



The removal of fossil fuel subsidies in Italy and interactions with the 2030 EU climate and energy framework

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Gtap23 Conference, 18/06/2020

Motivation

- The European Union (EU) has fixed precise targets to reduce its greenhouse gas (GHG) emissions by 40% in 2030 and by 80% in 2050
- To achieve these targets, the EU outlined two differentiated strategy:
 1. an emissions trading system (ETS) on large-scale emitters, industry and power sectors;
 2. abatement of emissions subject to country specific regulation in the remaining «non-ETS» sectors (e.g. industry, transportation and agriculture).

Therefore, the current EU carbon market represents a second-best solution (Böhringer et al., 2006; Böhringer et al., 2016).

Motivation

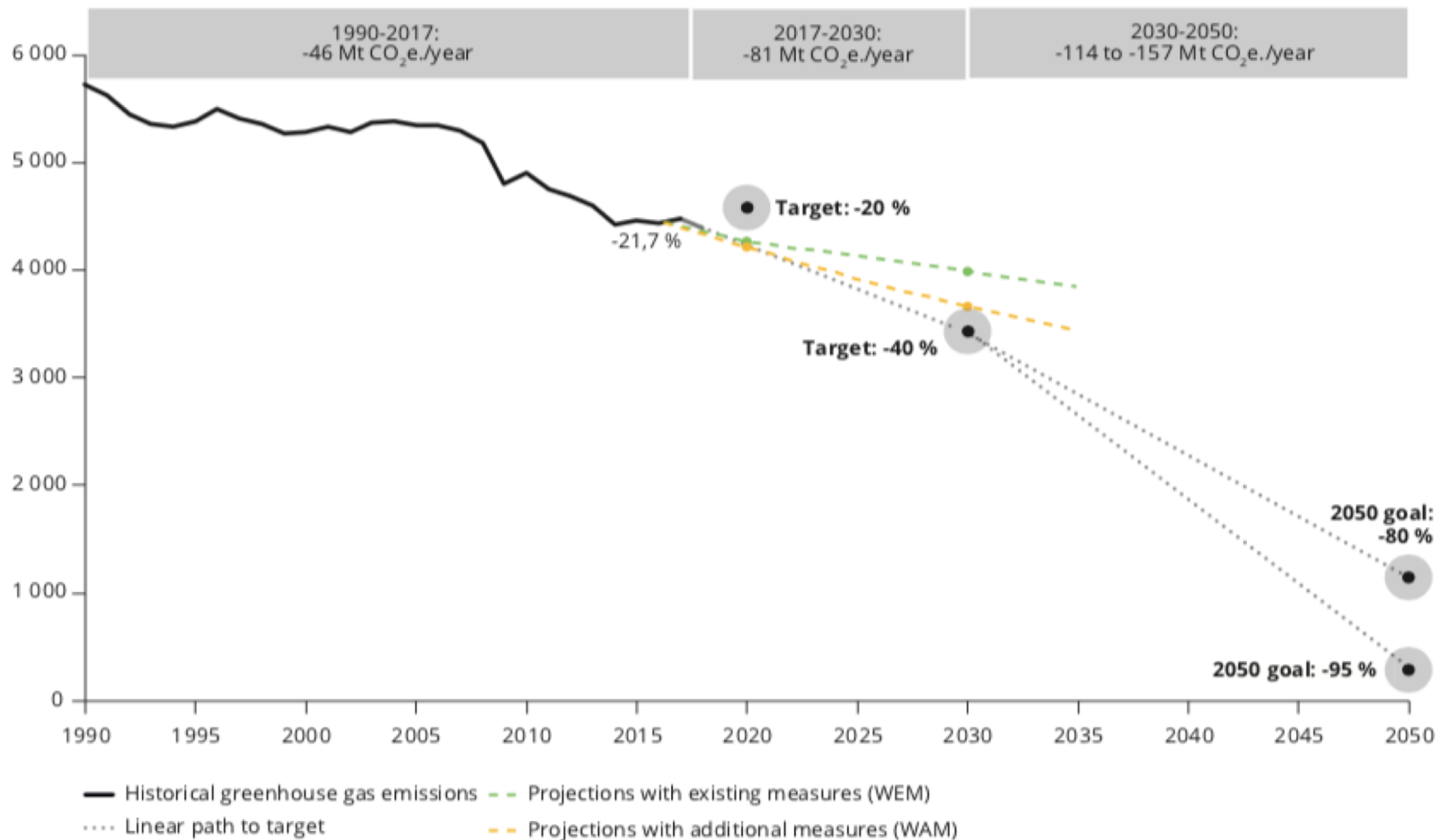
The aim of this work is to analyze the EU burden-sharing rule and evaluate MS welfare impacts for the EU 2030 targets and compare them with those occurring in some possible alternative rules.

- What happens in terms of GDP loss if the European Union include all GHGs and all sectors in the emission trading system (ETS)?
- How, a multi-gas ETS might impact the sectoral composition of output?
- Fossil fuel subsidies in Italy amount to around 16 billion euro, according to the Ministry of the Environment:
 - <https://www.minambiente.it/pagina/economia-ambientale>
 - https://www.minambiente.it/sites/default/files/archivio/allegati/economia_ambientale/italy_g20_self_report_ffs.pdf

Motivation

Figure 2.1 Greenhouse gas emission trends, projections and targets in the EU, 1990-2050

Million tonnes of CO₂ equivalent (Mt CO₂e)



