 2012 and 9.2% in 2011 respectively.

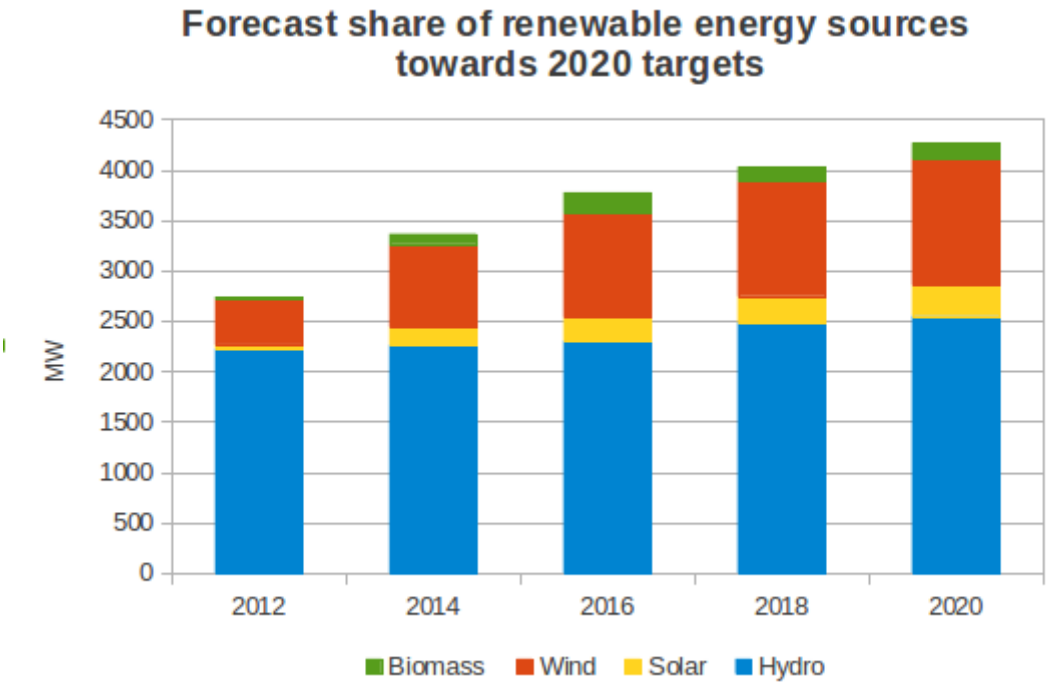

Figure 7. Forecast share of renewable energy sources in towards 2020 targets.

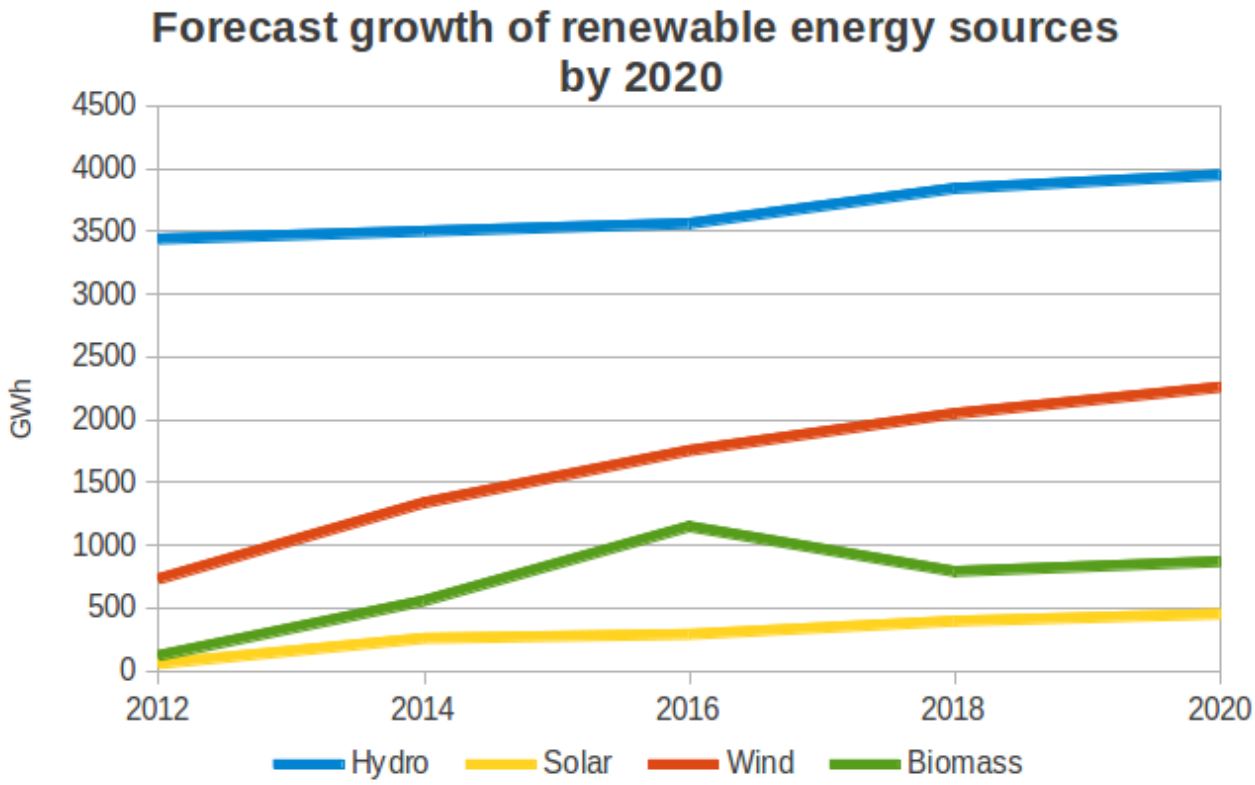

Figure 8. Forecast growth of renewable energy sources by 2020

According to the Renewable energy progress report of the European Commission from March 2013, Bulgaria is among the 13 member states reporting more than 2% over-achievement of the goals set in the national action plan for 2009 and 2010. The Commission is expected to issue the Second renewable energy progress report for Bulgaria, due in December 2013, covering the period from 2011 to the end of 2012.

