PROMITHEAS – 4

Knowledge transfer and research needs for preparing mitigation/adaptation policy portfolios

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Evaluation of Mitigation / Adaptation policy portfolios for Bulgaria

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ABBREVIATIONS

Abbreviation	Full name
AAU	Assign Amount Units
AHP	Analytical Hierarchy Process
AMS	Combination of AHP, MAUT, SMART
BAT	Best Available Technology
BAU	Business As Usual
BgEEF	Bulgarian Energy Efficiency Fund
BGN	Bulgarian Lev
BSREC	Black Sea Regional Energy Centre
CHP	Combined Heat and Power
EC	European Community
EE	Energy Efficiency
EPA	Environment Protection Act
ETS	Emissions Trading Scheme
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GEF	Global Environment Fund
GHG	Greenhouse Gases
HPP	Hydro Power Plants
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Chnage
JI	Joint Implementation (mechanism)
km	kilometre
ktoe	kiloton of oil equivalent
kWh	kilowatt hour
LEAP	Long-range Energy Alternatives Planning
m	meter
MAUT	Multi-Attribute Utility Theory
MEET	Ministry of Economy, Energy, and Tourism
MoEW	Ministry of Environment and Waters
MS	Member State
MWh	megawatt hour
NC	National Communication
NAPCC	National Action Plan for Climate Change
NPP	Nuclear Power Plant
NREAP	National Renewable Energy Action Plan
NSI	National Statistical Institute
OPT	Optimistic
PES	Pessimistic
PI	Policy Instrument
PM	Policy Mixes
PPP	Public-Private Partnerships
RES	Renewable Energy Sources
RES-e	Electricity produced by RES
SEWRC	State Energy and Water Regulatory Commission
SG	State Gazette
SMART	Simple Multi-Attribute Ranking Technique
T&D	Transmission and Distribution
toe	ton of oil equivalent
TPES	Total Primary Energy Supply
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
WPP	Wind Power Plant

ASSESSMENT OF THE THREE DEVELOPED SCENARIOS FOR BULGARIA, THROUGH THE MULTI - CRITERIA METHOD AMS

General comments

The three scenarios have been assessed trough the multi criteria method AMS. This method is combines three multi-criteria methods: Analytical Hierarchy Process (AHP), Multi-Attribute Utility Theory (MAUT) and Simple Multi-Attribute Ranking Technique (SMART) (Konidari and Mavrakis, 2007; 2006). AMS is developed for evaluating climate policy instruments (PI) or relevant Policy Mixes (PM) and with suitable modification for evaluating their interactions as well.

Three criteria are applied in AMS – environmental performance, political acceptability, and feasibility of implementation. The evaluation results for each criteria are reviewed below.

Required data

Table 1: Total emissions.

Scenario	Total GHG emissions (in $MtCO_{2eq}$)		
	2000	**2020**	**2050**
BAU	36,961	53,679	67,775
Opt	36,961	37,004	30,655
Pes	36,961	54,143	54,479

Table 2: Emissions per sector.

Scenario	GHG emissions (in $MtCO_{2eq}$)		
Households			
	2000	**2020**	**2050**
BAU	2,113	1,732	1,912
Opt	2,113	1,312	1,316
Pes	2,113	1,556	1,736
Agriculture			
BAU	0,770	0,779	1,101
Opt	0,770	0,584	0,794
Pes	0,770	0,584	0,846
Services			
BAU	0,316	0,560	0,791
Opt	0,316	0,492	0,674
Pes	0,316	0,516	0,734
Industry			
BAU	7,401	4,822	6,811
Opt	7,401	4,365	5,934
Pes	7,401	4,422	6,412
Transport			
BAU	4,983	9,480	13,391
Opt	4,983	7,182	2,037
Pes	4,983	7,556	5,308
Electricity generation			
BAU	19,474	31,660	37,484
Opt	19,474	21,544	19,811
Pes	19,474	28,071	34,612

Table 3: Other environmental effects under each scenario.

Scenario	Million Metric Tonnes CO_2 eq		
	2000	**2020**	**2050**
Environmental effects (Carbon Monoxide (CO)- Nitrogen Oxides (NOx)- Non Methane Volatile Organic Compounds- Sulfur Dioxide(SO_2))			
BAU	0,959	1,816	2,460
Opt	0,959	1,392	0,635
Pes	0,959	1,496	1,235

Table 4: Water Use.

Scenario	Billion m^3		
	2000	**2020**	**2050**
Energy			
BAU	3,475	3,578	3,799
Opt	3,475	3,543	3,651
Pes	3,475	3,578	3,799

Assignment of grades

The software ClimAMS-2012 is used for the evaluation of the scenarios (Figure 48).

