Transiting to a low-carbon economy in Mexico: an application of ThreeME model

A. **Mexican version of the model**

B. **Simulation results**

C. **Conclusion**

A. Mexican version of the model:
A neo-Keynesian CGE model

The disaggregation was based on the energy intensity of sectors and on their contribution in term of CO_2 emissions

| N°	Sectors	Emission %	N°	Sectors	Emission %
1	Agriculture, livestock and fishing	3.0%	17	Transport via pipeline	0%
2	Forestry	0.0%	18	others transports	0.8%
3	Mining	0.1%	19	Business services	1.1%
4	Manufacture of food, beverages and snuff	0.9%	20	Public services	0.5%
5	Manufacture of articles of paper and paperboard	0.9%	21	Extraction of oil	0.4%
6	Manufacture of chemical	2.1%	22	Manufacture of refined petroleum products	16.7%
7	Manufacture of cement and concrete	3.8%	23	Manufacture and distribution of gas	1.7%
8	Manufacture of steel	3.0%	24	Hydraulic	0%
9	Manufacture of motor vehicles and truck	0.0%	25	Geothermal	0%
10	Others industries	8.1%	26	Wind	0%
11	Construction of buildings	0.2%	27	Solar	0%
12	Air transport	2.0%	28	Biomass	0%
13	Rail transport	0.7%	29	Nuclear	0%
14	Water transport	1.1%	30	Coal-based	11.0%
15	Freight transport by road	14.6%	31	Oil-based	9.1%
16	Passager transport by road	1.2%	32	Gas-based	16.8%

- **Electricity sector is divided into 9 technologies**
  - ☐ Hydro, geothermal, wind, solar, biomass, nuclear, coal-based, oil-based and gas-based.
  - ☐ The evolution of each technology is determined exogenously
- **The demand for fossil fuel is detailed by type of economic agent (producers and households) and by type of fossil energy (Oil-Coal and Gas).**
- **Energy efficiency is endogenous since it depend on energy prices.**
  - ☐ The elasticity between capital and energy depend on their relative prices
- **The model allow to examine the macroeconomic rebound effect**
  - ☐ Reduction of expected energy saving due to an increase in energy demand

Energy Mix for electricity production 2050
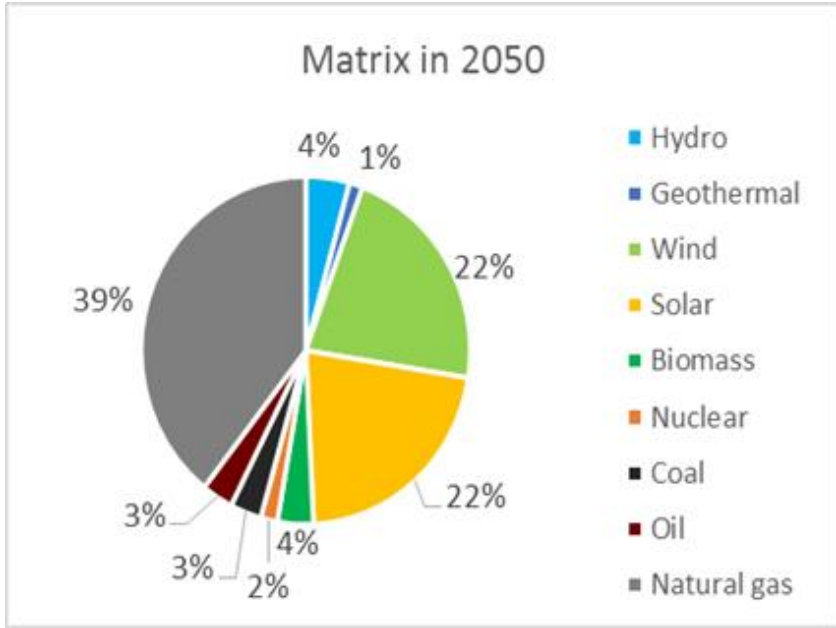
Electricity mix:

- ☐ 2008 - 2050: POLES forecast. Important penetration of Renewable since 2030. 50% clean energy in 2050.
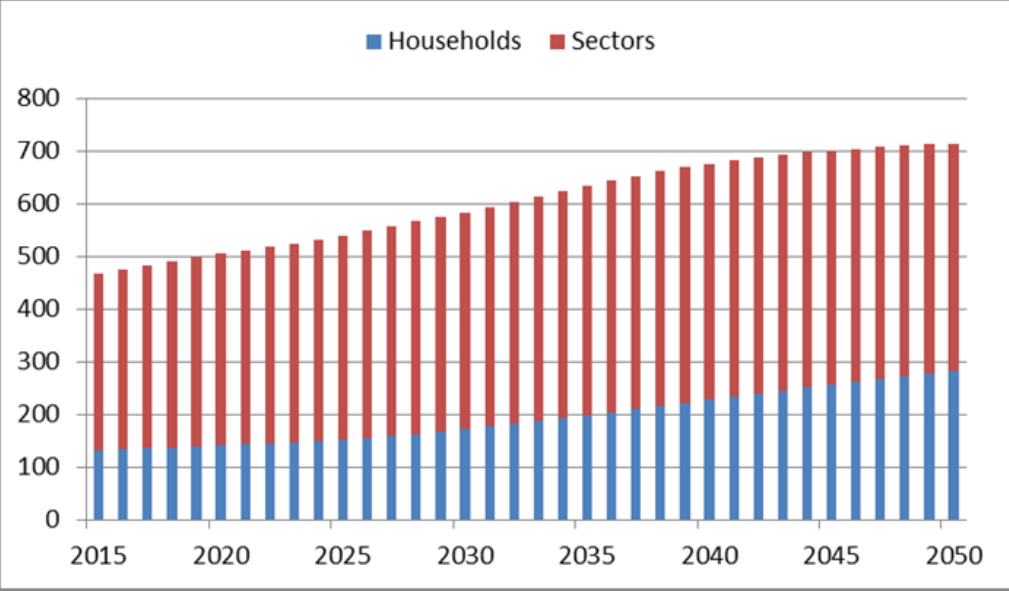
Energy efficiency :

- ☐ Trajectory trend of 1% on average per year for all sectors and 0.5% for households.

CO2 emissions from energy consumption (in MTCO2)

GDP growth:

- ☐ 2015 -2050: 3% on average per year (forecast from cook method: project firm)

International energy price from EIA

Alternative Scenarios simulated:

POLICIES

PSUB: Elimination of energy subsidy

PCO2TAX: Implementation of carbon tax

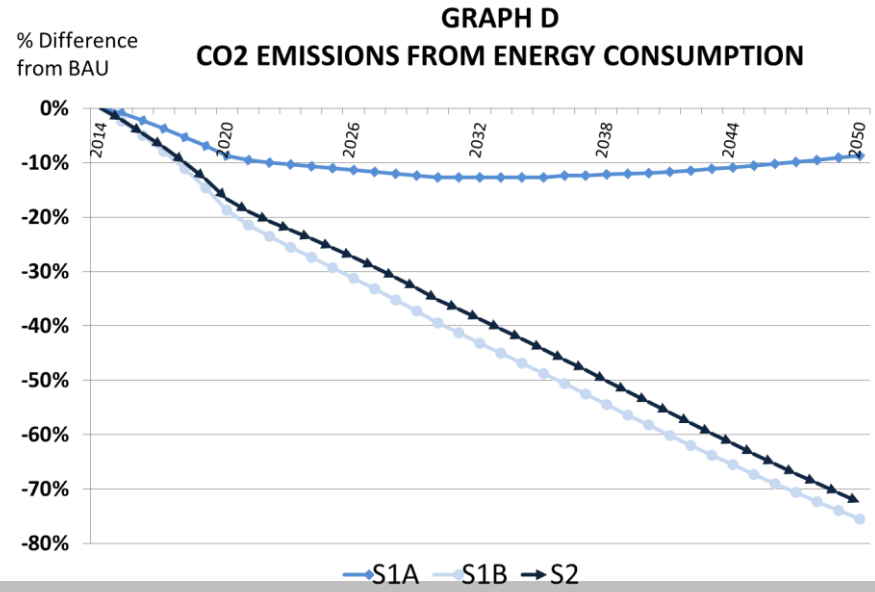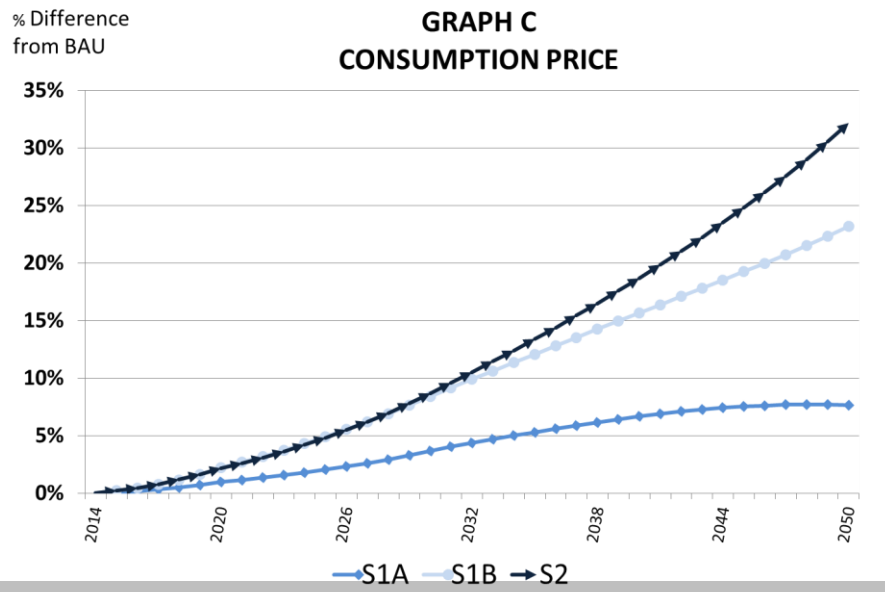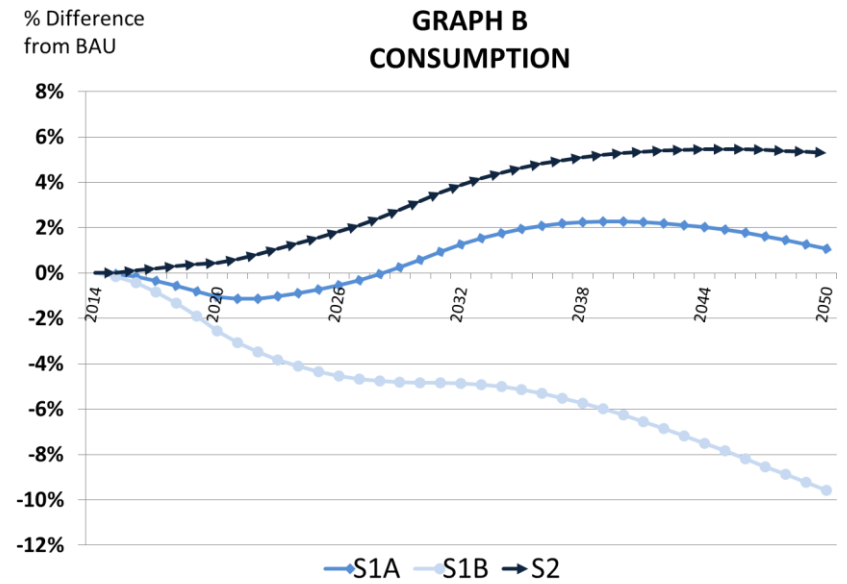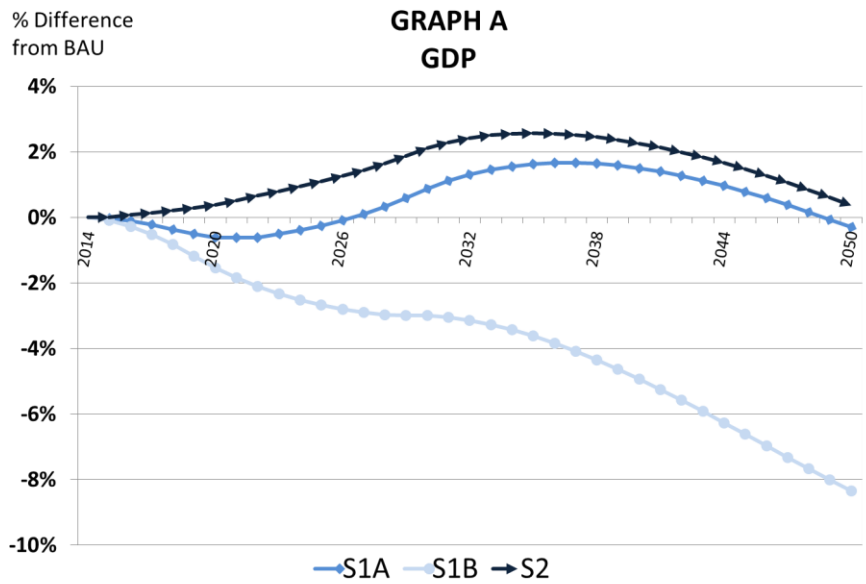**PREDIS:** Redistribution of the total revenue from carbon tax and subsidies