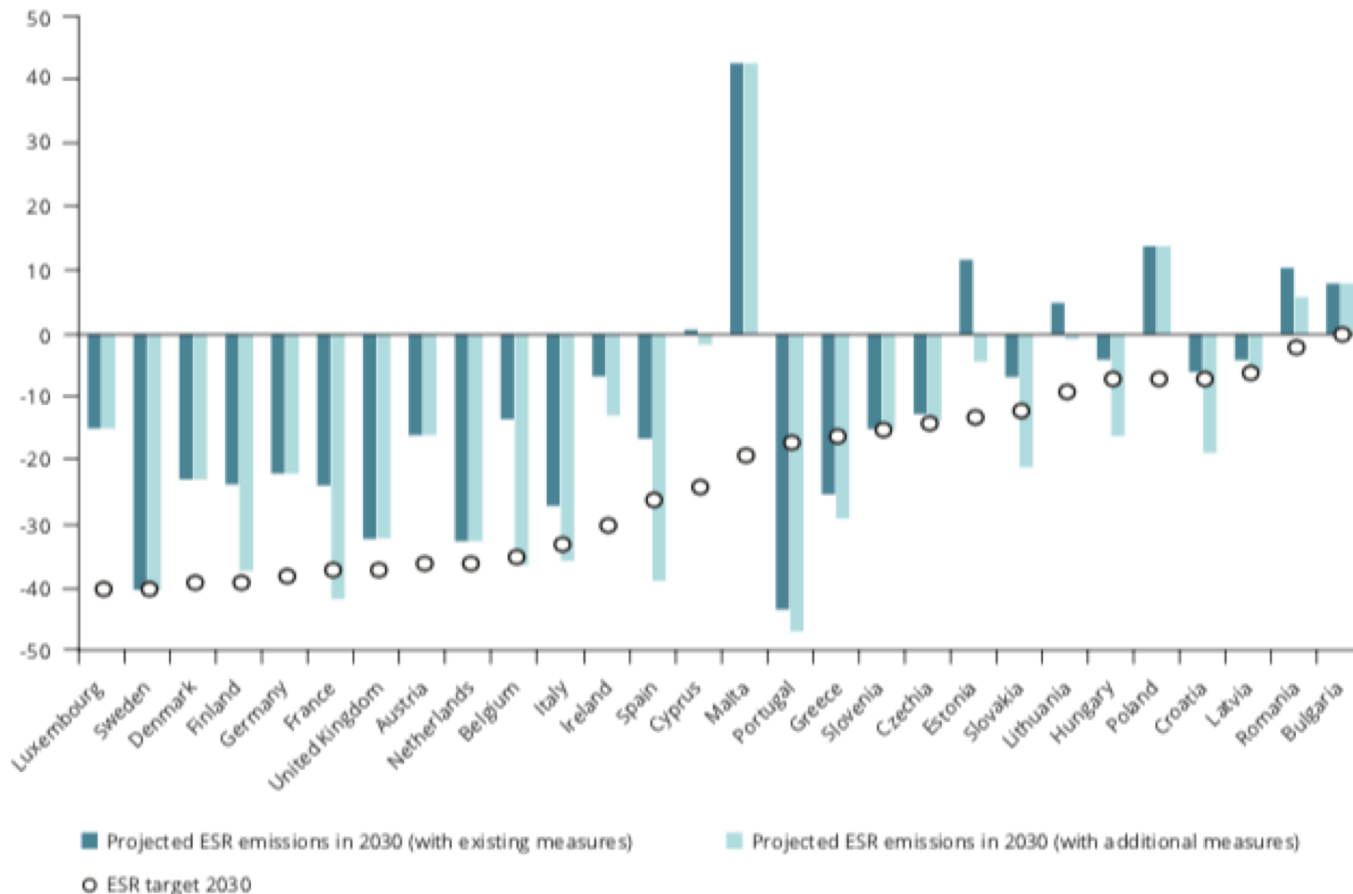
Notes: The calculations of GHG emission trends, projections and targets include emissions from international aviation and exclude emissions and removals from the LULUCF sector (to avoid the complexity of accounting). The 'with existing measures' scenario reflects existing policies and measures, whereas the 'with additional measures' scenario considers the additional effects of planned measures reported by Member States.

Sources: EEA (2019b, 2019e, 2019f); EEA (forthcoming) (2019b).

Motivation

Figure 2.8 Projected progress of Member States towards their 2030 Effort Sharing targets

Percentage change compared to 2005 calculated base year emissions



Notes: 17 Member States submitted a scenario with additional measures. For the other Member States (Austria, Bulgaria, Denmark, Germany, Luxembourg, Malta, Netherlands, Poland, Slovenia, Sweden), the scenario with existing measures is shown instead. Romania did not submit a projection in 2019, so its 2017 submission is shown instead.

Sources: EU (2017a, 2013a, 2013b, 2018g); EEA (2019f). Based on Member States' submissions.