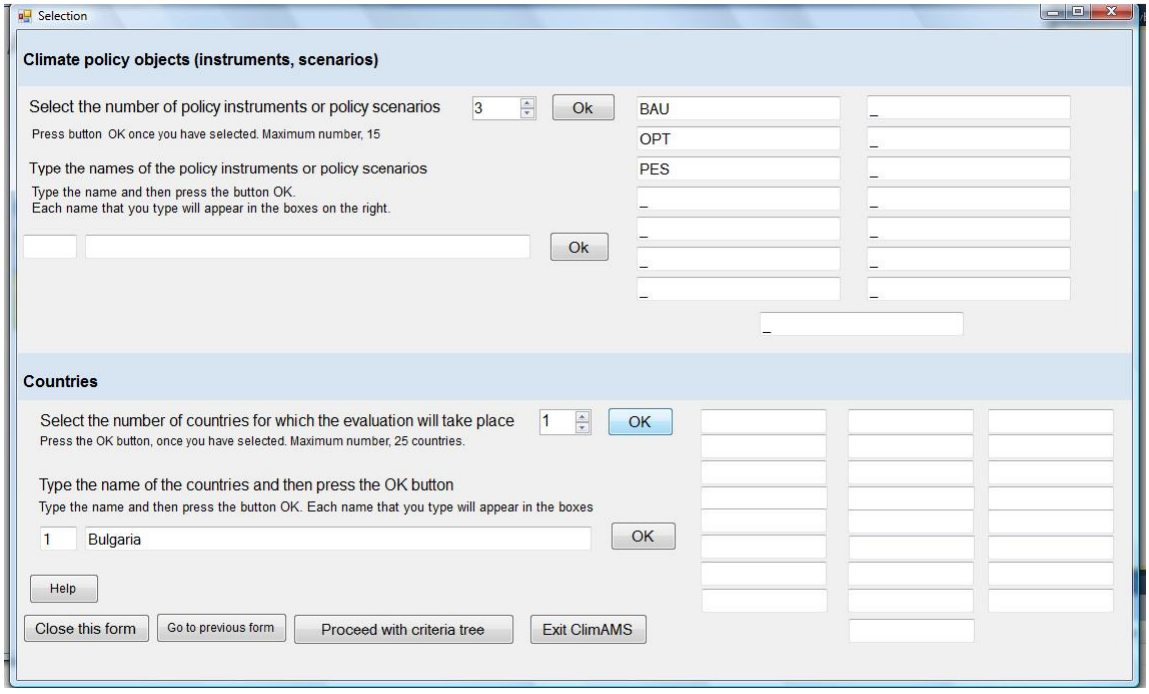

Figure 1: Comparison of the GHG emissions in each scenario (million metric tons CO_2eq).

Criterion 1: Environmental performance

Direct contribution to GHG emission reductions: For this sub-criterion, the outcome of LEAP for the total expected GHG emissions in year 2020 are used (Table 9). The scenario with the fewer amounts of emissions has the best performance for this sub-criterion.

Indirect environmental effects: The total amount of the total environmental effects provided by LEAP (Table 11) is used to assess the sub-criterion.

As a next step, the 2020 data is entered in ClimAMS (with negative value) to calculate respectively the direct effect on GHG emissions and indirect environmental effects.

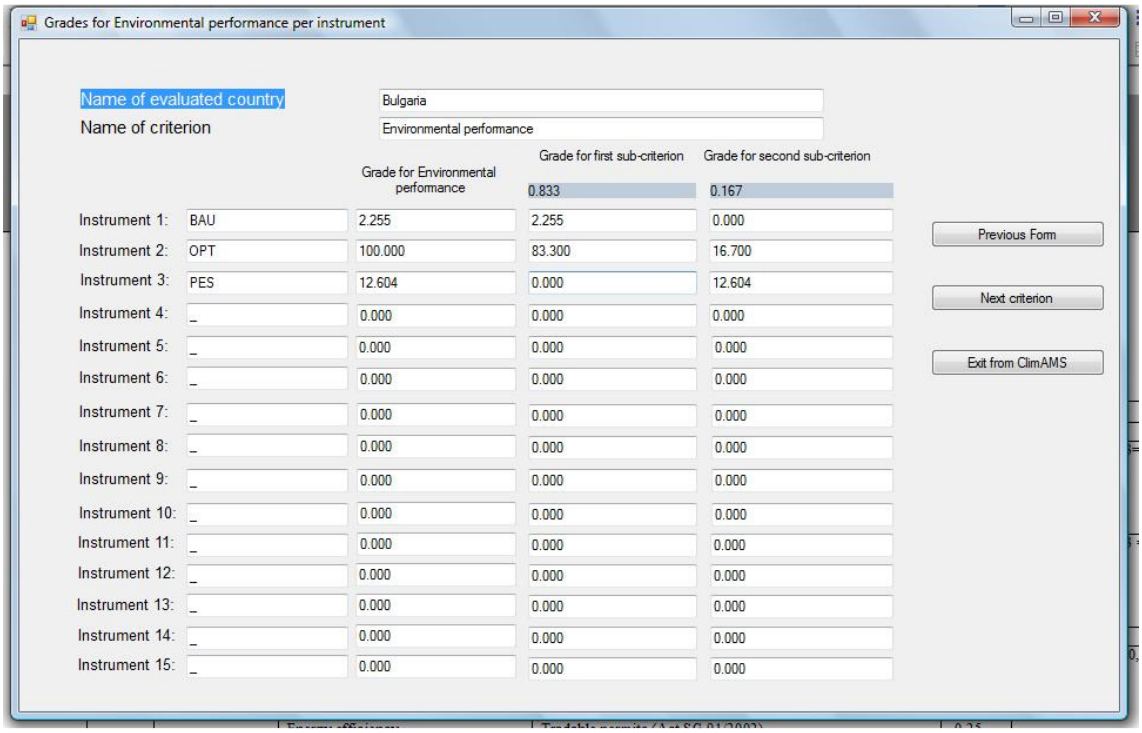

Figure 2: Environmental performance of the scenarios.