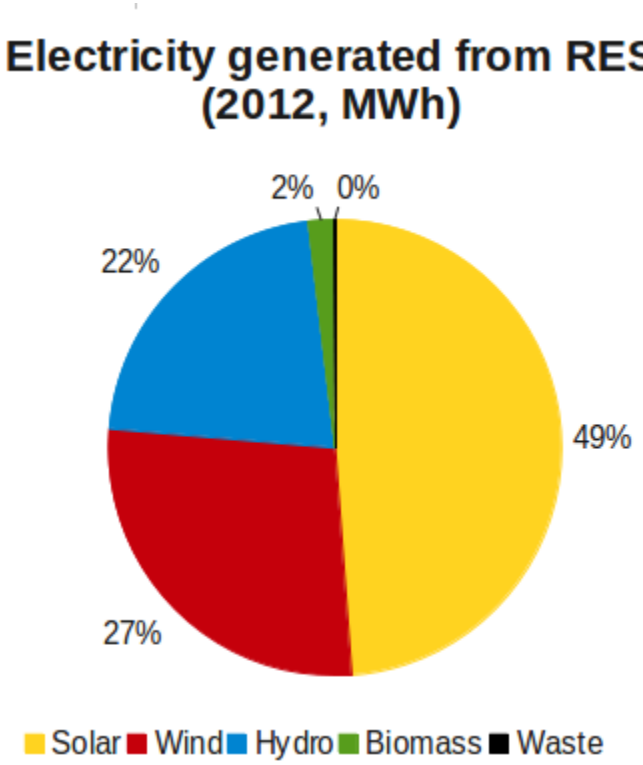

Figure 9. Electricity generated from RES in 2012 (in MWh)

Figure 9 shows data from the register of the Sustainable Energy Development Agency (SEDA), as of October 2012. Photo-voltaic installations are clearly the leader, delivering nearly half the electric power from RES in Bulgaria in 2012.

Table 2. Amount of RES energy generated, by type

Type of Energy	Number of units	Electricity generated (MWh)	% of power generated within the category	% of total
0 - 20	384	3 987		1%
Biomass	1	9	0%	0%
Hydro	37	365	9%	0%
Wind	16	207	5%	0%
Solar	330	3 406	85%	1%
20 - 100	331	14 725		5%
Hydro	67	3 562	24%	1%
Wind	48	2 466	17%	1%
Waste	1	67	0%	0%
Solar	215	8 631	59%	3%
100 - 500	268	71 086		25%
Hydro	46	11 929	17%	4%
Wind	80	21 909	31%	8%
Waste	1	150	0%	0%

Solar	141	37 097	52%	13%
500 - 1000	105	73 860		26%
Hydro	19	13 551	18%	5%
Wind	19	12 920	17%	5%
Solar	67	47 390	64%	17%
1000 - 5000	30	65 364		23%
Biomass	2	5 056	8%	2%
Hydro	12	25 418	39%	9%
Wind	4	12 916	20%	5%
Solar	12	21 974	34%	8%
5000 - 10000	2	13 189		5%
Hydro	1	6 003	46%	2%
Wind	1	7 186	54%	3%
10000 -	2	37 090		13%
Wind	1	19 186	52%	7%
Solar	1	17 904	48%	6%
Total	1 122	279 301		100%

An analysis of the data revealed the following interlinkages:

- **RES units generating up to 20 MWh** per month produce 34% of the electricity, or 1% total monthly electricity generation from RES, most of which comes from photo-voltaic panels.
- 331 units (30% of total RES) **generate between 20 and 100 MWh** per month, contributing around 5% to the total energy generated from RES. Two-thirds of those units are photo-voltaic panels.
- Assuming that the above two groups (**up to 20 MWh and between 20 and 100 MWh**) represent the small business that has invested in RES, the bottom line is: 715 power stations, or **64% of all RES power stations**, generate a total of 18 712 MWh electricity, or 6% of the total RES-generated energy.
- At the other end of the spectrum are only two large power stations – one wind turbine and one photo-voltaic station, producing 37 900 MWh in total, or **13% of total RES energy**. Those are really large facilities which, however, generate merely **twice the amount of energy generated by all remaining small RES power stations in the country**.
- If we add the next group, which includes two more large power stations, to this account, the bottom line is that the **four largest RES power stations** (over 50 000 MWh electricity) **generate 18%** of the total RES energy generated.
- The other large group of energy producers (1000 - 5000 MWh) per month includes 30 power stations which contribute for 23% of RES energy generation.
- The balance shows that 34 power stations generate 41% of RES electricity.

Thirteen of them are hydro power plants (11% of RES generation); two are biomass-based (2% of RES generation); six of the largest wind power stations (15% of RES generation) and 13 photo-voltaic power stations (14% of RES generation).

- Photo-voltaics - the RES that is most disputed by SEWEC - has the smallest power stations of **up to 20 MWh/month generating 2% of electricity, or 1% of the total RES mix**. Those are 330 power stations, or 29% of all stations of that kind. The largest 13 power stations (1% of all) of over 1000 MWh/month produce 29% of solar-generated electricity, or 13% of RES energy.
- There are 208 middle-sized (in terms of production capacity) photo-voltaic power stations (100-1000 MWh), producing 62% of solar-generated electricity.

In 2012 a sectoral interest organization uniting the majority of companies associated with wind power development in Bulgaria - Bulgarian Wind Energy Association (BWEA) - filed a lawsuit against decision No C-33 of the SEWEC to decrease the purchase price of wind-generated electricity by 22% as of July 1st, 2012. That decision, which cut down RES power producers' incomes by about 39%, was taken without prior discussion with all stakeholders and was published on SEWEC's website on a non-working day.

According to the BWEA "*an alarming situation is developing on the RES market in Bulgaria during the past year. The legal framework is changing too frequently, introducing more and more restrictive measures, not aiming to "cool down", but to "kill" investor interest in the sector*." In addition, BWEA emphasized that "***green energy has become a politically convenient excuse for raising electricity prices for consumers. In fact, it is the unstable and contradictory state policy in the sector that causes the unbalanced development of the RES mix in the direction of the most expensive sources.***"

The RES sector provided some 23 000 jobs in 2012, 12 000 of which direct. Calculations show that if the sector would be 'defrosted', an additional 15 000 jobs are expected to be created. Coincidentally, the energy efficiency sector is generating more and more jobs.

2.4 Options for reducing the amount of energy produced from coal

An inquiry at the European Network of Transmission System Operators for Electricity (ENTSO-e) shows the current status of the Bulgarian energy sector in 2013: electricity generation was **down by 12.3%** during the first quarter of 2013 compared to the same period in 2012. Domestic consumption decreased in the first quarter of 2013 by 9.6% (according to MEE) or 9.24% (ENTSO-e). Following the busier summer season, the decrease in consumption was maintained around 3% in comparison to the same period in 2012.

In the first quarter of 2013 **coal extraction in Bulgaria fell by 30.7%** compared to the same period in 2012, due to lower demand for resources by TPPs, caused by lower demand for electricity in the country and to limited exports.

Table 3. Carbon dioxide emissions from electricity generation (tonnes/MWh) by large power plats (excluding district heating and industrial plants), split by type of fuel.

CO2 emissions from electricity generation	EMISSIONS [kg/MWh]
Local coal	1100 - 1250

Imported coal	950 - 1000
RES	0

As can be seen from Table 2, RES yield clean and emission-free energy, while local and imported coal are among the most polluting fuels. Emission data on carbon dioxide – just one of the greenhouse gases – clearly points to the areas in which state policies ought to be focused and more efforts for development need to be made.