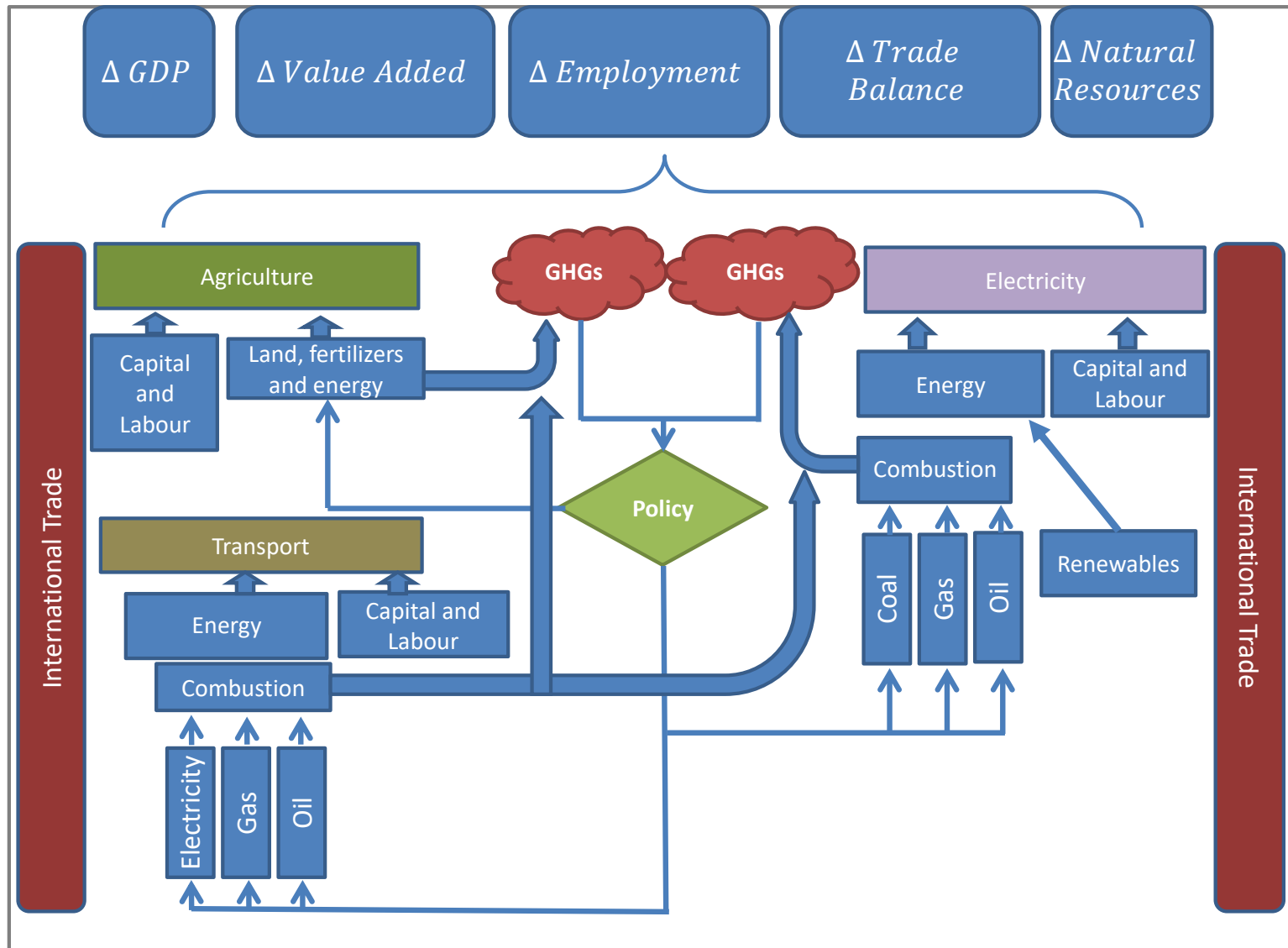
The **ERMES** (Economic Recursive-dynamic Model for Environmental Sustainability) **model**

- the capital stock is not fixed, but varies over time based on recursive dynamics;
- the latest version of the Gtap database or 9.2b was used, which for Italy and the EU updates the input-output tables
- the model's energy system has been extended in detail and considers the possibilities of replacement between 11 different types of sources, including renewable and clean energy (Peters, 2016);
- the substitution between electricity sources is based on CRESH (Constant Ratios of Elasticities of Substitution) functional form (Hanoch, 1975) with different levels of substitution for each technology (Cai and Arora, 2015);