Criterion 2: Political acceptability

Cost efficiency: For the first sub-criterion the mean CEI for each sector was calculated depending on the policy instruments that were under each scenario. Each value was multiplied with the respective amount of GHG emission reductions that were estimated by LEAP outcomes. The reductions were calculated against those of the BAU scenario for each sector.

Concerning adaptation, due to no available data these were not calculated for Bulgaria. Additionally, there were no specific measures for the described sectors in the respective previous session about the adaptation needs of the country that could be taken into consideration. The total values are inserted in ClimAMS, but as positive ones.

Table 5: Mean CEI for each sector depending on the policy instruments of the BAU scenario.

Mitigation					
Scen.	**Sector**	**Technological options**	**Policy instrument**	**CEI**	**Mean CEI**
BAU	Buildings	Energy management	Performance standards (energy certificates, mandatory audits) (Act SG 49/2007 – Act SG 102/2009, Act SG 117/1997)	-5,75	(-5,75-0,75-2,5)/3= -3
		Energy management	Subsidy (Act SG 117/1997)	-0,75	
		Energy efficient appliances	Energy labeling for appliances (Ordinance SG 65/2006 – SG 4/2007)	-2,5	
	Industry	Energy management	Performance standards (energy certificates, mandatory audits) (Act SG 49/2007 – Act SG 102/2009)	-5,75	(-5,75-0,5-1,25)/3 = -2.5
		Energy efficiency	Tradable permits (Act SG 91/2002)	-0,5	
		Best available technologies	Regulatory standards (combined type) (MC 238/2009 - SG 80/2009)	-1,25	
	Transport	-	-		-
	Energy	Promotion of RES technologies	Regulation standards (Certification of RES) (Act SG 10/2009-SG 85/2010)	-0,75	(-0.75-0,25-0,25-0,5)/4 = -0,438
		Promotion of RES technologies	Subsidy (Feed-in-tariffs) (Act SG 49/2007, Act SG 62/2007, Act SG 107/2007)	-0,25	
		Energy efficiency	Tradable permits (Act SG 91/2002)	-0,25	
		Best available technologies	Regulatory standards (combined type) (MC 238/2009 - SG 80/2009)	-0,5	
Adaptation					
	Water management		Regulation standards (Command and Control) (Act SG 67/1999)	-1/6	

Table 6: Mean CEI for each sector depending on the selected policy instruments of the OPT scenario.

Mitigation					
Scen.	**Sector**	**Technological options**	**Policy instrument**	**CEI**	**Mean CEI**
OPT	Buildings	Energy management	Performance standards (energy certificates, mandatory audits) (Act SG 49/2007 – Act SG 102/2009, Act SG 117/1997)	-5,75	(-5,75-5,75-0,75-2,5-0,75-2,5)/6= -3
		Promotion of RES	Performance standards (Act SG 35/2011 – Act SG 54/2012, Proposed)	-5,75	
		Energy management	Subsidy (Act SG 117/1997)	-0,75	
		Energy efficient appliances	Energy labeling for appliances (Ordinance SG 65/2006 – SG 4/2007 – Ordinance SG 41/2011 – SG 93/2011))	-2,5	
		RES- EE	Subsidy (Solar – appliances, isolation) (Proposed)	-0,75	
		Energy efficient lighting	Performance standards (Proposed)	-2,5	
	Industry	Energy management	Performance standards (energy certificates, mandatory audits) (Act SG 49/2007 – Act SG 102/2009)	-5,75	(-5,75-0,5-1,25-0,5-1,25)/5 = -1,85
		Energy efficient technologies	Tradable permits (Act SG 91/2002, proposed)	-0,5	
		Best available technologies	Regulatory standards (combined type) (MC 238/2009 - SG 80/2009 - Proposed)	-1,25	
		Energy efficient technologies -RES	Subsidy (Proposed)	-0,5	
		Fuel switch	Regulatory standards (from coal to natural gas) (Proposed)	-1,25	
	Transport	Fuel switch – Promotion of biofuels	Fuel switch (Act SG 35/2011 – Act SG 54/2012)	0,25	(0,25-1,75-0,5-0,25-0,25+2)/6 = 0,083
		EE technologies	Energy efficient vehicles (Proposed)	-1,75	
			Performance standards (transport management) (Proposed)	0,5	
			Subsidy (Proposed)	-0,25	
		EE technologies -	Behavior change (proposed)	-0,25	
		Promotion of innovative technologies	Support of research (proposed)	+2	
	Energy	Promotion of RES technologies	Regulation standards (Certification of RES-Quotas) (Act SG 10/2009-SG 85/2010, Act SG 35/2011 – Act SG 54/2012)	-0,75	(-0.75-0,25-0,25-0,5)/4 = -0,438
		Promotion of RES technologies	Subsidy (Feed-in-tariffs) (Act SG 49/2007, Act SG 62/2007, Act SG 107/2007)	-0,25	
		Energy efficiency	Tradable permits (Act SG 91/2002)	-0,25	
		Best available technologies	Regulatory standards (combined type) (MC 238/2009 - SG 80/2009)	-0,5	
	Waste management	Relevant to the sector technologies	Regulatory standards (Proposed)	-1	-1