An analysis of the structure of greenhouse gas emissions by type of resource in the energy sector indicates that **the main potential for savings is concentrated in the sphere of electric and thermal power generation from coal**, since that sector is responsible for over 90% of emitted greenhouse gases. In turn, about 70% of total emissions from electricity generation (excluding industrial power plants) come from the three large power plants that operate on local lignite coal – TPP AES Galabovo, TPP Maritsa Iztok 2 and TPP Contour Global Operations Bulgaria. That is why these power plants are the object of special attention, as their emission reduction potential by 2020 to a large extent predetermines the shift in emission trends for the sector as a whole.

Comparing data from various Bulgarian and international sources leads to the logical conclusion that Bulgaria's coal industry will be dying off in the middle term – a conclusion that is at odds with the draft of the Mining strategy of Bulgaria. There is a need for an immediate and thorough review of the principal priorities and national targets in the mining sector in general, and coal extraction in particular, that must, as much as possible, be carried out independently from the mining industry. **Bulgaria's energy sector should move towards introducing measures to increase energy efficiency and develop the RES sector, with special attention to small and decentralized installations.**

3. Analysis of existing jobs in the coal industry sector

Employment in the coal industry sector is a major focus of this report, considering that **jobs are being used as a 'shield' against reforms of the sector and against implementation of policies for permanent decommissioning of industrial capacities related to coal combustion**.

3.1 Employment in the coal extraction and energy sectors

According to data from the European Association for Coal and Lignite (EuroCoal), 12 800 people are directly employed in the Bulgarian coal extraction sector[1]. This number corresponds to the information from the Bulgarian National Statistics Institute (NSI) about **some 13 300 people employed in coal extraction**. According to NSI there are an additional 15 620 people directly employed in electricity generation, however, this number includes those employed in all power plants, including nuclear, non-coal-fired power TPPs and RES. The NSI has no data about the number of people employed by specific TPPs, nor about all TPPs in Bulgaria. In the process of research the authors made inquiries to MEE and the Ministry of Labor and Social Policy (MLSP). Their responses were identical: **both MEE and MLSP have no information about the number of jobs in the coal industry sector in Bulgaria**. In addition, MLSP is not working on any plans or strategies for alternative employment for the sectors associated with coal extraction.

According to publicly available data from **Maritsa Iztok Mines EAD, the number of people employed in the mines is 7 084[2].** It is worth noting that, in comparison with other companies in the energy and coal extraction sectors in Bulgaria, Maritsa Iztok Mines EAD is the most transparent one in providing publicly information about its activities.

No publicly available estimates are to be found regarding the indirect jobs generated, or regarding the indirect economic effects on the Stara Zagora region (Maritsa coal basin). However, according to local residents, the employees of the regional TPPs are transported by some 200 buses every day. The entire complex is also serviced by a significant range of additional services: catering for the workers, extraction and transportation of lime for the desulfurization equipment, external automatization consultants; subcontractors for specific construction and maintenance works related to securing the technical functioning of all equipment both in the TPPs and the mines, and many others.

3.2 Working conditions, remuneration and health

Working conditions in the mines and TPPs are among the most arduous in Bulgaria. The labor of miners and TPP employees is classified as first and second category[3]. First category includes miners in underground mines, while second category includes TPP and open mine workers.

Underground coal mines are found predominantly in the southwest of Bulgaria. Currently, they are in dire economic condition, anticipating the dismissal of nearly 20% of all employees, according to trade unions[4]. Wages in that region are considerably lower than those in the Maritsa Iztok complex, as can be seen from the Oranovo Mines case described below (see below). According to trade unions, lay offs planned in the coal

1 http://www.euracoal.org/pages/layout1sp.php?idpage=69 – Eurocoal – Country profile Bulgaria
2 http://www.marica-iztok.com/bg/profile.php
3 НАРЕДБА ЗА КАТЕГОРИЗИРАНЕ НА ТРУДА ПРИ ПЕНСИОНИРАНЕ - http://www.lex.bg/bg/laws/ldoc/-13043711
4 http://economix.bg/miniorite-razcitat-na-oste-po-skapi-vaglista

extraction sector in the entire country will affect about 3 500 jobs.

Miners are entitled to early retirement[5]. For example, the retirement age for women in the first category labor group is 48 years. People employed in the coal industry are entitled to higher retirement pensions, but often benefit from them for shorter periods of time[6]. This is the case due to various severe occupational diseases that afflict miners.

Pneumoconiosis is among the most frequently occurring diseases among coal miners. Pneumoconiosis is a combination of several lung diseases that rank among the most frequently disabling occupational diseases of the lungs. Pneumoconiosis is caused by unrestricted inhalation of dust. The symptoms top the effects of smoking, causing the development of chronic bronchitis or obstructive lung disease. Prolonged exposure to air pollution considerably increases the risk of chronic cardiovascular and pulmonary diseases and of malignant diseases. According to the latest information, the negative impacts on human health from air pollution occur at lower levels of pollution than was thought before.

The remuneration received by people employed in the Maritsa coal basin mines and the TPPs fueled by them, are perceived as relatively high, mostly above national average levels. Employees in the mines and TPPs also receive a number of social benefits: annual bonuses, holidays for the workers and their families. All of this, however, comes at the cost of worsened health and shortened lives.

An aspect that is often ignored by social researchers and analysts is the credit exposure of coal mine and TPP employees. As jobs in those sectors are considered relatively secure with respect to long-term occupation, banks readily give credits to people employed in those sectors. **The credit indebtedness of coal and energy sector employees is an additional stimulus for guarding their jobs and for their sharp reaction to threats of lay-offs in the sector.**

Hazards for those working in coal extraction and TPPs are not exhausted by the occupational diseases they could develop on the job. Working in a risk-saturated environment, such as moving elements (shafts, etc.), heavy machinery, combustion systems, excessively hot exhaust gases, open and underground mine works, are all factors that characterize working in the coal extraction and energy sectors as hazardous. Occupational accidents happen both in the mines and in TPPs – unfortunately not infrequently because of economizing on safety measures, and notwithstanding the warnings issued by occupational safety state services. **In Bulgaria the most common reasons for death following occupational accidents in mines include landslides, explosions or falling from high elevations.**

During most of 2013 trade unions have been warning that the worsening economic state of the coal industry is conducive to neglect of safe working conditions, and hence to accidents. The case could have been different, if Bulgaria had developed a plan for gradual exit from the use of coal, and accessible re-qualification programs, targeting specifically coal extraction and TPP employees.

On July 16th, 2013, a landslide in the Oranovo Mine[7] took the life of four miners. A fifth miner died while taking part in the rescue action searching for his buried co-workers. The accident happened following an explosion in the small underground mine Oranovo in Simitli region. The miners come from the villages neighboring the mine, which is one of the few external sources of income for the local community. There is no rescue service at the Oranovo mine. Currently there are 260-270 people employed in

5НАРЕДБА ЗА ПЕНСИИТЕ И ОСИГУРИТЕЛНИЯ СТАЖ - http://lex.bg/laws/ldoc/-549442558
6http://www.septemvri23.com/Otvoreno_pismo_ot_Atanaska_Peneva_edna_ot_vdovicite_v_Maritza_Iztok.htm
7http://offnews.bg/index.php/262256/udalzhavat-s-mesets-sroka-za-zaklyucheniyata-po-intsidenta-v-oranovo

the mine, the average salary being around 400-500 BGN.