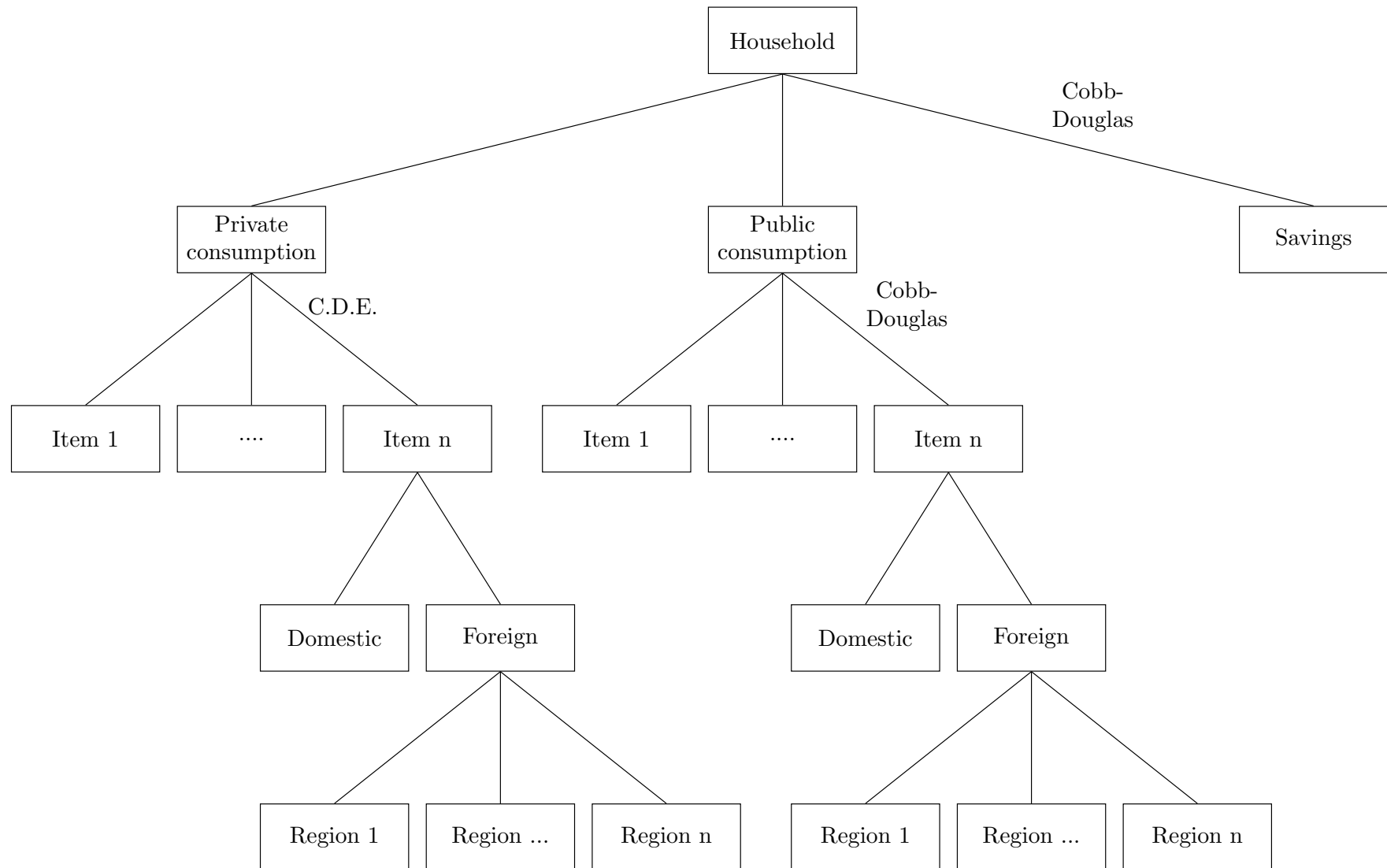
The ERMES model

- CO₂ emissions deriving from energy processes (as in Peters et al. 2015), but also those of CH₄, N₂O and FGASS deriving from agriculture, industrial processes and residential (Golub et al. 2012);
- the economic policy module allows you to impose three types of measures simultaneously on different sectors: 1) tax, 2) emissions cap, 3) a cap & trade (emissions cap with exchange of permits);
- ERMES has the flexibility to select the types of gas and the economic sectors in addition to the countries subject to the economic policy measure;
- the economic sectors have been disaggregated considering those included in the ETS system and those excluded;

