

*Project: "First Biennial Update Report (FBUR)"*

***POLICY PAPER FOR DETERMINATION OF POTENTIAL NATIONAL  
GREENHOUSE GAS EMISSION LIMITATION/REDUCTION TARGETS***

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Ministry of Environment  
and Physical Planning



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The First Biennial Update Report on Climate Change is a significant national contribution to fulfilling the country's commitments to the UNFCCC.

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## 1. Introduction

This policy paper is prepared as a part of the First Biennial Update Report (FBUR) project financed by United Nations Development Programme (UNDP) for the Ministry of Environment and Physical Planning as a beneficiary. Its aim is to contribute to the process of determination of potential national greenhouse gas (GHG) emission limitation/reduction targets, in preparation for the United Nations Framework Convention on Climate Change (UNFCCC) 21<sup>st</sup> Conference of Parties (COP 21), that will be held in Paris in 2015. The Republic of Macedonia is expected to deliver its intended nationally determined contribution in the context of the 2015 agreement, by the first quarter of 2015 (or if not possible, then by August 2015), and this policy paper should contribute to that process.

It analyses and compares the top-down scenarios presented in the Third National Communication on Climate Change (TNC) and bottom-up scenarios - without measures (WOM), with existing measures (WEM) and with additional measures (WAM), presented in the FBUR main report, prepared by the Research Center for Energy and Sustainable Development of the Macedonian Academy of Sciences and Arts.

The expected content of “Intended nationally determined contributions of Parties in the context of the 2015 agreement” is not yet finalized, but according to the draft document<sup>1</sup> of the Ad Hoc Working Group on the Durban Platform for Enhanced Action it would contain the following:

- Type of mitigation contribution;
- Time frame or time period;
- Base year;
- Coverage in terms of:
  - Geographical boundaries;
  - Sectors;
  - Greenhouse gases;
  - Percentage of total/national emissions covered.
- Baseline emissions and related assumptions and methodologies, including methods for the projection of carbon intensity of GDP;
- A quantification of expected emission reductions, including estimates with and without land use, land-use change and forestry;
- Annual estimated reduction in emissions intensity of the economy;
- Methodologies, emission factors and metrics used, including global warming potentials in accordance with the relevant decisions of the Conference of the Parties;
- Peaking year;
- Expected use of international market mechanisms, including how double counting is avoided;
- Approach to accounting for the land-use sector;
- Estimated macro-economic and marginal costs of achieving the commitments or targets, describing the methods used to estimate them;
- An indication of additional mitigation action to be achieved through the provision of support.

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<sup>1</sup> <http://unfccc.int/resource/docs/2014/adp2/eng/7drafttext.pdf> [accessed on November 14, 2014]

This policy paper covers only part of the above, related to mitigation policies and measures in buildings, transport and energy supply sectors. Nevertheless, these sectors cover most of the GHG emissions in the Republic of Macedonia, and also those are sectors in which policies and measures may achieve quick and easy results, and in which, the already implemented measures are even now achieving results. The policy paper also contains recommendations for follow-up actions which will help setting the mitigation contributions reflective of the national circumstances and, at the same time, being widely perceived as equitable and fair, and collectively sufficient to keep global temperature increase below 2°C.

## 2. Top-Down Approach of the Third National Communication

The Republic of Macedonia has submitted its TNC as part of the UNFCCC process. The Communication has considered 3 groups of scenarios, related to possible outcomes of the future integration processes. Group 1 scenarios are European Union (EU) type year-end scenarios, which are consequential to the Macedonian presumed accession to EU in 2020. Group 2 scenarios are assuming that the Republic of Macedonia would opt for Quantified Emissions Reduction or Limitation Targets (QELRC). Group 3 are scenarios in case the Republic of Macedonia opts for baseline or business as usual (BAU) deviation type of targets.

Group 1 scenarios: Targets are given for 2030, 2040 and 2050 compared to 1990. Three scenarios were considered, EU\_Low, EU\_Medium and EU\_High. Their top-down targets are given in Table 1, while the modelled results are given in Table 2 and Figure 1.