Accidents in the Oranovo mine are a recurring problem: in 2007 there were two fatal occupational accidents there. On March 5th, 2007, 32 miners were injured after a pit-gas explosion and two of them later died from their injuries. Several months later two more miners died in another occupational accident. The promised compensations for the casualties and their families have not been paid yet. At the same time, a number of experts, as well as local people, have publicly stated that **safety in the mine is being systemically neglected**. The occupational safety state services issued a number of instructions, indicating that the mine is dangerous and should be closed. The mine has been in operation for 10 years beyond its projected life, and coal seams are being exploited that go far below the depth initially planned.

Between 2000 and the end of 2012, 29 miners have lost their lives on the job in Bulgaria:

- **on 28 June 2010** a 55-year old worker in Troyanovo-3 mine employed by Maritsa Iztok Mines EAD died after an occupational accident;
- **on 14 May 2008** a 37-year old worker died in an accident in Troyanovo-1 mine of Maritsa Iztok Mines EAD;
- **between July 2007 and January 2009** four miners were buried by landslides;
- **in June 2007** a 47-year old miner died while loading explosion pits;
- **in March 2006** a miner died in Djurkovo mine after an explosion incident;
- **in November 2005** a 47-year old miner died as a result of an accidentally detonated explosion in a mine operated by Gorubso-Kurdjali;
- **between September 2003 and August 2004** three miners were buried under landslides and died in three different mines: Djurkovo, Cherno more and Pirin;
- **in April 2003** a 39-year old miner died in a rock-slide in Drujba mine;
- **in January 2003** a 44-year old worker was run over by a wagon in Petrovitsa mine in Madan;
- **in October 2002** a 49-year old worker fell between two bulldozers in Troyanovo-Sever mine of Maritsa Iztok Mines EAD and died.

It must be noted that, regardless of the rapid development of RES in Bulgaria, the new technologies implemented and the need for training, including for working at heights, **there is no information about a fatal accident or severely injured workers in the RES and energy efficiency sectors** in the past few years.

In the course of time it can be observed that **trade unions that should normally defend the rights of coal industry workers tend to react after the fact, and chiefly whenever there is an immediate threat for lay-offs** . Things unfolded in a similar fashion in 2010 as well, when Brikel EAD was about to be closed down. Trade unions react sharply when faced with the threat of losing jobs, without taking into account the fact that the closure of that specific TPP had been decided and planned years ago. In addition, trade unions fail to notice the fact that re-training programs should have been in place in order to assist the transfer of laid off workers into another occupation. Trade unions could take a step in the right direction by transforming their mode of work from passive to pro-active by participating early on in the process of seeking and identifying of solutions for new jobs for those employed in coal extraction and TPPs.

An official inquiry to MLSP yielded the information that **Bulgaria has neither strategy, nor programs developed specifically for re-training people employed in the coal extraction sector**. However, some training measures are in place that are not specifically provided for that purpose, but could be implemented in the coal sector. The

programs currently open for both unemployed and employed people are mainly funded by Operational Program Human Resources (OPHR). The “I can do more” program in the framework of the OPHR offers opportunities for obtaining main and additional qualification, based on a voucher system[8].

Mono-sectoral micro-regions are geographical areas that are heavily dependent on one, or several interrelated economic factors. An example of a mono-sectoral region is the territory in the vicinity of the complex of open mines and TPPs located in the Maritsa coal basin. When a great share of a region's economy is occupied chiefly by one large and centralized economic sector, local inhabitants are likely to develop a serious dependence on it. In combination with local residents' (workers and employees) fears to put forth direct questions regarding pollution and its effects on human health, or about the economic dependence and need for support of alternatives for the development of the local economy, mono-sectoral development often turns from a blessing, as it was in the good days of high demand of the product, into a curse when the market has no need for that produce.

In the times of the planned economy in USSR, in Russia alone around 45% of all towns were mono-sectoral (about 460 towns)[9]. This is valid even today for some 150-160 Russian towns, comprising about 11% of Russia's population. These 'mono-sectors' are exclusively related to the production of petrol, gas, coal, steel and machine-building. With very few exceptions, those towns suffer many economic hardships and large-scale unemployment. As a rule, these towns require considerable state subsidies with the sole purpose of maintaining employment levels and public order. Consequently, not many resources remain for human resource development or for infrastructure maintenance. Mono-sectoral towns and regions all over the world share a similar fate: after decades of flourishing, they are left in an unenviable state of decay, facing a bleak future.

During the 50s of the twentieth century Detroit, USA – a city historically associated with car manufacturing – numbered nearly 2 million inhabitants. The automatization of car manufacturing processes considerably reduced the need for employees - about 200 000 – 300 000 fewer people per decade. Today the city has less than 700 000 inhabitants and entire quarters are depopulated. Between the 60s and the number of people employed in the car manufacturing industry today has shrunk by 87%.

This warning must be sounded also in settlements in the coal-extractive industrial regions in Bulgaria. In the Maritsa coal basin region coal mines and TPPs are the chief providers of employment, together with additional external services, such as the transportation of employees and supply of materials. Any decrease of the market price of coal or electricity would seriously affect the local economy and employment levels. The situation in the regions where small coal mines are the chief employer is similar: Oranovo mines in Simitli region; Beli breg mines in Dragoman region and Stanyantsi mine in Godech region.

It is of utmost importance that mono-sectoral towns and regions strive for diversification of their economic activities, in order to prevent the dependence of livelihoods on a single type of production or service.

8http://азмогаповече.com/

9http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CCkQFjAA&url=http%3A%2F%2Fec.europa.eu%2Fregional_policy%2Fconferences%2Fod2011%2FOpen-Days-FTP-2011%2Fdocs%2F153-11UNIV05-11UNIV05_-_Zubarevich_Natalia_PPT.ppt&ei=zIOIUqaoGYmItQbgoIGYCw&usg=AFQjCNE9riGaTDDR3p2RyFGaFSfQKyzYBw&sig2=qpmfK7po4RNYBrkDJMyY3A&bvm=bv.56643336,d.Yms

4. Alternatives to current jobs in the coal industry sector

The targets set in the spheres of environment, energy, combustion plants and associated greenhouse gas emissions, require that Bulgaria approach seriously the issues related to coal extraction and TPPs. In addition, some of these targets are not just national – they have been set in the framework of international legal packages that are binding for Bulgaria as a member of the EU, and which require making certain commitments within a specified period of time.

The Bulgarian state, decisively and repeatedly, although lacking a clear plan, tends to postpone the implementation of measures required by the greater part of its international commitments. This is due partly to lack of capacity and partly to lobbying by various stakeholders. Nevertheless, the result is failure to implement long-planned policies and measures. This is the situation in the coal extraction and coal energy sectors. There is a widespread erroneous belief that the decommissioning of TPPs and mines would happen overnight – an impossible act, because of the socio-economic risks it would create.