	Agriculture	EE technologies	Regulatory standards (Proposed)	0,5	(0,5+0,5)/2 = 0,5
			Subsidy (Proposed)	0,5	
Adaptation					
	Water management		Regulation standards (Command and Control) (Act SG 67/1999)	-1/6	(-1/6-0,83)/2 = -0,5
			Fees (Proposed)	-0,83	
	Forest management		Regulatory standards (Proposed)	-1/6	
	Agriculture		Land management (Proposed)	-1	

Table 7: Mean CEI for each sector depending on the selected policy instruments of the PES scenario.

Mitigation					
Scen.	**Sector**	**Technological options**	**Policy instrument**	**CEI**	**Mean CEI**
PES	Buildings	Energy management	Performance standards (energy certificates, mandatory audits) (Act SG 49/2007 – Act SG 102/2009, Act SG 117/1997)	-5,75	(-5,75-5,75-0,75-2,5-2,5)/5= -3.45
		Promotion of RES	Performance standards (Act SG 35/2011 – Act SG 54/2012)	-5,75	
		Energy management	Subsidy (Act SG 117/1997)	-0,75	
		Energy efficient appliances	Energy labeling for appliances (Ordinance SG 65/2006 – SG 4/2007 – Ordinance SG 41/2011 – SG 93/2011))	-2,5	
		Energy efficient lighting	Performance standards (Proposed)	-2,5	
	Industry	Energy management	Performance standards (energy certificates, mandatory audits) (Act SG 49/2007 – Act SG 102/2009)	-5,75	(-5,75-0,5-1,25)/3 = -2,5
		Energy efficient technologies	Tradable permits (Act SG 91/2002, proposed)	-0,5	
		Best available technologies	Regulatory standards (combined type) (MC 238/2009 - SG 80/2009 - Proposed)	-1,25	
	Transport	Fuel switch – Promotion of biofuels	Fuel switch (Act SG 35/2011 – Act SG 54/2012)	0,25	(0,25-1,75+0,5)/3 = -0,333
		EE technologies	Energy efficient vehicles (Proposed)	-1,75	
			Performance standards (transport management) (Proposed)	0,5	
	Energy	Promotion of RES technologies	Regulation standards (Certification of RES-Quotas) (Act SG 10/2009-SG 85/2010, Act SG 35/2011 – Act SG 54/2012)	-0,75	(-0.75-0,25-0,25-0,5)/4 = -0,438
		Promotion of RES technologies	Subsidy (Feed-in-tariffs) (Act SG 49/2007, Act SG 62/2007, Act SG 107/2007)	-0,25	
		Energy efficiency	Tradable permits (Act SG 91/2002)	-0,25	
		Best available technologies	Regulatory standards (combined type) (MC 238/2009 - SG 80/2009)	-0,5	
	Waste management	Relevant to the sector technologies	Regulatory standards (Proposed)	-1	-1
	Agriculture	EE technologies	Regulatory standards (Proposed)	0,5	0,5
Adaptation					
	Water management		Regulation standards (Command and Control) (Act SG 67/1999)	-1/6	(-1/6-0,83)/2 = -0,5
	Forest management		Regulatory standards (Proposed)	-1/6	

Table 8: Overall cost efficiency for the three scenarios.

Scen.	Mitigation/Adaptation Cost (pseudo-monetary units)										Total
	Buildings		Agriculture		Industry		Transport		Energy		
	M	A	M	A	M	A	M	A	M	A	
BAU	0	0	0	0	0	0	0	0	0	0	0
OPT	-1,464	0	0.098	0	-0,850	0	0,191	0	-4,43	0	-6,452
PES	-0,759	0	0.098	0	-1,000	0	-0,64	0	-1,73	0	-4,036

For **dynamic cost efficiency**, there are no available data from LEAP so the SMART procedure is used. OPT and partially PES encourage the introduction of innovative technologies, including RES (particularly wind offshore and electricity from biomass), passive buildings, electric vehicles. In BAU innovations are not directly encouraged. In PES the innovations are encouraged in a similar way as in BAU (as most policy instruments are similar). Research is indirectly promoted in OPT scenario, but not in the other two scenarios. The assigned grades are: BAU: 2; OPT: 6; PES: 5.

For **competitiveness,** in BAU and to a lower extent in PES, the economy will be affected by the climate change. The reduced water availability will result in high adaptation cost of the energy sector (i.e. reduced HPP generation), for the agricultural and forestry sectors (i.e. reduced yield or change of crops). The national competitiveness will remain unchanged in all scenarios, given that the other countries commit to similarly ambitious goals. The assigned grades are: BAU: 3, OPT: 5, PES: 4.