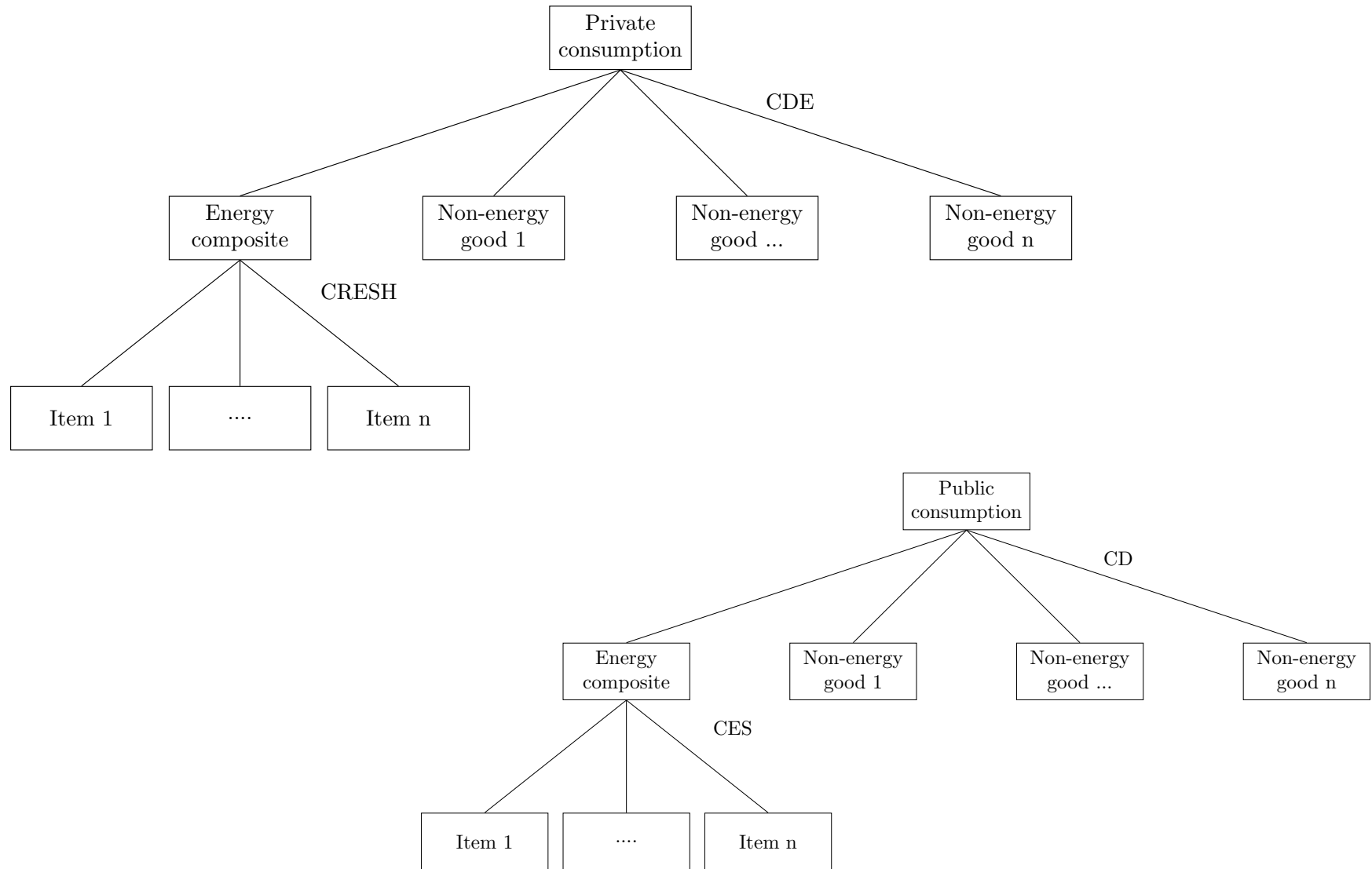
The ERMES model



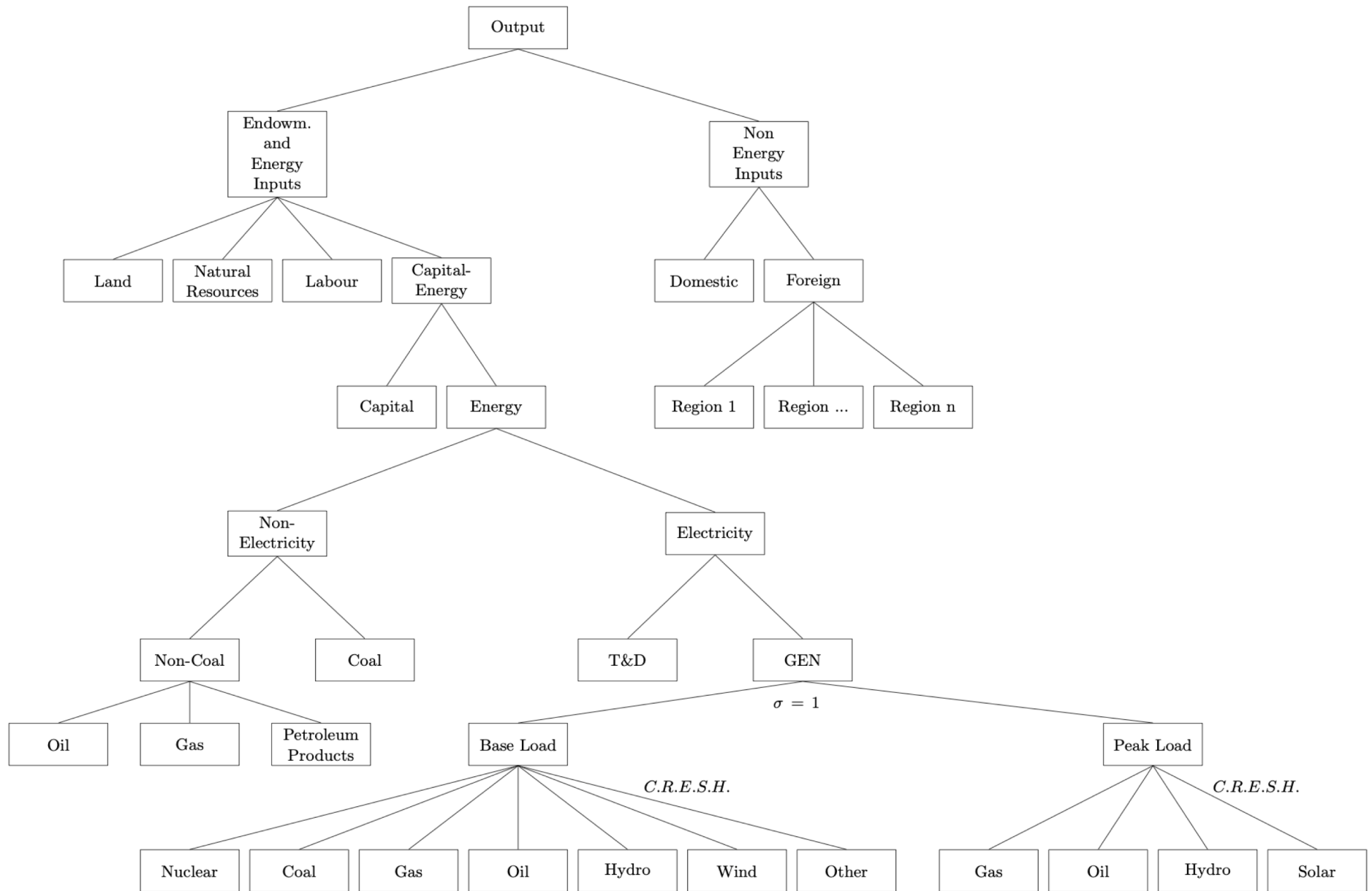
The model demand



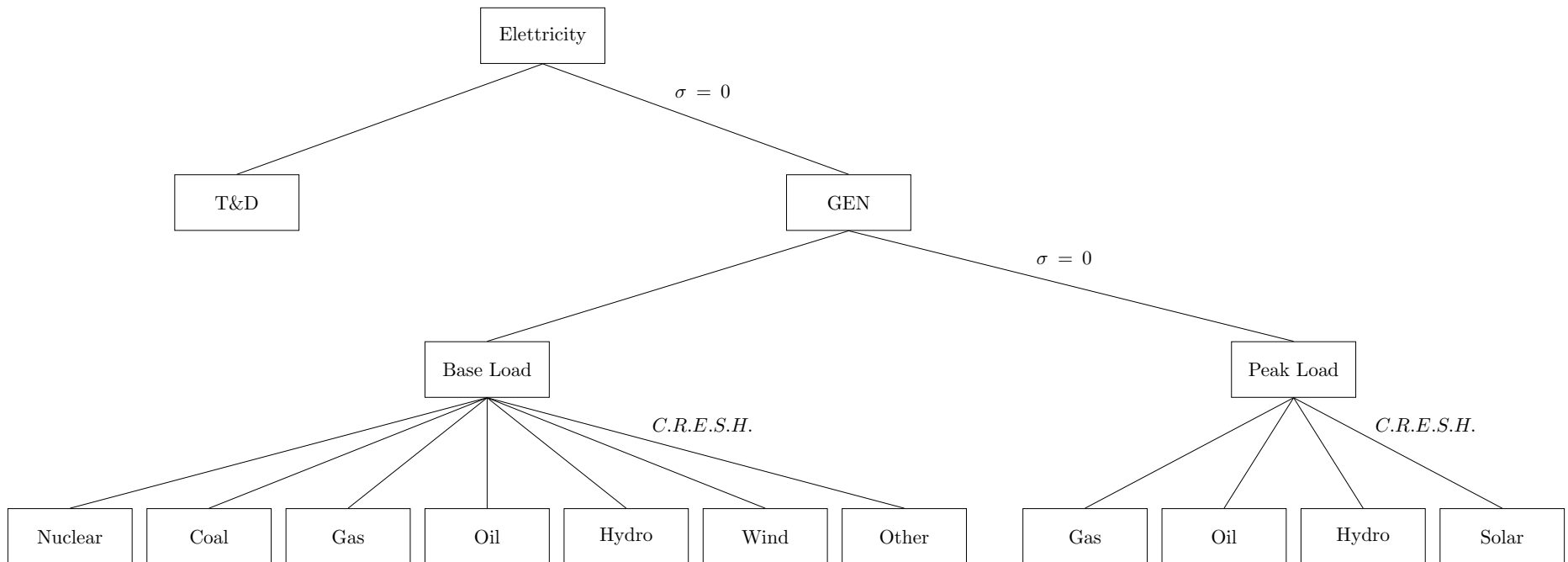
The model demand



The supply



The electricity production nest



GHG Emissions

Emissions of GHGs are linked to the underlying economic drivers

$$W_y = \alpha_y Y$$

$$W_{X_i} = \alpha_i X_i$$

$$W_{C_i} = \alpha_i C_i$$

Where Y_i is sectoral output, X_i is sectoral demand for intermediate and C_i is consumption demand for good i

Climate policy

The model can simulate three different policies:

- 1) the explicit implementation of a carbon tax (CTAX), with the corresponding effects on final fossil fuel use, sectoral output (and on emissions quantity) endogenously set by the model.
- 2) The implementation of cap on emissions, with the implicit carbon price endogenously set by the model.
- 3) Cap and Trade

Ad valorem tax are calculated as the ratio between revenues and tax base:

$$TRC_{ijr} = \left(\frac{W_{ijr} CTAX_r}{PM_{jr} QO_{jr}} \right)$$

Where TRC is carbon tax rate, PM is the market price, QO is output, CTAX is the carbon tax. This ad valorem tax is then added to the market price.

SIMULATION EXERCISE

Data description

- Data come from the GTAP9.2b database (Aguiar et al. 2015)
- Disaggregated electricity sector using the Gtap-Power database (Peters, 2016).
- 68 sectors of the economy and 15 regions/countries of the World.
- The policy scenarios are updated considering the recent 2030 climate and energy framework.
- The calibration year is 2015 and the simulation time is 2015-2030.

Regional and sectoral breakdown

Sectors	Regions
14 agriculture sectors	Italy
28 industry sectors	Germany