The decommissioning of TPPs and mines will not and cannot happen in the short-term. A period of two or three decades is, however, fully realistic and sufficient to provide for effective re-training measures, diversification of economic activities in the regions that depend on coal extraction and coal combustion. By that time many employees would have reached retirement age and would not need to change profession or to be included in programs, while keeping their comfort and security. In fact, finding economic alternatives and new forms of employment most of all pertains to the regions themselves. They need to provide incentives for younger people and the next generations to stay and make their living there.

A list of exemplary activities and good practices from other countries follows, which can be applied in local models.

4.1. Recultivation of the mines

Open mines are open wounds in the Earth's surface that can span tens of square kilometers, which have been historically exploited in the course of decades. Maritsa Iztok mines, for example, take up an area of 240 km2. When a mine stops functioning, the mine operator is obliged to recultivate the terrain, including:

- fill up with soil;
- protect ground- and surface waters from toxic chemical leaks;
- plant new vegetation on site.

These tasks can sometimes be no less challenging than exploitation of the mine itself. These activities could also provide jobs for many people who had heretofore worked at the mines.

4.2 Development of RES

The potential for developing RES, energy efficiency measures and site recultivation offers opportunities for employment for people previously employed in the coal sector.

Research in the USA indicates that **investment in RES creates 40% more jobs compared to the same investment in the coal sector**. At the same time, the discourse in Bulgaria presents coal as a local resource, while wind turbines and solar panels are mostly imported from abroad and support chiefly the foreign economies.

To a large extent this is a deliberately imposed myth, as Bulgaria does produce

photo-voltaics, solar panels for hot-water and heating, biomass boilers, as well as insulation materials and energy-saving window and door frames. The greatest part of these production activities remains in the Bulgarian economy and creates far more jobs that can potentially be more equally distributed around the country.

Renewable energy and energy efficiency technologies can be implemented anywhere as needed – they are small-sized and vary in concept and technological complexity. These technologies can provide jobs for people with different qualifications – from fitters to engineers. Even with larger-scale technologies, such as wind turbines, Bulgaria could potentially produce many of the components necessary for their manufacture and maintenance.

According to information from NSI around 13 000 people are employed in the coal extraction sector. In comparison, the RES sector provided 12 000 jobs in 2012, and there are potentially 15 000 more jobs in the coming years, in the absence of artificially created obstructions. The opportunities for new jobs in the sphere of energy efficiency are even greater.

4.3 Thermal energy

The idea that energy includes only electric power is common in Bulgaria. In fact, the energy we need most often is energy for heating or cooling our homes. According to information from the *Partnership agreement for the new programming period of the European Union 2014-2020*, **approximately 40% of buildings in Bulgaria are heated by means of electricity, while the EU average is 11%**. This represents an unjustifiable waste when power from TPP is concerned. It must be noted that during coal combustion in TPPs, only about 30% of the energy produced is converted into electricity, with the rest going up the smokestack in the form of hot steam. At the next stage, nearly half of the electric power produced is lost along transmission lines from the site of generation to the electricity distribution network of the final customer, where it is then transformed back into thermal energy for heating. The last stage also involves great waste, as is the case with any switch of the energy carrier.

Many modern forms of RES provide a solution to that problem – generating thermal power when and where it is required. Solar panels for hot water for domestic use are able to supply all the hot water required by one household during minimum six months in the year. Even during the cooler months this technology can provide benefits and reduce the need of additional heating of water. There are technologies available that can cover the needs of industrial facilities as well. These are most often installed by small local enterprises which could re-train and employ people laid off from the coal extraction or conventional energy sectors.

4.4 Biomass, pellets and wood chips

Biomass-fed boilers and fireplaces are another technology that could provide for the heating needs of households and even of industrial facilities. Unlike old wood stoves, modern systems are designed with high efficiency in mind – between 75% and 93% with pellet-fed boilers, for instance. Many modern biomass-fed fireplaces and boilers are fitted with devices for complete combustion of flue gases, making them an acceptable solution even for densely populated city areas without central heating, where the necessary shafts for chimneys are in place.

The latest generation of such biomass-fueled systems - fireplaces and boilers running on pellets and wood chips – are fully automated and do not require any additional time for maintaining the combustion process. The electricity consumption by the automation process is negligible, starting at 50 Wh, or an order of magnitude less

than even the most efficient comparable air conditioners and thermal pumps.

The manufacture of pellets, eco-briquettes and wood chips offers an excellent opportunity for starting up small enterprises and using waste products from agriculture, forestry and biomass from wetlands. These are local resources that are non-polluting and that lead to the creation of jobs along the value chain – including for transport of the materials, manufacturing and distribution to numerous small customers and systems. Although it lacks the economy of scale characteristic of TPP or coal mines, there are huge economies to be made from efficient use of energy by combustion at the point of consumption without any losses from energy transmission.

4.5 Energy efficiency

Energy efficiency is another promising sphere in terms of employment. In 2005 Bulgaria adopted a national program for renovation of multi-family residential buildings, which plans the insulation of 680 000 apartments in panel buildings by 2020. Up until now there is hardly any progress on the implementation of the program. Clearly, a lot more political will needs to be directed towards its enforcement, rather than towards fossil fuel combustion or nuclear energy projects. In the current programming period only, Bulgaria could have availed of 203 million Euro from the European Regional Development Fund for renovating residential buildings. Although the Bulgarian State set up a measure worth just 32 million Euro, due to faults in the law on multi-family residential buildings and the highly complicated co-financing mechanisms, even these funds will remain unabsorbed.

In contrast to Bulgaria, the Czech Republic implemented two financing schemes for renovating buildings, resourced both from national and European funding and from the emissions trading income. Approximately 26 000 jobs were created as a result – approximately equal to the entire Bulgarian coal extraction and electricity generation sectors combined[10].

The implementation of the First national energy efficiency action plan 2008-2010 can potentially have the effect of creating jobs associated with the implementation of activities and measures for increasing energy efficiency, as set up in the action plan. The goal is to create new jobs in the sphere of energy efficiency and renewable energy, in order to compensate for current jobs in coal facilities that are scheduled to go out of business.

Based on comparative analyses and expert evaluations, there is sufficient confidence in the estimate that **no fewer than 2 500 workers and specialists** can be employed in implementing activities stipulated in the action plan. The associated social impacts include also improving living standards of the employees' family and kin. In addition, the implementation of the action plan would lead to increasing employees' qualifications – an advantage that would facilitate the process of finding a job.

The main goal here is to achieve sustainable energy development in Bulgaria – a goal that can be achieved solely by implementing new and environmentally-friendly technologies, such as RES and energy efficiency measures.