For **equity** the ratio GHG emission reductions in $MtCO_2eq$ to capita is used. It is considered that the larger the ratio is the fairer is the scenario in sharing the burden among the sectors.

Table 9: Equity measurement.

Scenario	Total amount of 2020 GHG emissions ($MtCO_2eq$)	Reductions compared to BAU	Population in 2020 (in million)	Ratio reductions tCO_2eq per capita
BAU	83,533	0	7,006	0
OPT	61,689	21,844	7,006	3,118
PES	71,090	12,443	7,006	1,776

For **flexibility**, the policy instruments need to be assessed in view of their property to offer a range of compliance options. In BAU, the minor availability of obligations offers the greatest flexibility. In OPT and PES, the majority of the policy instruments are command and control ones, allowing no or minimum flexibility, such as the obligatory RES share in new and reconstructed buildings, obligatory mixing of traditional fuels with biofuels, obligatory implementation of the audit recommendations, etc. On the other hand, there are several flexible influencing mechanisms (i.e. different levels of performance standards for boilers, lighting, appliances, etc.) and several economic incentives. Due to the similarity of the introduced instruments in PES and OPT, equal grades are given for both. The assigned grades are: BAU - 6, OPT - 4, PES - 4.

For **stringency for non-compliance**, PES and OPT will include penalties for non-compliance, particularly concerning the numerous command-and-control policy instruments. The grades are: BAU – 6, OPT – 4, PES – 4.

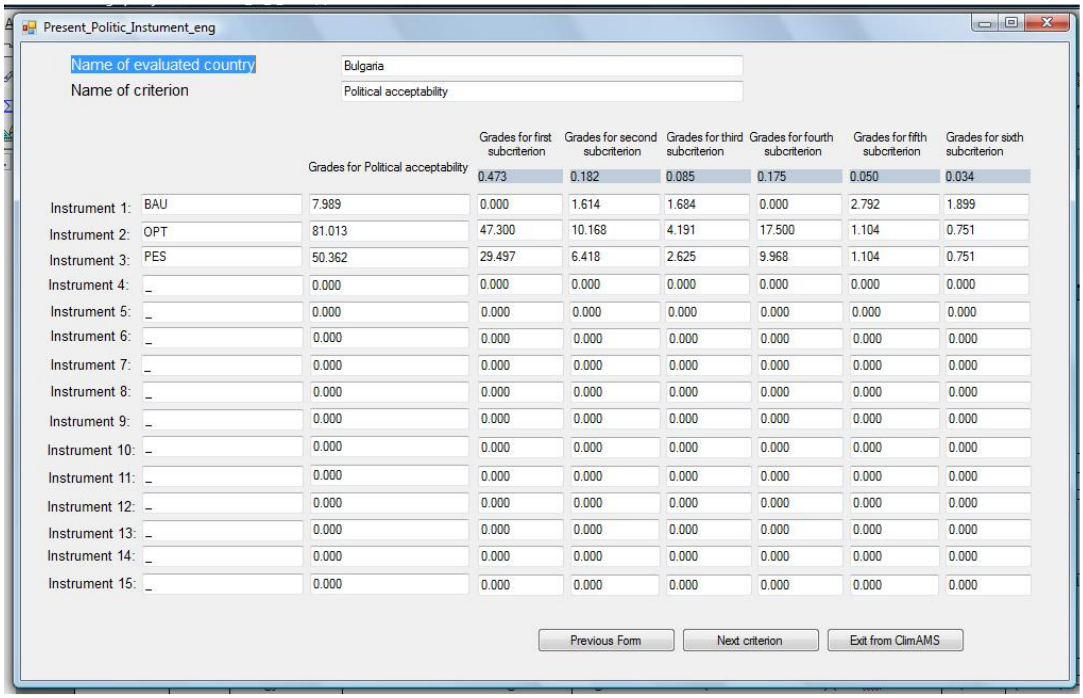

Figure 3: Political acceptability.

Criterion 3: Feasibility of Implementation

The *implementation network capacity* in Bulgaria is of different level considering the policy areas that each scenario includes.

In the field of energy efficiency and renewable energy, the existing capacity of the implementation network can be considered as very good. More specifically:

- The Sustainable Energy Development Agency[1], under the Ministry of Economy, Energy and Tourism is a large specifically dedicated State institution that is active in the field for more than 10 years.
- The Directorate "Energy strategies and policies for sustainable energy development" within the Ministry of Economy, Energy, and Tourism[2] is specifically dedicated to renewable energy and energy efficiency policies.
- The State Energy and Water Regulatory Commission[3], established in 1999, regulates for several years RES feed-in tariffs, RES guarantees of origin, and others.

On the other hand, the implementation network responsible for climate change policy issues is limited to only entity, one Directorate (of the 15 Directorates in total) of the Ministry of Environment and Waters[4]. An illustration for the limited activities in this domain is the lack of presenting any adaptation measures in the Third National Action Plan for Climate Change 2013-2020 (3rd NAPCC, 2012) and the lack of national studies related to adaptation, specified in the 3rd NAPCC and 5th NC.

All these authorities provide a wide range of information about their policies freely available at websites, brochures, events, etc and respond to requests.