TARGET

TCO2: Emission target

TMIX-RENEW: renewable intensive. 82% of clean energy in 2050.

TMIX-FOSSIL: Fossil intensive. 74% of natural gas in 2050.

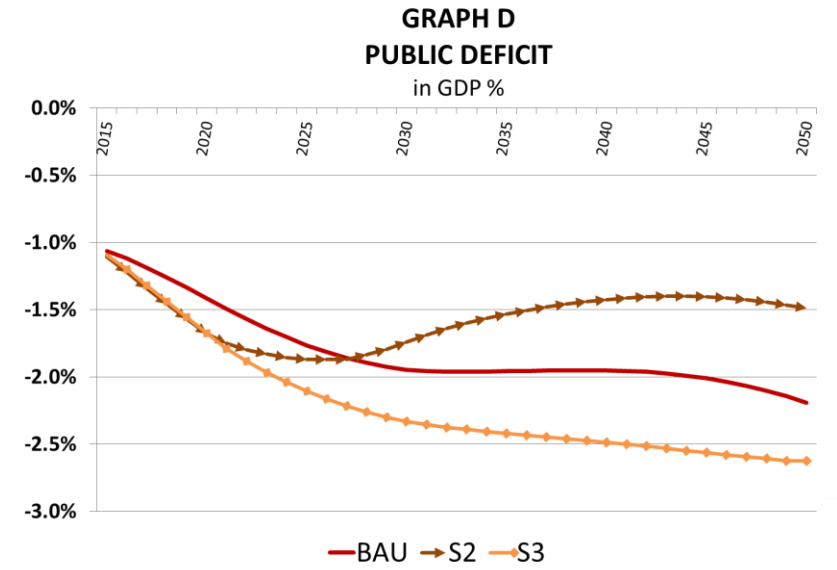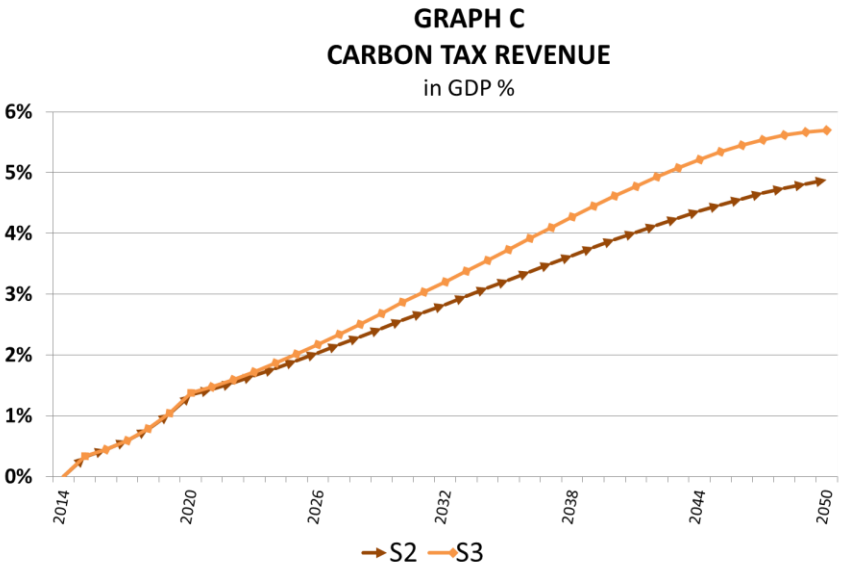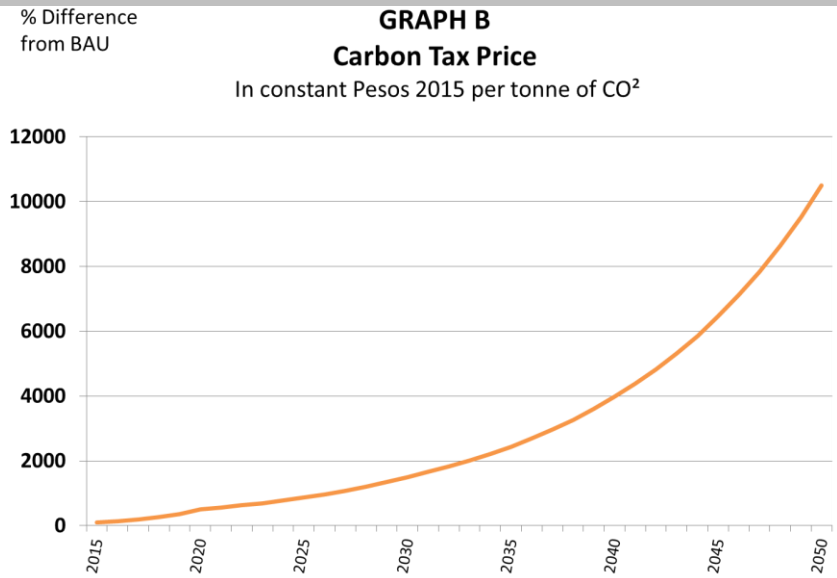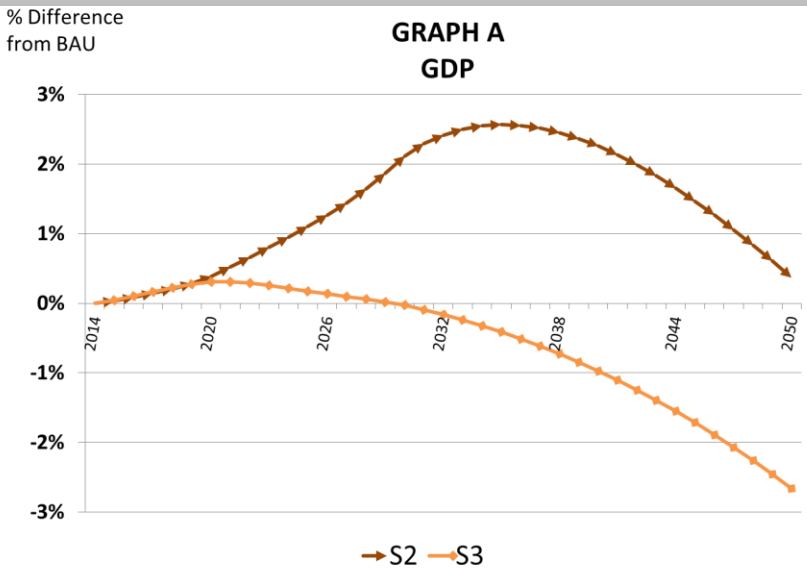|	Scenario	Policies	Target mix	Target CO2
S1	**Fiscal policy <u>without</u> redistribution**			
	• **S1A**. Phasing out of energy subsidies	PSUB	**TMIX-RENEW**	
	• **S1B.** Phasing out of energy subsidies and implementation of a carbon tax	PSUB **+ PCO2TAX**	**TMIX-RENEW**	**TCO2**
S2	**Fiscal policy <u>with</u> redistribution** • Phasing out of energy subsidies and implementation of a carbon tax	PSUB + PCO2TAX (S1) **+ PREDIS**	**TMIX-RENEW**	
S3	**Changing the electricity mix (& fiscal pol. <u>with</u> redis.)** • Fossil intensive electricity mix	PSUB + PCO2TAX (S1) **+ PREDIS**	**TMIX-FOSSIL**	