4.6 Solar power

A project initiated in 2010-2011 by a small group called “The Jobs Project” in Morgantown, West Virginia, aims to seek and find alternative employment in the energy sector in the entire Apalachee region. Jobless and part-time miners were re-trained as

10http://bankwatch.org/sites/default/files/Home-is-where-the-heat-is.pdf

fitters and began installing solar panels on rooftops.[11]

Such starting up systems, although small, offer an indication to coal regions that there could be opportunities for job creation and economic development beyond coal. Before the start of the project that is being implemented in Virginia and Kentucky, people were rather pessimistic, as for decades the electricity in those regions had been produced solely from coal. The project aims to offer alternatives for the local economy that can be multiplied. The systems built by re-trained workers from the mines cover up to 30% of electricity consumption of the buildings. Given current electricity prices in the USA, there is a seven-year pay-off period, after which the electricity can be used for own needs.

4.7 Agriculture

There are not sufficient publicly available data regarding land contamination in the vicinity of mines and TPPs in Bulgaria. In view of latest information from the Ministry of Environment and Water (MOEW) regarding the release of 270 kg of mercury by Bulgarian TPPs, it can be assumed that many of those sites will not be appropriate for growing organic vegetables and fruit. Although boundless fields of sunflower and grains can be seen today in the vicinity of the Maritsa TPPs, these crops are grown in monocultural large-scale land plots, by means of agricultural machinery.

Certain forms of farming can respond to the need for more jobs. These include **tree farming for timber and cannabis growing, including as a technical crop for the recultivation of land**. Tree farming for timber is practiced by small family farms in many European countries. Growing different tree species takes varying amounts of time, however, for those who find it hard to wait long, there are fast-growing species, such as paulownia, poplar or other widely spread coniferous species. New technologies, such as hardening of the soft wood of fast-growing species provides an environmentally-friendly way of improving the quality of timber from those species. In addition, timber processing using these new technologies could offer yet another employment niche along the supply chain [12].

Growing technical crops for fiber, such as cannabis, is also an excellent opportunity for occupation. Cannabis was widely used in the past, but obtained unwarranted notoriety in the twentieth century. Lately, the popularity of cannabis has been increasing as a crop that can be used for producing technical fibers, paper and chemicals. It is one of the alternatives currently available for those regions that get progressively decreasing incomes from tobacco production, and could likewise provide an alternative for coal extraction regions. Fiber processing and the extraction of valuable components requires the development of an entire associated mini-industry.

11http://www.huffingtonpost.com/2011/02/03/the-jobs-project_n_818006.html
12http://www.accoya.com/

PART THREE

Recommendations

The following recommendations are developed as a result of the research and analysis conducted for the purposes of this report on economic and energy alternatives for coal industrial regions in Bulgaria.

1. Consistent implementation of policies and transparent decision-making

It is of utmost importance that transparency gradually increases regarding the processes, decision-making and data related to the operation and commercial activities of all involved stakeholders in the energy sector. **At present, finding and extracting data for analysis of some economic sectors, related to energy generation, is difficult.** The authors regard this as a major shortcoming, that is to a great extent valid for the entire Bulgarian mining and energy sectors in general. This deficiency could be overcome in the short term, provided state authorities possess the political will to work to that end. At the time of writing of this report, however, this is highly doubtful.

In addition to the need for more transparency of the energy sector, it should be emphasized that the appearance of deliberate or accidental errors in public reports on energy and coal extraction, as well as contradicting data provided by international sources, do not help improve confidence in the stakeholders concerned, including state institutions related to that sector.

Environmental association Za Zemiata filed a court case against MOEW for refusing to divulge information in accordance with the Public access to information Act about exceeding of emissions of sulfur dioxide, nitric oxide and particulate matter in Bulgaria. Za Zemiata took the case to court following the refusal of information, requested in August 2013. The request concerned the official warning by the European Commission, as well as media-announced report on reducing emissions of harmful substances by large combustion plants, jointly produced by the MOEW and the MEE.

According to article 3 of the Energy Act, state policies in the energy sector is carried out by **Parliament and the Council of Ministers**. Clearly, energy is a sector of great strategical importance, both for the economy and for the environment. The long-term consequences of contradicting plans and actions by the two responsible institutions for the development of the sector are equally unclear with respect to the development of the country in general, as well as to all those employed in the coal extraction and energy sector and associated economic sectors, and directly and indirectly concern all Bulgarian citizens. Moreover, the contradictory indications given by Parliament and the Council of Ministers, various working groups, political formations and most of all the coal extraction and energy companies, could not lead to any constructive results, especially when actual changes occur in the absence of broad public debate that should be open and exclusively in the public interest.

2. Jobs and re-training for people employed in diminishing economic sectors

An opinion issued by the European Economic and Social Committee states that the transition towards 'green economy' will initially also lead to loss of jobs in traditional manufacturing industries. These losses must be alleviated by means of the social contract and workers' employability must be supported through re-training programs.

The establishment of a more environmentally-friendly economy could stimulate demand for both high- and low-skilled labor, as stated in the European Commission's *Green Growth* paper.

At present, trade unions do not contribute towards increasing the quality of life and independence of those employed in the coal extraction and energy sectors.

In the course of time it can be observed that trade unions that should normally defend the rights of coal industry workers tend to react after the fact, and chiefly whenever there is an immediate threat for lay-offs . Trade unions could take a step in the right direction by transforming their mode of work from passive to pro-active by participating early on in the process of seeking and identifying of solutions for new jobs for those employed in coal extraction and TPPs.

It is of utmost importance that mono-sectoral towns and regions strive for diversification of their economic activities, in order to prevent the dependence of livelihoods on a single type of production or service.

Experience shows that the debate on the transition beyond coal combustion is hardly tolerated in regions that are economically dependent on the operation of TPPs or coal mines. This includes the municipalities of Stara Zagora, Radnevo, Galabovo, Dimitrovgrad. Za Zemiata has made multiple requests to various local actors, including Stara Zagora municipality, the regional authorities, and even the town library, for renting a public space to hold debates regarding the future of the coal industry. However, all of these requests were tactfully rejected.

There have been attempts to stage large gatherings, especially of people that are threatened by the inadequacy of their skills in an changing environment. There is pressure and fear of losing one's job that are not visible from outside. All of these tactics do not contribute towards solving the problems either of the TPPs and the mines, or of their employees. The only winners from such actions are the company owners. Those who stand to lose from it are the offspring of families dependent on coal extraction.

People working in the coal sector have the right to know more about the life and health status of their families, as well as about the opportunities they would have when (not if) there are laid off. Such a transformation of the communication must occur notwithstanding the inaction or possible obstructions on part of the trade unions. The logic of public interest holds local and state authorities responsible for the elimination of rudimentary feudal-like models and for the establishment of democratic values.

Clearly, despite their harming the climate, environment and human health, coal does constitute the largest share of domestic energy needs in Bulgaria. For that reason, and also because of the sensitivity and scale of the issue, the state must immediately take proactive and sensible measures to initiate discussions, in order to publicly expose the situation comprehensively and in its true scale.