Compared to BAU, the additional policies included in OPT and PES would be a challenge for the existing implementation network, since most of the new policy instruments

[1] www.seea.government.bg
[2] www.mi.government.bg
[3] www.dker.bg
[4] www3.moew.government.bg

concern renewable energy and energy efficiency, where the capacity is relatively high. The assigned grades are: BAU – 7, OPT – 6, PES – 6.

The **administrative feasibility** can be considered higher for BAU and PES compared to OPT. This is because compared to OPT these two scenarios include a much lower number and relatively simple policy instruments. The substantial changes included in OPT and PES would require reallocation of responsibilities within the public sector, amendment of the legislation, control and measurement. The assigned grades are: BAU – 8, OPT – 4, PES – 5.

For **financial feasibility**, the scenarios have relatively high performance. Public bodies have access to several EU funds, such as EU Structural and Cohesion Funds and IEE projects (notably Concerted Actions) to design and implement climate change policies. OPT due to a number of subsidies, certificates and audits included so as to promote RES and EE technologies is more difficult to be implemented succesfully under this subcriterion, but the presence of tradable permits assists this imbalance in financial resources. PES has less subsidies, but due to more additional policies compared to BAU will have a slightly higher financial burden. The assigned grades are: BAU – 8, OPT – 6, PES – 7.

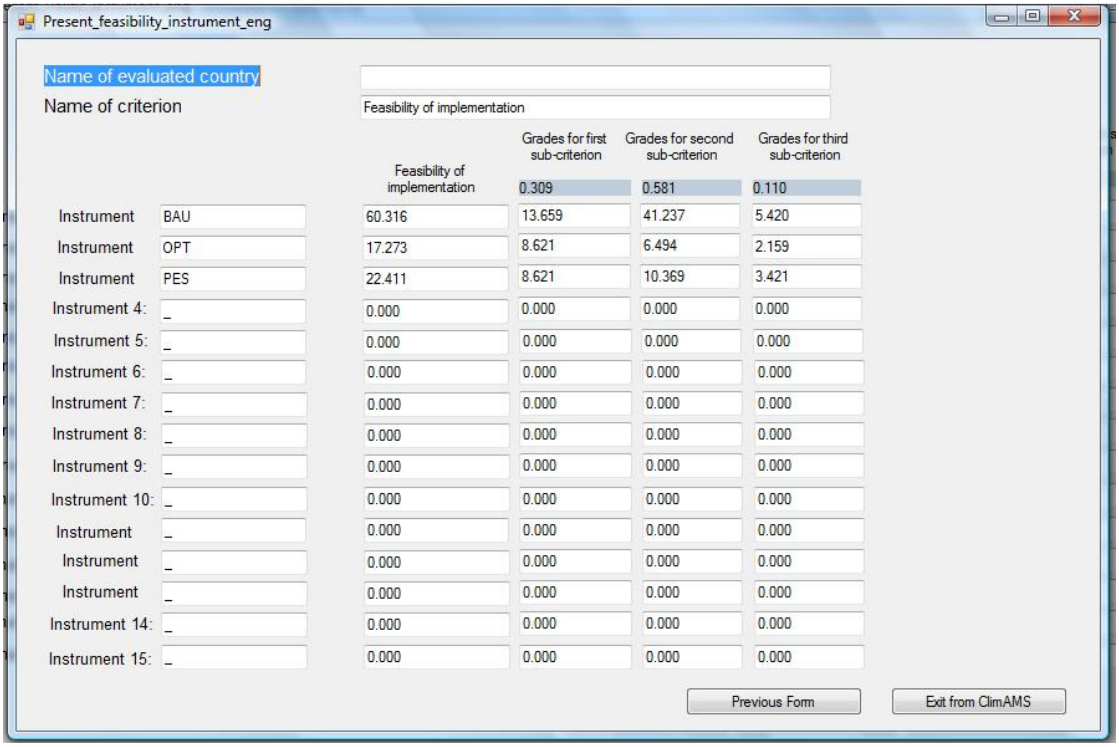

Figure 4: Feasibility of implementation.

The overall final score for each policy portfolio is presented in the below figure:

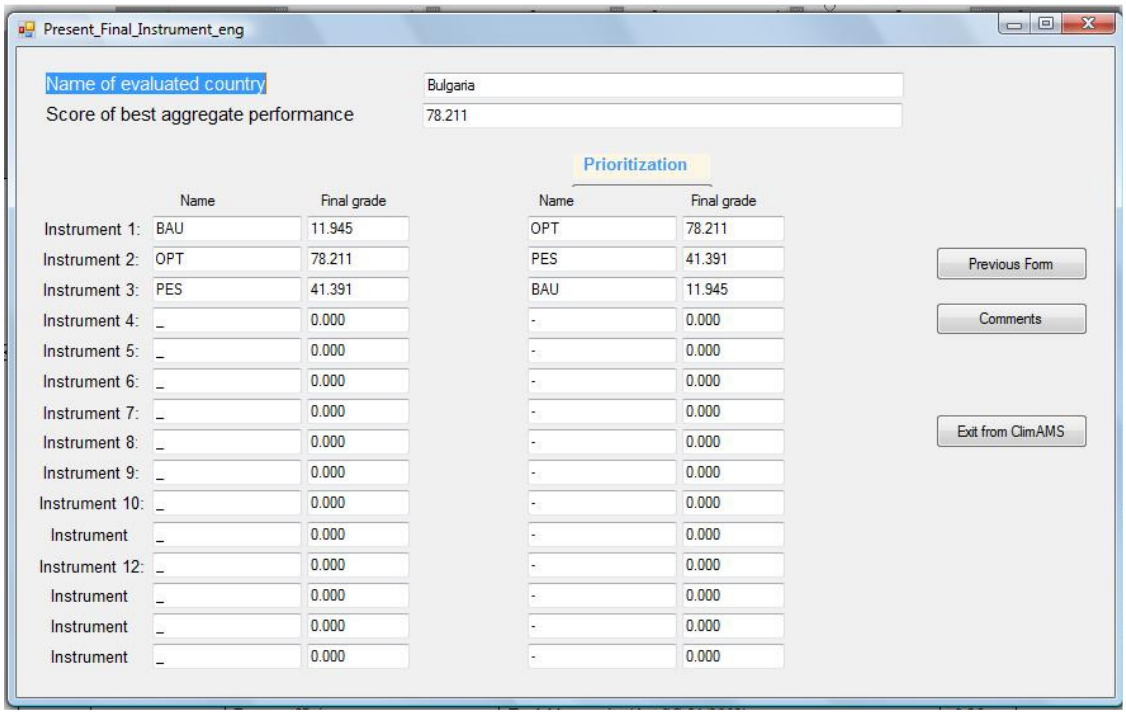

Figure 5: Final grades.

Table 10: AMS results for each scenario.

Criteria	**Scenarios**		
	BAU	**Opt**	**Pes**
Direct contribution to GHG emission reductions (0,833)	0	83,33	47,450
Indirect environmental effects (0,167)	0	16,70	12,801
Environmental performance (0,168) - A	**0**	**100,00**	**60,251**
Cost efficiency (0,473)	0	47,300	29,497
Dynamic cost efficiency (0,183)	1,614	10,168	6,418
Competitiveness (0,085)	1,684	4,191	2,625
Equity (0,175)	0	17,500	9,968
Flexibility (0,050)	2,792	1,104	1,104
Stringency for non-compliance (0,034)	1,899	0,751	0,751
Political acceptability (0,738) - B	**7,989**	**81,013**	**50,362**
Implementation network capacity (0,309)	13,659	8,621	5,420
Administrative feasibility (0,581)	41,237	6,494	2,159
Financial feasibility (0,110)	5,420	10,369	3,421
Feasibility of implementation (0,094) - C	**60,316**	**17,273**	**22,411**
Total (A+B+C)	**11,945**	**78,211**	**41,463**

The calculations show that the policy portfolio in OPT is by far the best one in terms of overall performance. The policy portfolio in BAU is by far the worst one.

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CONCLUSIONS

This report concerns the development and assessment of three (3) climate change mitigation and adaptation policy scenarios for Bulgaria. Each of them is characterized by a different policy portfolio and is named after it as Business As Usual (BAU), Optimistic (OPT) and Pessimistic (PES).

All scenarios take into consideration the following national objectives: i) 8% reduction of the annual greenhouse gas emissions by 2012 compared to the base year 1988; ii) 16% share of RES in total final energy consumption by 2020 and 10% share of RES in the final energy consumption in transport sector and iii) 9% reduction of the annual final energy consumption in 2016, compared to the average final energy consumption for the period 2001-2005.

BAU scenario

The BAU scenario concerns the time evolution of the already implemented mitigation and adaptation policy instruments (set into force before 31 December 2010) in Bulgaria until the year 2050 and serves as the reference against which the outcomes of the other scenarios are compared.

The currently implemented Bulgarian mitigation policy stimulates: i) penetration of RES in electricity production and transport sector, ii) energy efficiency in buildings and industrial systems; iii) GHG reduction through emission trading (EU-ETS, JI, and GIS). Concerning the adaptation policy, the main instrument is the preliminary assessment of flood risks and the respective prevention measures, if needed.

Bulgaria achieved the goal of 8% reduction of GHG emissions by 2012 (compared to the base year 1988) mainly because of the decrease of final energy consumption in the industrial sector and the partly substitution of coal and oil by biomass, natural gas and electricity. According to the outcomes of the LEAP model for the BAU scenario, GHG emissions in Bulgaria will increase by 17,5% in 2020 and by 54,4% in 2050 compared to the year 1992[5]. The share of RES in total final energy consuption in 2020 will be 12,9% and the share of biofuels in total final energy consumption in transport sector will be 9,8%. The final energy consumption in 2016 will increase by 20,5% compared to the average final energy consumption for the period 2001-2005.

OPT scenario

The Optimistic scenario concerns the time evolution of an enhanced mitigation/adaptation policy portfolio that Bulgaria will implement during the time interval 2011 - 2050. This enhanced policy portfolio takes into account the policy instruments adopted after 1st January 2011 as well as plans of the country and supports: i) the introduction of efficient technologies in almost all sectors targeting to the maximum reduction of GHG emissions through the maximum exploitation of the potential of the country in energy efficiency and renewable energy sources and ii) the necessary infrastructure for the adaptation of the country towards the minimum – in size and extent - expected climate change impacts.