GRAPH A — GDP (% Difference from BAU): scenarios S1A, S1B, S2

GRAPH B — CONSUMPTION (% Difference from BAU): scenarios S1A, S1B, S2

GRAPH C — CONSUMPTION PRICE (% Difference from BAU): scenarios S1A, S1B, S2

GRAPH D — CO2 EMISSIONS FROM ENERGY CONSUMPTION (% Difference from BAU): scenarios S1A, S1B, S2

GRAPH A — GDP (% Difference from BAU)

GRAPH B — Carbon Tax Price (In constant Pesos 2015 per tonne of CO_2)

GRAPH C — CARBON TAX REVENUE (in GDP %)

GRAPH D — PUBLIC DEFICIT (in GDP %)

Sectorial Results

- Employment is higher in S2 with more reduction of CO2 emissions
- Almost all sectors benefits from the measures, particularly those labours intensive like services, industry and electric power (S2)
- The electric power sector with high level of renewable (S2) is more labour-intensive than fossil fuel sectors.

GRAPH A — AVERAGE CREATION OR LOSS EMPLOYMENT PER YEAR, In thousand, Period 2015-2050

GRAPH B — CO2 EMISSION FROM ENERGY CONSUMPTION IN 2050, % Difference from BAU
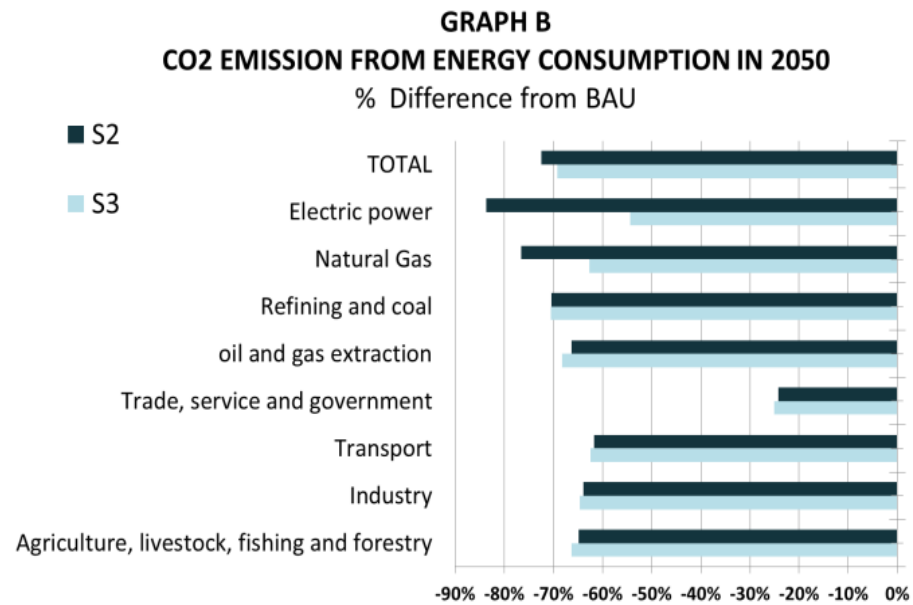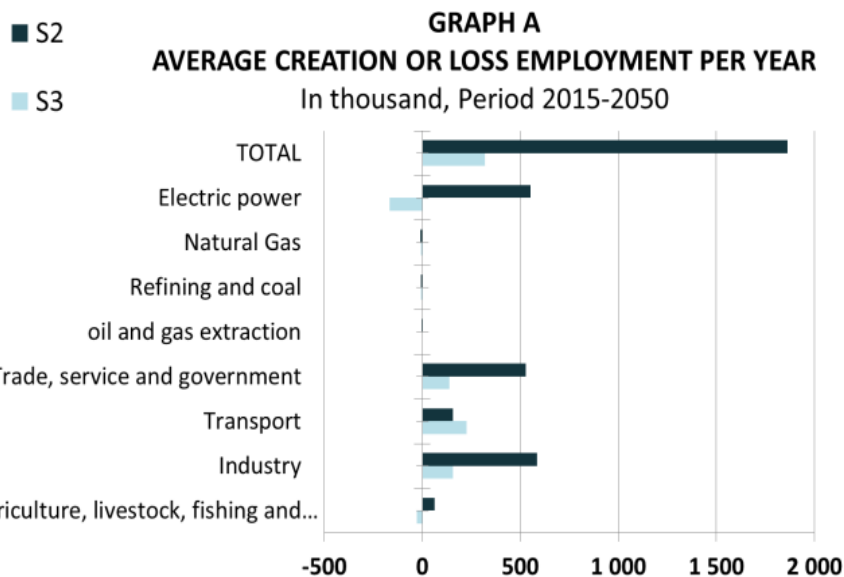
- Positive economic effect of energy transition policies depend on the way the policy is implemented