Indefinite deferment of decisions regarding re-raining individuals employed in the sectors treated in this report could increase the cost of implementing less popular measures for a shorter period of time in a social environment that is unfavorable for decision-making.

3. Energy efficiency

In the context of an economic union Bulgaria sets high targets for the food sector on the one hand, while for the sectors such as coal extraction and energy, even the targets set lower are hardly reached. An illustration of that is the sector's resistance and the inaction of the responsible state institutions regarding the implementation in Bulgaria of the *Third energy liberalization package*, that has been running late for years.

The state should set targets for the sector only after detailed review of all options,

evaluating various models, policies and good international practices. Targets could be more ambitious, as was definitely the case for the milk-processing sector. Setting unambitious sectoral targets renders Bulgaria only a formal member-state of the world's largest economic union. Deliberately reduced capacity, absence of will for real implementation of significant changes and scandalous lobbying to maintain the status quo are evident.

The successful implementation of the Second national energy efficiency action plan and the national intermediate indicative target for energy savings requires the development and **implementation** of additional schemes to facilitate financing to promote consumption-reducing projects and activities. Industrial plant owners and energy traders need to speed up the implementation of energy efficiency measures in order to achieve their targets in 2016, **and should be regularly consulted and supported by the state.**

4. Renewable energy sources

As member of the EU to follow development trends in the Union that aim to promote the RES sector and energy efficiency policies and measures.

Micro and small RES enterprises must be supported in order to reduce environmental damage, ensure diversification of available energy resources and support small communities, instead of large corporate plants.

Since 34% of power plants generate 1% of electricity from renewable sources, it is evident that their taxation would not considerably affect the general situation and could not salvage the big debtors in the Bulgarian electric power sector (e.g. NEC, BEH, etc.). At the same time, those taxes would cause difficulties for the owners of those 384 power plants, possibly forcing some of them to bankruptcy. In view of the above, the decision to remove the tax for access and to keep prices for those producers would have far more positive than negative effects on the system as a whole. **The idea to introduce a 30% tax on energy produced by RES must be abandoned**, as that would lead to a total lock-in of the sector.

Bulgaria's energy system ought to work towards introducing measures to increase energy efficiency and development of the RES sector, with special attention to small-scale and decentralized facilities.

The following priorities are identified as extremely important for Bulgaria and its future development:

- Prevent divestment of investors' assets from the RES sector by introducing a retro-active change of legislation. This would help restore trust in Bulgaria's investment climate.
- RES energy producers must be treated as equal actors on the energy market, not as a burden to society, as in the attempts to manufacture opinion witnessed in the past few years.
- Adopting trading rules for electric power that allow RES producers to participate in a well-functioning liberalized market, in line with national obligations in the context of the EU.
- Revoke discriminatory and illegal decisions taken by state institutions, in order to avoid bankruptcy of RES projects. It must be remembered that the RES sector has nearly 1.2 billion Euro worth of bank loans.
- The grid and compensating capacities need to be developed in order to allow the joining of new RES capacities.
- The legal basis concerning the energy sector needs to change in order to allow for

micro-producers of electric and thermal energy.

- The development and implementation of energy efficiency measures need to be promoted in all sectors.
- The continuous reduction of purchase prices for energy produced from RES does nothing to promote the development of the sector, nor of sustainable energy. Such a trend is not observed with coal industry prices – a fact that the state exercises prejudice on different sectors of the economy.
- Expedient and result-oriented state policies must be immediately launched, in order to promote energy generation from RES and the gradual decommissioning of coal-fired power plants.
- The energy produced and consumed in Bulgaria in 2012 is considerably less than that in 2011, pointing to the conclusion that there is no need for new capacities and coal-fired power plants, as has been suggested by the government.
- As the analysis above emphasizes, the key activities in the coal extraction sector need to address increasing energy efficiency and introducing environmentally-friendly measures in currently operational power plants, instead of aim for the construction of new facilities and investments in new units on site of old power plants.

Maritsa coal basin has lignite reserves that are relatively easy to extract. For decades this fact has created and maintained a dependent mono-sectoral micro-region in the vicinity of Stara Zagora. Miners and their families and the micro-economy are in a state of dependence, combined with an induced feeling of despair that does not help their overall quality of life. In addition, the occupational health problems suffered by those employed at mines and TPPs, as well as the health problems of their family members living near those mega-structures, are a result of the large quantities of sulfur, nitric oxides and particulate matter emitted by the coal industry.

The targets set with respect to the environmental and energy sectors, combustion plants and associated greenhouse gas emissions, require that Bulgaria approach seriously the issues related to coal extraction and TPPs. From a mid-term perspective the coal extraction sector is dying down. Joint and organized evaluation of all possible actions is urgently needed in view of increasing unemployment in the sector, projected for the coming 30 years. This will allow for the implementation of good practices and models available today.

A key alternative for coal industry in Bulgaria is contained in the opportunities for increasing energy efficiency and the use of RES. This process should be smoothly and gradually carried out, paying special attention to increasing the capacity of the grid to join new small RES units, and the construction of small independent grids.

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APPENDIX A

Glossary

Active energy	Electric power, produced by generators and delivered during a specified period of time, and capable of powering mechanical work or creating heat, measured in 'Watt-hours' (Wh) and derivative units.
Balancing energy	Active electric power activated by the grid operator in order to compensate for the difference between registered and actual supply schedules, as well as for the fluctuation of loads without a negotiated supply schedule.
Balancing group	A group comprising one or more traders of electric power, users or owners of the grid, organized in accordance with the requirements of the rules laid out in Article 91, point 2 of the Energy Act.
Biofuels	Liquid or gaseous transportation fuels produced from biomass.
Biomass	A biodegradable fraction of products, waste and scraps from agriculture (including vegetable and animal matter), forestry and associated industries, including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste.
Household customer	A customer who buys electric or thermal power from hot water or steam as energy carrier for heating, air conditioning and hot water supply, or natural gas for own household needs.
Gross final energy consumption	The consumption of energy products, supplied to industry, transport, households, services, including public services, agriculture, forestry, fisheries, including electricity and heat consumption by the energy sector for the purpose electric and thermal power generation, including the losses in the transmission and distribution of electric and thermal power.
Interconnected network	Transmission and or distribution grids that are interconnected.
Temporary storage	The storage of gas through compression in the gas transmission and distribution grids, with the exception of the facilities, reserved for the operators of gas transmission networks necessary for their operation.
Direct power line	A power line connecting directly the facilities of an electricity generator, or of its subsidiary, or with a customer, for the purpose of electricity supply.
Energy resource extraction for use by the State	The extraction of energy resources for industrial production of electric and / or thermal power, realized on site of the concession of an energy company, based on the concession granted, when the quantity of energy resources extracted by the concessioner is no less than 50 percent of the quantity of the specifics energy resource extracted