Table 1 Group 1 scenarios (EU)

Group 1 scenarios	2030	2040	2050
EU_Low	-20%	-30%	-40%
EU_Medium	-30%	-45%	-60%
EU_High	-40%	-60%	-80%

Table 2. Total CO<sub>2</sub> Emissions under Baseline and EU Mitigation Scenarios (kt)

Scenario	2011	2014	2017	2020	2023	2026	2029	2032	2035	2038	2041	2044	2047	2050
Baseline	9481	10311	10298	10049	10343	11774	13550	14118	11712	12286	12837	13376	13816	14166
EU_Low	9481	10267	10195	5718	6187	6485	6836	7116	7102	6865	6628	6313	5997	5681
EU_Medium	9481	10259	10177	5583	6043	6214	6453	6273	5918	5563	5208	4735	4261	3788
EU_High	9481	10207	10030	5587	5777	5979	5681	5208	4734	4261	3788	3156	2525	1894

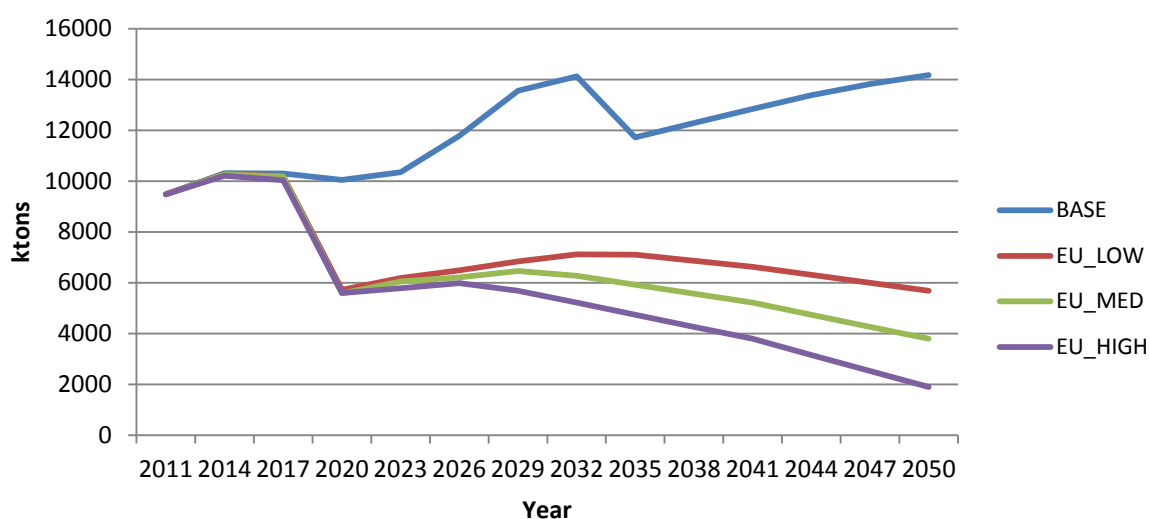


Figure 1. Total CO<sub>2</sub> Emissions under Baseline scenario and EU Mitigation Scenarios (kt)

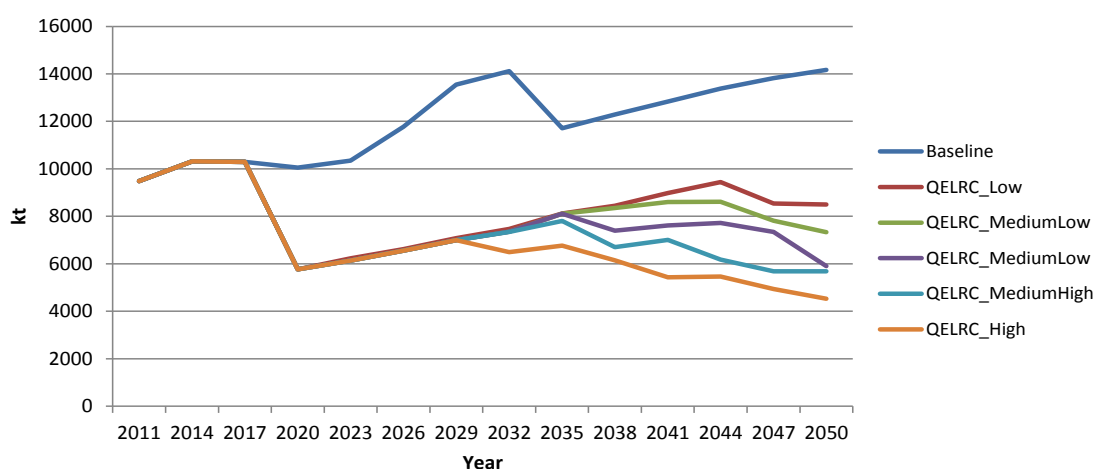
Group 2 scenarios: Targets are given as QELRC for 2021-28 period compared to 1990, and then for each 8-year commitment period. Five scenarios were considered, QELRC\_Low, QELRC\_MediumLow, QELRC\_Medium, QELRC\_MediumHigh and QELRC\_High. Their top-down targets are given in Table 3, while the modelled results are given in Table 4 and Figure 2.