Transmission and Distribution	France
Nuclear power	Spain
Coal-fired power	UK
Gas-fired power as base load	Poland
Wind power	Rest Of EU
Hydroelectric power as base load	USA
Oil-fired power as base load	China
Other power nec: biomass, geothermal	Russia
Gas-fired as peak load	South Asia
Hydroelectric as peak load	Latin America
Oil-fired as peak load	Middle East and North Africa
Solar power: photovoltaics and thermal	SSA(Sub-Saharan Africa)
13 services sector	Rest of the World

Scenarios

Scenarios	Sectors	GHGs	2020	2030
Baseline (BAU)	-	-	No policy	No policy
ETS	ETS sectors for EU economies	CO ₂ , N ₂ O, PFC	cap and trade -21% wrt 2005	cap and trade -43% wrt 2005
ETS FFS	ETS sectors for EU economies	CO ₂ , N ₂ O, PFC	cap and trade -21% wrt 2005	cap and trade -43% wrt 2005
	+			
	Fossil fuel subsidies gradual phase out			
ESD	ETS sectors for EU economies	CO ₂ , N ₂ O, PFC	cap and trade -21% wrt 2005	cap and trade -43% wrt 2005
	+	+	+	+
	Non-ETS	All other GHGs	-13% wrt 2005	-33% wrt 2005
ETS on all sectors	ETS for all sectors	All GHGs	cap and trade -21% wrt 2005	cap and trade -43% wrt 2005
			+	+
			-13% wrt 2005	-33% wrt 2005

Fossil fuel subsidies scenario (ETSFFS)

ETS + Fossil fuel subsidies gradual phase-out in Italy implemented after 2020 as a possible alternative to ESD additional measures.

Revenues that result from the removal split between three types of recycling:

- i) increase the current budget savings
- ii) subsidize renewables
- iii) improve energy efficiency of the industry sector

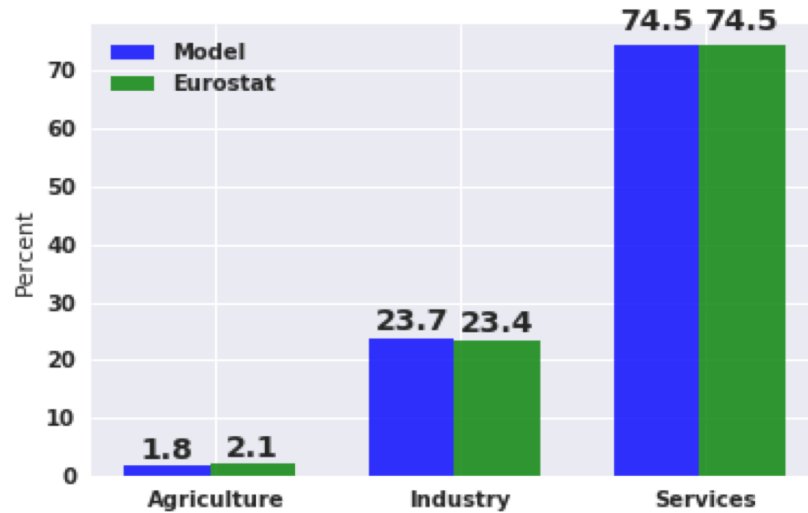
To transform investment efforts (millions of USD) into input-augmenting technical change in energy efficiency we follow Corradini et al. (2018).