	annually in the country.
Additional services	All services, necessary for the exploitation of the electricity system, including voltage control and reactive power supply; frequency containment reserve, frequency restoration reserve power exchange, spinning reserve, the option of staring up without an external source, supplying part of a grid and load control.
Access	The right to use the electricity or natural gas grid(s) for transmitting electric power or natural gas in return for payment in conditions, specified by a legal ordinance.
Supply	The sale, including re-sale of energy or natural gas to customers.
Long-term energy balance forecasts	Energy balances forecasts that encompass a period of 10-15 years.
Long-term indicator levels	Quality indicator levels for the service supplied for a period of 10 years
Electric power	Active electric energy.
Electricity transmission grid	All electric transmission lines and electric devices that serve to transmit and transform electric power from high to middle voltage and re-distribute electric energy currents
Electricity distribution network	All electric transmission lines and electric devices of high, middle and low voltage, which serves to distribute electric energy.
Energy for own needs	The amount of energy used for the operation of facilities and installations that generate energy from renewable sources.
Energy for own consumption	The amount of energy used to supply sites, branches and facilities that belong to the owner of facilities and installations for energy generation from renewable sources.
Energy from renewable sources	Energy from renewable non-fossil sources: wind, solar, energy stored as heat in the atmosphere – aerothermal energy, energy stored as underground heat – geothermal energy, energy stored as heat in surface water – hydrothermal energy, ocean energy, hydro electric power, biomass, gas from renewable sources, landfill gas and gas from waste water treatment plants.
Energy undertaking	An entity carrying out one or more of the activities related to the generation, transformation, transmission, storage, distribution, delivery and supply of electric/thermal energy or natural gas, on the basis of a license issued under the law; or an entity that extracts energy resources based on a concession for extraction; or an entity carrying out activities for the generation of electric and / or thermal energy without the obligation to be licensed for the activity carried out; or an entity carrying out activities for transporting petrol and petrol products by means of pipelines.
Energy resources	Primary energy carriers (coal, petrol, gas, etc.), petrol products and renewable energy sources, used for the

	generation of electric power or power for heating or cooling.
Pollution	Any direct or indirect emission to air, water or soil as a result of human activity, of substances or heat that could: a) be harmful for human health or for the quality of aquatic ecosystems, or for terrestrial ecosystems that are directly dependent on those; b) cause material damage; c) aggravate or obstruct legal use of the environment.
Combined combustion	Combined combustion from renewable and non-renewable sources during which at least 20% of the fuel used for the generation of electric and / or thermal power come from renewable sources.
Final customer	A customer who buys electric power or natural gas for own use.
Combined operator	An energy enterprise, licensed for at least two of the activities: transmission, distribution of natural gas and an activity listed in Article 39, paragraph 1, point 4 of the Energy Act.
Combined heat and electric power generation	The generation of thermal and electric power in the same process in accordance with the needs for thermal power.
Last resort supplier	a) an energy enterprise that supplies electric power to household and non-household final customers, connected to the high-voltage electricity transmission grid, in the respective licensed territory, when those customers have not selected another supplier, or b) an energy enterprise supplying natural gas to the site of customers connected to the gas distribution grid in the respective licensed territory, when those customers have not selected another supplier.
High-voltage grid	Electric grid with a rated voltage of 60 KW or higher.
Middle-voltage grid	Electric grid with a rated voltage in the range of 1 KW to 35 KW.
Electric grid connection point	All points in the electric grid construction owned by the electric power enterprise, to which connection facilities for one or more consumers are connected.
Return on investment	Return on investment, expressed as a percentage of the capital invested.
Independent heat transmission grid	A heat network servicing part of a heat supply territory, which is connected to one or more sources of heat, located within the same territory and able to independently satisfy connected heat loads.
Public supplier	Public supplier of electric power, providing electricity supply to public suppliers and consumers, connected to the grid.
Public suppliers	Public suppliers of electric power providing electricity supply to consumers, connected to distribution grids for their licensed territories.
Organized electricity market	All forms of electricity trade in which the manner, place and time of contracting the deals are publicly known and announced in advance by trade rules.

Heating period	The period of time during which thermal energy is used for heating.
Reporting period	The period of time between two readings of the measurement unites for commercial transaction, monitoring devices and individual appliances for heat energy distribution.
Balancing energy market	Organized trade with electric power and natural gas for the purposes of keeping the balance between generation and consumption in the electricity system, and respectively between the import and consumption of natural gas
Energy services user	a) final customer, buying energy or natural gas from a supplier who provides public services, and / or b) user of personal and / or distribution grid for energy or natural gas supplies.
Power supplied	The maximum active power for which the transmission or distribution enterprise, in accordance with the connection contract, provides as available for use by the consumer, in the limit of ownership of the electricity facilities or for transmission to a distribution network at the spot of connecting a site of the distribution network, charactered by a level of rated voltage and number of phases at which it is supplied by a power factor of no less than 0.9.
Transmission of electric and thermal power or natural gas, petrol and petrol products	Transmission of electric or thermal power or natural gas, petrol and petrol products by means of the transmission grid or pipelines.
Transporter enterprise	An enterprise that owns the transmission network, is licensed to transmit electricity and carries out the transmission of electricity and the exploitation of the transmission grid.
Eligible consumer	A consumer of electricity that satisfies the conditions set in the rules for access to the electricity transmission and respectively the electricity distribution network.
Recognized asset value	The value of all assets congressed by the Commission owned by an energy enterprise that are in use and are related directly to the licensed activity.
Connecting	An activity realized in accordance with legal and technological requirements that ensures a direct connection from a technologically approved connection point to the outlet of the control/measuring device for natural gas, servicing one or a group of customers.
Added capacity	Maximum allowable active capacity corresponding to the transmission capacity of the respective grid and to the facilities for connection on the spot of connection of a customer site or of a transmission enterprise.
Producer	An entity producing electric and / or thermal power or gas from renewable sources or carrying out extraction of natural gas.
Regulation period	The period between two monitoring checks.
Availability	The capacity of a producer to provide available power during a given period of time in order to supply electricity.

	Measured in 'Watt per hour' and derivative units.
Distribution	Transmission of electricity or natural gas via transmission grids.
Distribution grid	The system of heat transmission facilities located beyond the property border between heat transmission enterprise and customers. In multi-family buildings it is a part of the building installations.
Distribution of thermal power	Transmission of thermal power via installations for household hot water supply, heating, conditioning and other devices of the customers.
Cold reserve capacity	The reserve capacity needed for to the adequate level, purchased by the electricity system operator in the form of availability of energy aggregates that are not supposed to operate in a given period of time and which the operator can activate in the case of deficit.
Resources for producing biofuels and liquid fuels from biomass	Plant species, discards and wastes from agriculture, forestry, fisheries and aquaculture.
Heat transmission grid	A system of heat transmission and technical facilities located between the property boundary of the heat transmission enterprise with the source of heat and / or the customers, that serve for the transmission of heat from the source to the customers.
Heat supply system	The system of energy sites and facilities for the production, transmission and supply of heat energy to consumers.