*Table 3 Group 2 scenarios (QELRC)*

Group 2 scenarios	2021-28	2029-36	2037-44	2045-52
<b>QELRC_Low</b>	+20%	+10%	0%	-10%
<b>QELRC_MediumLow</b>	+10%	0%	-10%	-20%
<b>QELRC_Medium</b>	0%	-10%	-20%	-30%
<b>QELRC_MediumHigh</b>	-10%	-20%	-30%	-40%
<b>QELRC_High</b>	-20%	-30%	-40%	-50%

*Table 4. Total CO<sub>2</sub> Emissions under Baseline and QELRC Mitigation Scenarios (kt)*

Scenario	2011	2014	2017	2020	2023	2026	2029	2032	2035	2038	2041	2044	2047	2050
<b>Baseline</b>	9481	10311	10298	10049	10343	11774	13550	14118	11712	12286	12837	13376	13816	14166
<b>QELRC_Low</b>	9481	10311	10298	5764	6225	6621	7076	7468	8125	8450	8984	9444	8545	8499
<b>QELRC_MediumLow</b>	9481	10311	10298	5764	6139	6554	6999	7351	8107	8351	8605	8610	7820	7330
<b>QELRC_Medium</b>	9481	10311	10298	5764	6139	6554	6999	7351	8107	7392	7614	7719	7347	5910
<b>QELRC_MediumHigh</b>	9481	10311	10298	5764	6139	6554	6999	7341	7809	6703	7003	6179	5681	5682
<b>QELRC_High</b>	9481	10311	10298	5764	6139	6554	6999	6494	6762	6148	5437	5460	4938	4531



*Figure 2. Total CO<sub>2</sub> Emissions under Baseline Scenario and QELRC Mitigation Scenarios (kt)*

Group 3 scenarios: BAU deviation type target, given for period 2020-2050. Three scenarios were considered, BAUdev\_Low, BAUdev\_Medium and BAUdev\_High. Their top-down targets are given in Table 5, while the modelled results are given in Table 6 and Figure 3.

*Table 5 Group 3 scenarios (BAU deviation)*

Group 3 scenarios	2020	2028	2036	2044	2052
<b>BAUdev_Low</b>	-10%	-15%	-20%	-25%	-30%
<b>BAUdev_Medium</b>	-15%	-20%	-25%	-30%	-35%
<b>BAUdev_High</b>	-20%	-30%	-40%	-50%	-60%



Table 6. Total CO<sub>2</sub> Emissions under Baseline and BAU Deviation Mitigation Scenarios (kt)

Scenario	2011	2014	2017	2020	2023	2026	2029	2032	2035	2038	2041	2044	2047	2050
Baseline	9481	10311	10298	10049	10343	11774	13550	14118	11712	12286	12837	13376	13816	14166
BAUdev_Low	9453	9564	9280	5693	6193	6521	6910	7266	8033	8453	9032	9494	9929	10020
BAUdev_Medium	9453	9400	8888	5757	6143	6430	6769	7189	7953	8407	8962	9363	9339	9316
BAUdev_High	9453	9267	8576	5794	6188	6506	6869	7197	7383	7029	6858	6688	6326	5964