Fossil fuel subsidies classification

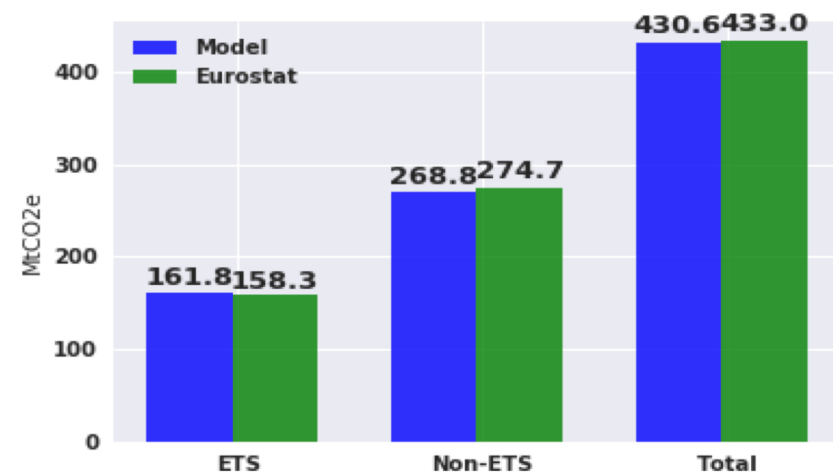
<i>Description</i>	<i>Classification</i>	
Direct transfers of funds	On-budget	Direct subsidies
Potential direct transfers of funds		
Foregone revenues	Off-budget	Indirect subsidies (tax expenditures, exemptions, tax credits, etc.)
Regulatory support mechanisms		
Tax exemptions and rebates		
Selective exemptions of government standards		
Implicit income transfers resulting from a lack of full cost pricing		

Static Calibration from 2011 to 2015: Italy

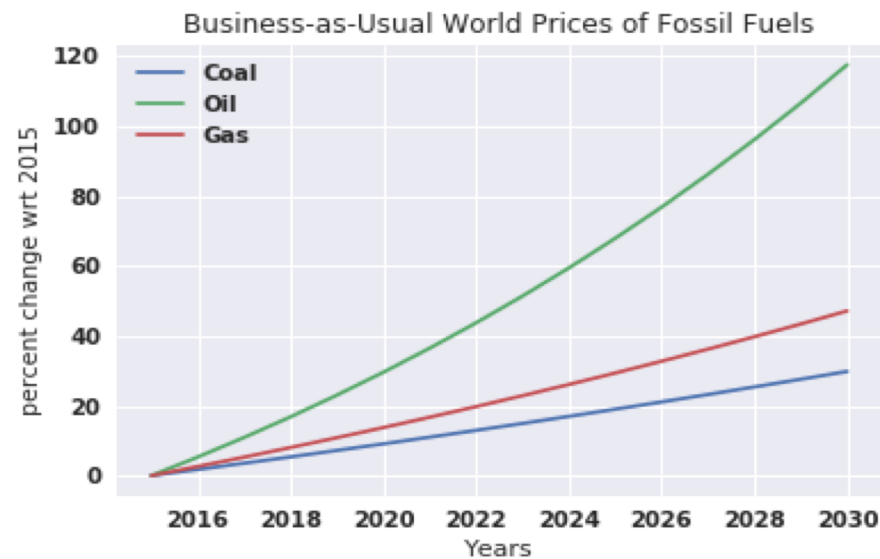
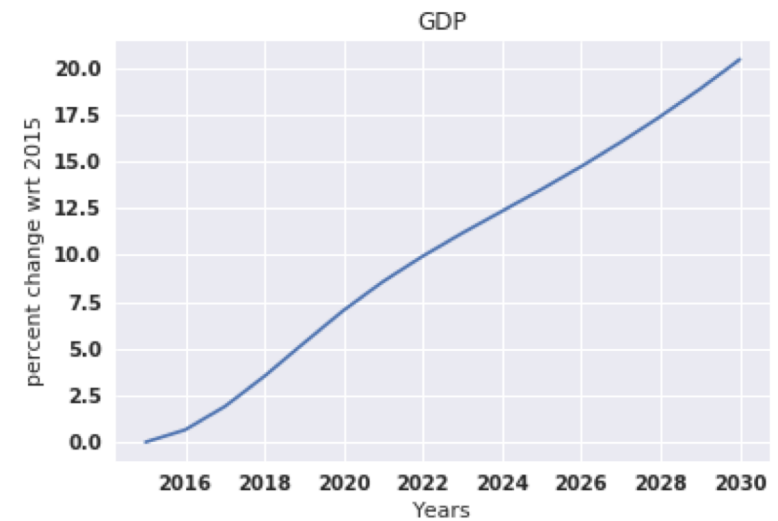
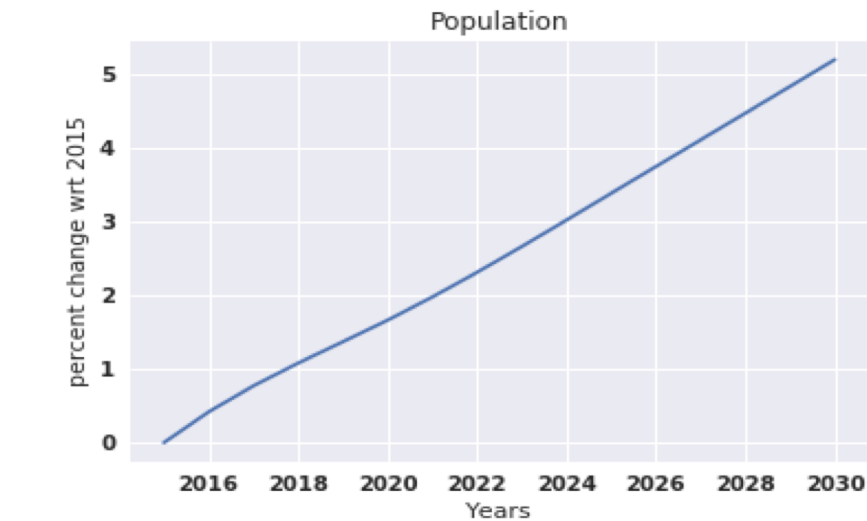
Value added: sectoral share %



