

MONTENEGRO

ECRAN modelling training

Module 3

task 1 and 2



KEY ASSUMPTIONS

- GDP MER: growth 3.7% : in 2030 will be 5.151 bill \$ and in 2050 10.652 bill \$
- Population: growth 0.3% : in 2030 will be 651.7 thousand inhabitants and in 2050 691.9.

Task 1

Historical data were inserted for:

- Electricity Generation Sector
- Industry Sector
 - Iron and steel
 - Non Ferrous metals
- Cost of fuel and technologies

Task2

Reference / HAM scenario

	Hist. total energy	Fuel share	End year value Reference scenario	End year value HAM
residential	Growth 1%	Electricity	2030, 41%	2030, 38%, 2050, 30%
		Residential fuel oil	2030, 0%	2030, 0%
		Diesel	2030, 0.5%	2030, 0.5%
		Coal lignite	2030, 0%	2030, 0%
		LPG	2030, 0.3%	2030, 0.3%
		Solar photovoltaics	2030, 0.5, 2050, 2%	2030, 2, 2050, 5%
		Solar thermal	2030, 0.5, 2050, 2%	2030, 2, 2050, 10%
		biomass	remainder	remainder

Agricultural and fishing	Growth 5%	electricity	Growth 21%	Growth 21%
		diesel	remainder	remainder
		biodiesel	2050, 30%	2050, 50%
services	Growth 3,5%	Electricity	remainder	remainder
		Coal lignite	2030, 0%	2030, 0%
		LPG	2030, 5%	2030, 5%
		Other oil	2030, 0%	2030, 0%
		biomass	2050, 20%	2050, 20%
		Solar photovoltaics	2030, 2, 2050, 5%	2030, 5, 2050, 10%
		Solar thermal	2030, 2, 2050, 5%	2030, 5, 2050, 10%

Aluminum and steel industry are very important and their share in total energy consumption is very high. Aluminum plant in previous period consumed more than 40% of total electricity in Montenegro but now days it is lower. By 2020 it will more than double.

industry	
• Iron and steel	Growth 3%
• Non ferrous metals	Step(2014, 83.2, 2020, 200)

transport				
• Road	Growth (2.5%)	Diesel	Remainder	Remainder
		Motor gasoline	2050, 20%	2050, 15%
		Other oil	2030, 0%	2050, 0%
		Biodiesel	2030, 30%	2050, 30%
		CNG	2030, 30%	2050, 30%
		electricity	2050, 10%	2050, 20%
• rail	Growth (2.5%)	Electricity	2030, 100%	2030, 100%
		Diesel	2030, 0%	2030, 0%

Transformation

	Reference scenario	HAM scenario
transformation		
• losses	Interp(2014, 19.5, 2030, 8, 2050, 7)	Interp(2014, 19.5, 2030, 8, 2050, 5)
Elec.generation		
• TPP Pljevlja	Step(2018,100,2024,0) MW	Step(2018,100,2024,0) MW
• Hydro small	Step(2012, 8.7, 2015, 33.6, 2016, 36.6, 2017, 38.6, 2018, 80.6, 2019, 87.6, 2025,120.9) MW	Step(2012, 8.7, 2015, 33.6, 2016, 36.6, 2017, 38.6, 2018, 80.6, 2019, 87.6, 2025,120.9) MW
• Wind	118 MW	189.7 MW
• New hydro	406 MW	406 MW
• TPP Pljevlja II block	220 MW	-
• biomass	-	29.3 MW
• solar thermal	-	31.5 MW

Results

In 2011, emission was 2513 thousand metric ton CO₂ eq, 40% of reduction is 1508, and with HAM scenario we have lower result in 2030, but for reference scenario is higher.

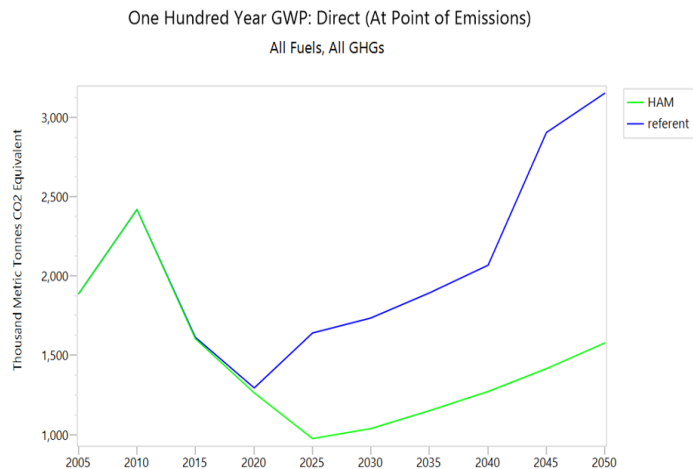
One Hundred Year GWP: Direct (At Point of Emissions)