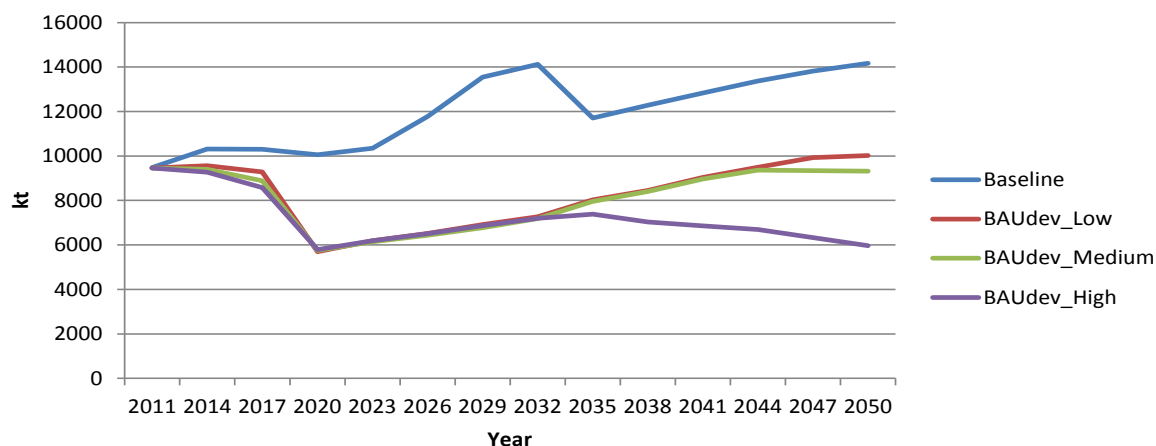


Figure 3. Total CO<sub>2</sub> Emissions under Baseline and BAU Deviation Mitigation Scenarios (kt)

		Ambition level		
		Low	Medium	High
EU	Cumulative emissions (kt)	302,613	269,871	234,929
	Cumulative total system costs (2012M€)	51,725	52,243	52,487
	Incremental specific reduction cost (€/t)	2.70	4.53	4.85
QELRC	Cumulative emissions (kt)	345,878	320,961	285,950
	Cumulative total system costs (2012M€)	51,338	51,521	52,092
	Incremental specific reduction cost (€/t)	0.99	1.86	4.17
BAUdev	Cumulative emissions (kt)	347,519	340,113	300,290
	Cumulative total system costs (2012M€)	51,550	51,809	52,945
	Incremental specific reduction costs (€/t)	2.35	3.82	8.64

Colour code:	Good	Acceptable	Poor
Cumulative emissions (kt)	<300,000	300,000 - 325,000	>325,000
Cumulative total system costs (2012M€)	<51,600	51,600 - 52,000	>52,000
Incremental Specific reduction costs (€/t)	<2.00	2.00 -4.00	>4.00

Figure 4. Comparative Assessment of the Mitigation Scenarios

Figure 4 summarizes the results of TNC, giving total emissions, as well as total system costs and incremental specific reduction costs (increment of the assumed carbon price) for different groups of scenarios and ambition level. It finds a medium ambition level for a QELRC type of scenario as the best from the cost-benefit point of view (one yellow and two green scores). Thereby, the medium ambition level for a QELRC type of scenario for period 2021-2028 covers a range of targets between

+10% and -10% relative to 1990 level and, for each subsequent 8-year budget period, the targets are reduced for 10 percentage points (see Table 3).

### ***3. Bottom-Up Approach of First Biennial Update Report***

The climate change mitigation analysis in FBUR is a continuation of the analysis carried out in the TNC. Taking into consideration the changes that happened in the interim period, first the baseline scenario was revised which reflects development without implementing mitigation measures, the so called **scenario without measures** (WOM scenario). Further on, using **bottom-up approach** and starting from specific mitigation measures in buildings, transport and energy supply sectors, each measure has been modelled individually and its mitigation potential (achievable emissions reduction) and the specific reduction cost have been calculated.

The measures that have relatively high degree of certainty for implementation (those which have already been started/planned for near future, which are priority projects/policies in the sectoral strategic and planning documents or which are result of laws that have already been adopted or shall be adopted in future) are the so-called existing measures which are an integral part of the first mitigation **scenario with existing measures** (WEM). A **scenario with additional measures** (WAM) was created for the purpose of prioritizing the further mitigation actions and measures and analyzing higher levels of ambition.

The WOM was developed in line with the baseline scenario from the Energy Development Strategy 2015-2035. Taking this into consideration, this scenario contains **specific assumptions on the energy supply side**:

- Use of domestic resources:
  - No new large hydro power plants will be built because the investors are not interested and/or there is a resistance of some organizations and the local population.
  - The capacity of the power plants with feed-in tariffs is limited to the capacity for which at least a decision for temporary preferential producer is issued by the Energy Regulatory Commission of the Republic of Macedonia. This capacity is 65.4 MW for small hydro power plants, 50 MW for wind power plants, 18 MW for solar power plants and 7 MW for biogas power plants.
- Supply technologies:
  - After revitalization, the Thermal Power Plant (TPP) Oslomej is planned to work on imported high-quality coal.
  - A nuclear power plant shall not be built in the analyzed period.
- Energy imports:
  - An interconnection to a new gas pipe line is not considered (taking into account the current situation in the region), which means that there is only the capacity of the existing gas pipe line available.
  - The price of imported electricity is the price at the electricity market and in the following three years it is projected to be about 50 €/MWh, while in the period after

it is projected to increase to 90 €/MWh, which gives this model a regional component.