- Results are also dependant on a number of uncertain assumptions (elasticity levels, technical progress)

- The results support the notion that promoting a carbon tax is compatible with both environmental and economic gain, without necessarily giving up on the potential of the tax in term of reduction of CO_2 emissions (a limited rebound effect)
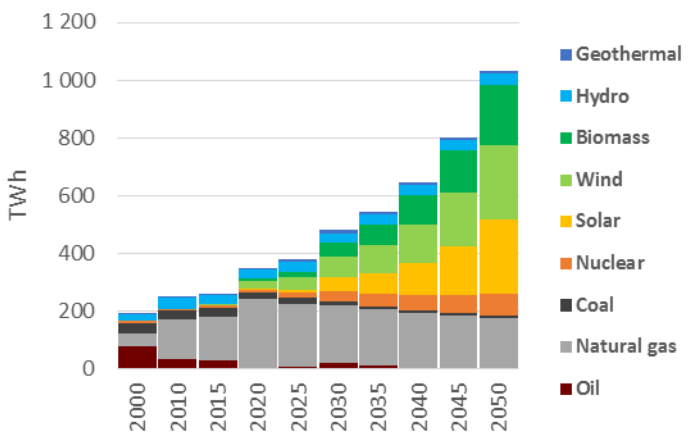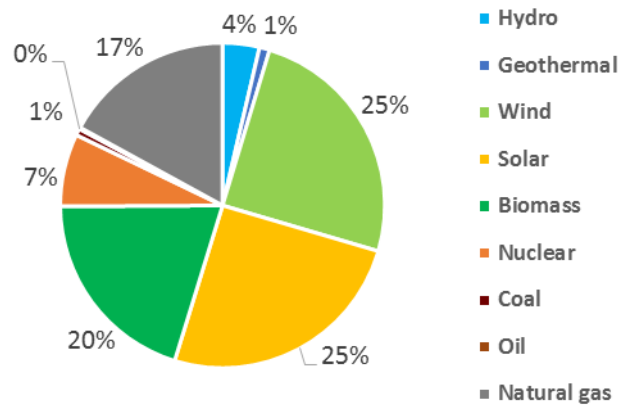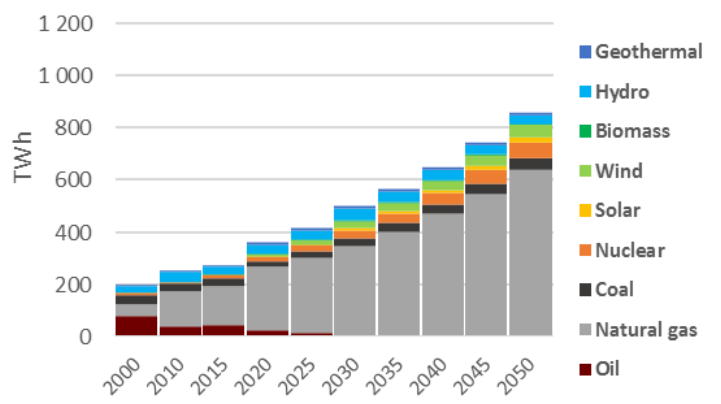
APPENDIX

TMIX-RENEW

Power generation

Matrix in 2050

TMIX-GAS

Power generation

Matrix in 2050