All Fuels, All GHGs

Branch: new monte 3

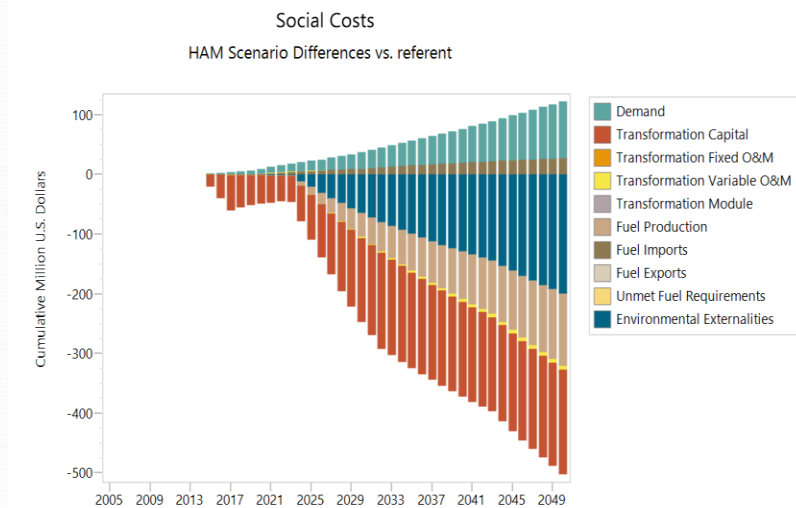
Units: Thousand Metric Tonnes CO₂ Equivalent

Scenarios	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
HAM	1,887.4	2,419.9	1,605.2	1,262.9	974.6	1,040.2	1,150.9	1,274.9	1,416.4	1,578.1
referent	1,887.4	2,419.9	1,612.3	1,293.7	1,641.2	1,735.8	1,892.1	2,069.2	2,907.0	3,153.9



HAM scenario is more expensive than reference in terms of demand-side costs and in terms of imported fuel costs but there are savings in transformation cost, fuel production and environmental externalities.

Social Costs										
HAM Scenario Differences vs. referent										
Branch: new monte 3										
Units: Discounted 2005 Cumulative Million U.S. Dollars. Discounted to Year: 2005.										
Cost Categories	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Demand	-	-	0.9	6.9	15.3	26.3	39.7	55.6	74.0	94.6
Transformation Capital	-	-	-20.2	-46.4	-73.4	-139.0	-158.4	-157.2	-162.0	-174.0
Transformation Fixed O&M	-	-	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1
Transformation Variable O&M	-	-	-0.1	0.3	0.4	-1.7	-3.2	-4.5	-5.6	-6.8
Transformation Module	-	-	-	-	-	-	-	-	-	-
Fuel Production	-	-	-0.1	-1.2	-14.2	-40.2	-61.7	-79.8	-99.1	-121.4
Fuel Imports	-	-	0.0	1.3	5.9	9.8	15.3	19.7	23.6	27.2
Fuel Exports	-	-	-	-	-	-	-	-	-	-
Unmet Fuel Requirements	-	-	-	-	-	-	-	-	-	-
Environmental Externalities	-	-	-0.2	-1.5	-22.0	-65.6	-100.6	-130.2	-162.4	-200.0



HAM scenario is cheaper than the reference because the NPV has negative value.

Cumulative Costs & Benefits: 2005-2050. Relative to Scenario: referent. Discounted at 5.0% to year 2005. Units: Million 2005 U.S. Dollar	
	HAM
Demand	94.61
Residential	-
Agriculture and Fishing	94.61
Services	-
Industry	-
Transport	-
Transformation	-180.94
Distribution_Losses	-
Own Use	-
Electric Generation	-180.94
Resources	-94.21
Production	-121.37
Imports	27.16
Exports	-
Unmet Requirements	-
Environmental Externalities	-200.02
Non Energy Sector Costs	-
Net Present Value	-380.56
GHG Savings (Mill Tonnes CO ₂ e)	25.58
Cost of Avoiding GHGs (U.S. Dollar/Tonne CO ₂ e)	-14.88

Thank you for your attention

Montenegrin LEAP Team

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