**On the demand side it is assumed** that all the new technologies shall have the same efficiency as the existing ones, but there is a possibility for the model to switch from one technology, using one type of fuel to another with a different type of fuel.

In the **scenario with existing measures**, following measures were included:

1. Labeling of appliances
2. Public awareness campaigns and energy efficiency info centers
3. Rulebook on energy performance of buildings
4. Increased use of railway
5. Increased use of bicycles, walking and introduction of parking policy
6. Renewal of vehicle fleet
7. Distribution losses reduction
8. Electricity import (market)
9. Increased utilization of renewable energy sources
10. Biofuels – delay until 2025
11. Higher penetration of solar collectors

*Table 7. Summary CO<sub>2</sub> emission results in 2020, 2030 and cumulatively by 2020 and 2030 in WOM, WEM and WAM scenarios*

	WOM	WEM	WAM
CO <sub>2</sub> emissions in 2020 (kt)	11,561	9,269	8,694
CO <sub>2</sub> emissions in 2030 (kt)	17,891	12,124	11,214
Cumulative CO <sub>2</sub> emissions by 2020 (kt)	90,033	80,007	79,348
Cumulative CO <sub>2</sub> emissions by 2030 (kt)	212,634	173,301	165,032
Reduction compared to WOM (CO <sub>2</sub> emissions in 2020)		20%	25%
Reduction compared to WOM (CO <sub>2</sub> emissions in 2030)		32%	37%
Reduction compared to WOM (cumulative CO <sub>2</sub> emissions by 2020)		11%	12%
Reduction compared to WOM (cumulative CO <sub>2</sub> emissions by 2030)		18%	22%

The **scenario with additional measures** includes all the measures from WEM scenario, 3 improved WEM measures, and 3 additional measures:

#### **Improved WEM measures**

1. Improving vehicles efficiency, tax exemption for hybrid and electrical vehicles
2. Introduction of a CO<sub>2</sub> tax and electricity import (market)
3. 10% Biofuels

#### **Additional measures**

4. Phasing out of incandescent lights
5. Phasing out of resistive heating devices

## 6. Railway extension to Bulgaria

The results are summarized in Table 7 and figure 5, for all three scenarios, WOM, WEM and WAM, and for years 2020 and 2030. The reduction of emissions up to 2020 may be interpreted as results of domestic action taken to enhance mitigation ambition in the pre-2020 period, which may be useful when preparing “Intended nationally determined contribution”.