Beyond 2020, it is assumed that ambitious policy instruments are enforced, resulting in substantial reduction of GHG emissions as well as adaptation policy instruments will meet the minimum adaptation needs in the agricultural sector and in water and forest management.

According to the outcomes of the LEAP model for the OPT scenario, GHG emissions in Bulgaria will decrease by 13,25% in 2020 and by 33,26% in 2050 compared to the year 1992. The share of RES in total final energy consuption in 2020 will be 13,9%, 1% more than BAU because of the introduction of solar in household sector and the share of biofuels in total final

[5] 1992 is considered the base year in this report, since data were not available before this year. Moreover, the GHG emission sources which are taken into consideration in this study do not include land use change and forestry and the industrial processes due to missing data. They are mostly those related to the mitigation policy measures which are implemented.

energy consumption in transport sector will be 10,3%. The final energy consumption in 2016 will increase by 12% compared to the average final energy consumption for the period 2001-2005.

PES scenario

The Pessimistic scenario concerns the time evolution of a mitigation/adaptation policy portfolio that the country will implement up to 2050 without exploiting fully the national potential in energy efficiency and renewable energy sources and by facing the worse expected impacts of climate change, taking into account the policy instruments adopted after 1st January 2011.

This scenario assumes less ambitious mitigation policy by limiting the possible technological options only to a selected number of sectors with the highest energy efficiency potential and the most promising for the country types of RES. The scenario considers the implementation of all policies approved (existing or planned) policies, but no additional policies apart from those in line with the EU climate change policy and the country priorities.

Given that the country has not approved any policies beyond 2020, it will be assumed under this scenario that the ones adopted before 2020 will be extended until 2050, as well as that minimum additional policies will be enforced after 2020. Despite the huge needs of adaptation (driven by the high global GHG emission levels and the related temperature changes), only the planned adaptation measures will be implemented.

According to the outcomes of the LEAP model for the PES scenario, GHG emissions in Bulgaria will decrease slightly (by 0,03%) in 2020 and will increase by 10% in 2050 compared to the year 1992. The share of RES in total final energy consuption in 2020 will be 13% and the share of biofuels in total final energy consumption in transport sector will be 10,2%. The final energy consumption in 2016 will increase by 12,4% compared to the average final energy consumption for the period 2001-2005.

Assessment outcomes[6]

Using the multicriteria method AMS, the three (3) policy portfolios were assessed against their environmental performance (amount of GHG emissions and secondary environmental effects), political acceptability (attitude of the involved entities (target groups) towards the relevant policy portfolio) and feasibility of implementation (applicability of the policy portfolio from the point of the governmental and national pertinent entities).

The BAU scenario is characterized by the highest final energy consumption and the worst environmental performance, compared to the other scenarios, which results from the limited number of mitigation and adaptation policy instruments. PES is characterized by moderate environmental performance while OPT has the lowest amount of GHG emissions and the lowest energy consumption.

The policy portfolio of the OPT scenario is overall the most promising since, apart from the best performance towards the reduction of GHG emissions, it ends up as the most cost effective for the target groups (residential, industrial, energy and transport sectors) compared to the other two policy portfolios. It offers a fair distribution of the "environmental" burden among the respective sectors. Moreover, OPT and partially PES encourage the introduction of innovative technologies, such as wind offshore, passive buildings, electric vehicles and promotes indirectly research. In BAU, innovations are not directly encouraged.

The implementation network (the governmental and national entities that will implement the policy instruments) provides a wide range of relevant information freely available at websites, brochures, events, etc. and responds to requests. Given the above and the fact that BAU includes a much lower number and relatively simple policy instruments, BAU will

[6] The assessment outcomes depend on the level of expertise of the person who makes the assessment as well as the degree of justification concerning the sub-criteria.

require least institutional changes compared to the other two policy mixtures. The substantial changes included in OPT and PES would require reallocation of responsibilities within the pertinent authorities, amendment of the legislation, control and measurement, which would be a challenge for the existing implementation network, since most of the new policy instruments concern renewable energy and energy efficiency, where the capacity is relatively high.

Given the above, the mitigation/adaptation policy portfolio which characterizes the Optimistic scenario is the one to achieve most of the goals of the climate change policy of Bulgaria. Nevertheless, the success of this policy portfolio requires the effectiveness of the implementation network and a more stringent frame for non-compliance.

In this report, the component of adaptation in climate change policy is not fully developed since the country hasn't set an adequate framework to reduce its vulnerability to climate change. Moreover, the design and assessment of relevant policy instruments require data related to the frequency of extreme events, water resources and use, low-income groups, biodiversity, the health sector, etc., which are not available at the moment.

Concluding, the scenarios of this report were developed under the same assumptions for the evolution of GDP and population for the period 2011-2050. In order to perceive the performance and applicability of the three (3) policy portfolios, the report should include six (6) more scenarios with the combinations "low population growth – high GDP growth" and "high population growth-low GDP growth", according to the socioeconomic frameworks presented in the IPCC pathways (new generation of IPCC scenarios).