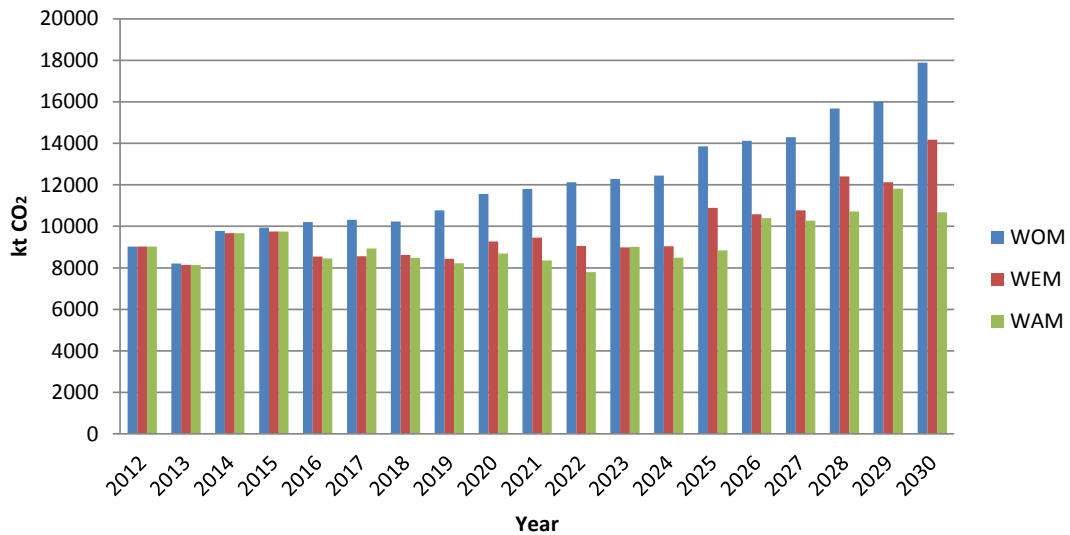


Figure 5. Comparison of GHG emissions in the WOM, WEM and WAM scenarios

#### 4. Comparison between Scenarios

When preparing the position for UNFCCC COP 21, the government will make their pledge based on one of the top-down scenarios, as presented in TNC. In order to assess the cost of the pledge it will have to use the results of bottom-up scenarios in FBUR. Closest matching between FBUR type scenarios and TNC type scenarios is given in Table 8. The costs are not comparable, since TNC uses top-down approach, and will result in different measures than FBUR, which uses bottom-up approach.

Scenario with existing measures when converted to QELRC consistent pledge, based on budget period 2021-2028, corresponds to 7% increase of emissions, compared to 1990 emissions levels, while scenario with additional measures corresponds to -2% emission change. That means that with already existing measures the government can make MediumLow pledge of QELRC of +7%, without need for any additional measures and actions. Considering actions recognised as additional, it can make Medium QELRC of -2%. These two are realistic scenarios, in case that government wants to make developed countries like pledge.

In case the government prefers to make type of pledge more typical for developing countries, than would go for deviation of business as usual (DEV BAU) type of pledge. Since BAU scenarios can be considered to be one without measures, the difference between WEM and WOM, as well as WAM and WOM will make DEV BAU of respectively -20% and -25% change in 2020, and -32% and -37% change in 2030. The exact matching with TNC type scenario is BAUdev\_High, which would pledge -20% change for 2020 and -32% change for 2030. There is no more ambitious BAUdev type of scenario in TNC consistent with WAM scenario, but it can easily be offered, with -25% pledge for 2020 and -35% pledge for 2030.

*Table 8. Comparison of TNC top down and FBUR bottom-up scenarios.*

	WOM (BAU)	WEM	WAM
CO2 emissions in 1990 (kt)	9,469		
FBUR: 2020 Emissions (kt)	11,561	9,269	8,694
FBUR: 2030 Emissions (kt)	17,891	12,124	11,214
FBUR: Cumulative Emissions 2021-2028 (kt)	106,609	81,170	73,872
FBUR: Average Emissions 2021-2028 (kt)	13,326	10,146	9,234
FBUR: 2020/1990 Emissions		-2%	-8%
FBUR: 2030/1990 Emissions		28%	18%
FBUR: QERLC 2021-2028		7%	-2%
TNC: QERLC 2021-2028		+10% MediumLow	0% Medium
FBUR: DEV BAU 2020		-20%	-25%
TNC: DEV BAU 2020		-20% BAUdev_High	-20% BAUdev_High
FBUR: DEV BAU 2030		-32%	-37%
TNC: DEV BAU 2030		-32% BAUdev_High	-32% BAUdev_High

The difference between QELRC and DEV BAU type of pledges may be quite significant for fast developing countries starting from low emission level, but will not make much real difference in the Republic of Macedonia. Meanwhile, the nominal pledge number may look more attractive in DEV BAU type of pledges.

## 5. Policy recommendations

As the UNFCCC COP 21 approaches, Republic of Macedonia will be expected to deliver a pledge for post 2020 greenhouse gas (GHG) emissions target. There are two possible types of pledges expected from the government, based on its Third National Communication, one consistent with Quantified Emissions Reduction or Limitation Targets (QELRC) type promising to reduce average yearly GHG emissions over the budget period (probably 2021-2028), from the certified emissions base year (1990, or some other), the other being deviation from business as usual (BAU) promising to reduce emissions from expected BAU emissions. Choosing between the two sets is more political than substantial, QELRC type of pledge being pertaining to developed countries and DEV BAU type of pledge pertaining to developing countries. The government should choose based on where it wants to be perceived. Also, DEV BAU type of pledge will psychologically deliver more agreeable numbers.

There is also a question of the level of ambition that the Government of the Republic of Macedonia wants to show on the way to COP 21. If it wants to be consistent with already existing policies and measures, and thus show only ambition not to retract on already implemented policies, it could either pledge MediumLow QELRC of 7% change for GHG emissions for budget period 2021-2028 from 1990, or it could offer -32% deviation from BAU in 2030, consistent with BAUdev\_High scenario from TNC. The -20% DEV BAU in 2020 is already consistent with existing measures.

If the Government wants to show more ambition, consistent with additional measures, it could either pledge Medium QELRC of -2% change for GHG emissions for budget period 2021-2028 from 1990, or it could offer -35% deviation from BAU in 2030. Implementing additional measures prior to 2020 would mean DEV BAU of -25% in 2020.

The available options and necessary decision to be made are summarized in Figure 6. The Government has to decide to be more or less ambitious, which may depend on its negotiating platform, and to pledge a QELRC or DEV BAU type of contribution.

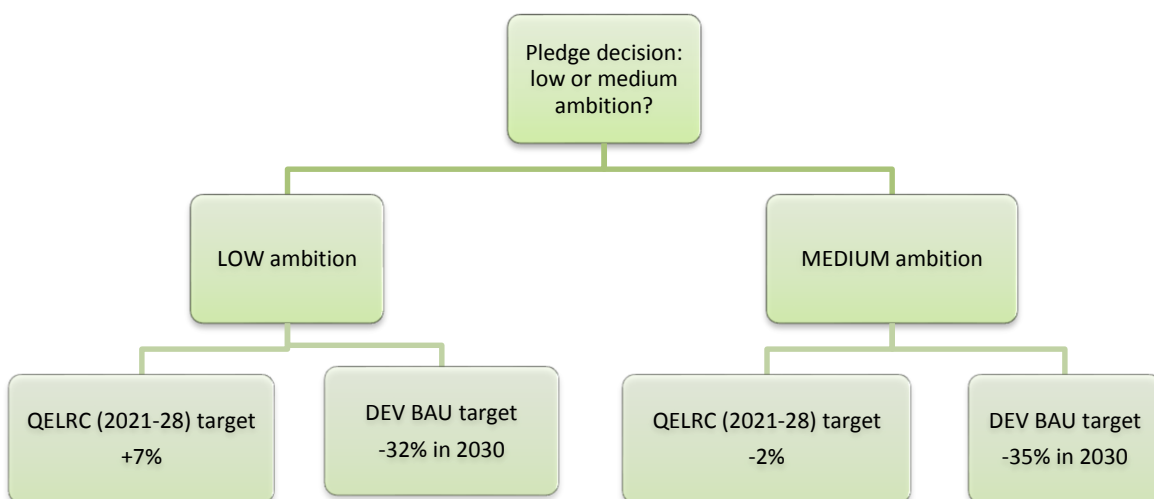


Figure 6. Options and decisions to be made



Based on all the analyses conducted so far, the following can be recommended as the **first indicative pledge of the Republic of Macedonia**:

#### **DEVELOPING COUNTRY LIKE TYPE OF PLEDGE**

**LOW AMBITION:** 20% deviation of BAU in 2020 and 30% deviation of BAU in 2030, achievable with WEM measures

**MEDIUM AMBITION:** 25% deviation of BAU in 2020 and 35% deviation of BAU in 2030 achievable with WAM measures

#### **DEVELOPED COUNTRY LIKE TYPE OF PLEDGE**

**LOW AMBITION:** 7% change for GHG emissions for budget period 2021-2028 compared to 1990 level

**MEDIUM AMBITION:** -2% change for GHG emissions for budget period 2021-2028 compared to 1990 level

However, **the process of determination of national contributions should be continued in an intensive dialog with the relevant policy makers and other stakeholders, using the existing technical and analytical capacity.** Specifically,

- The three sectors covered by FBUR, buildings, transport and energy supply, should be revisited, to confirm/revise measures in WEM and especially in WAM scenarios;
- The analysis should be extended to other sectors, as waste, agriculture and industry;
- Sensitivity analyses concerning the base year should be conducted (having in view relevant UN and EU processes) and most adequate base year should be agreed upon;
- Peaking year should be determined for WEM and WAM scenarios (following the suit of the recent indicative pledge of China);
- Given the EU candidate status, Macedonian mitigation contribution should be analysed in the context of EU 2030 climate and energy package;
- The model should be refined so that ETS and non-ETS sectors may be modelled separately, having in mind different measures applied in them. ETS sector will be mainly governed by the price of emission certificates, while the non-ETS sector will continue to be governed by the national policies and measures;