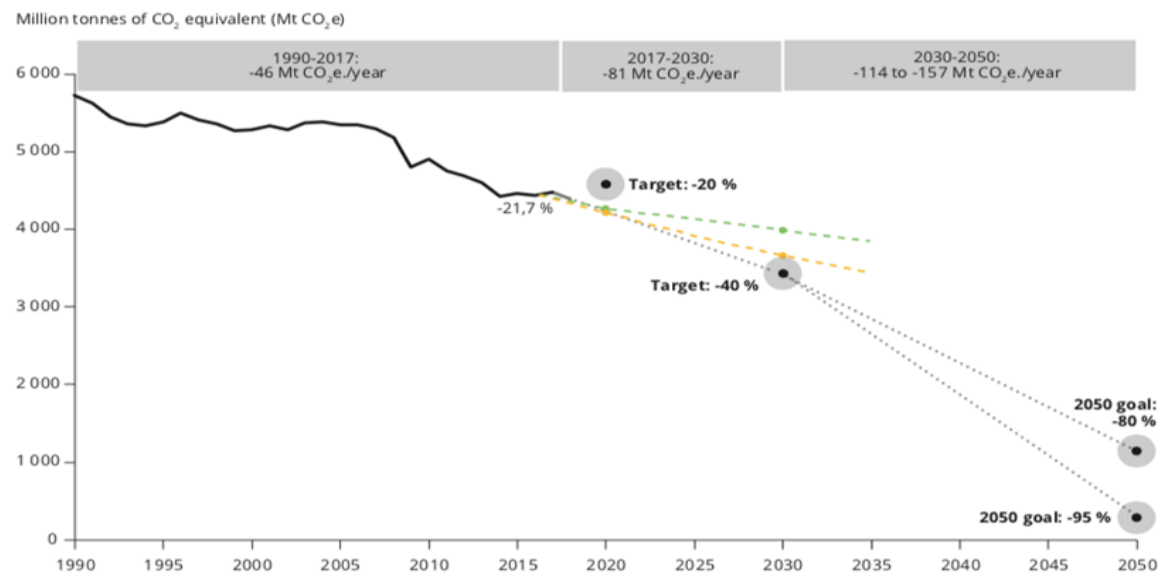
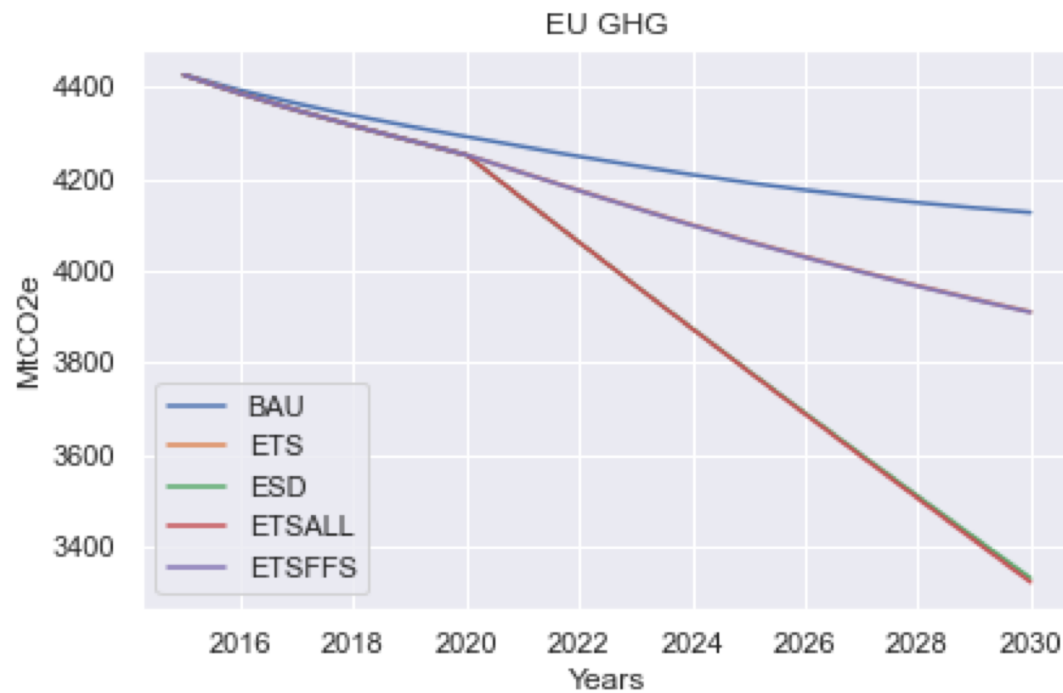
GHGs emissions in Italy (2015)



Dynamic Calibration: Baseline scenario to 2030: Italy

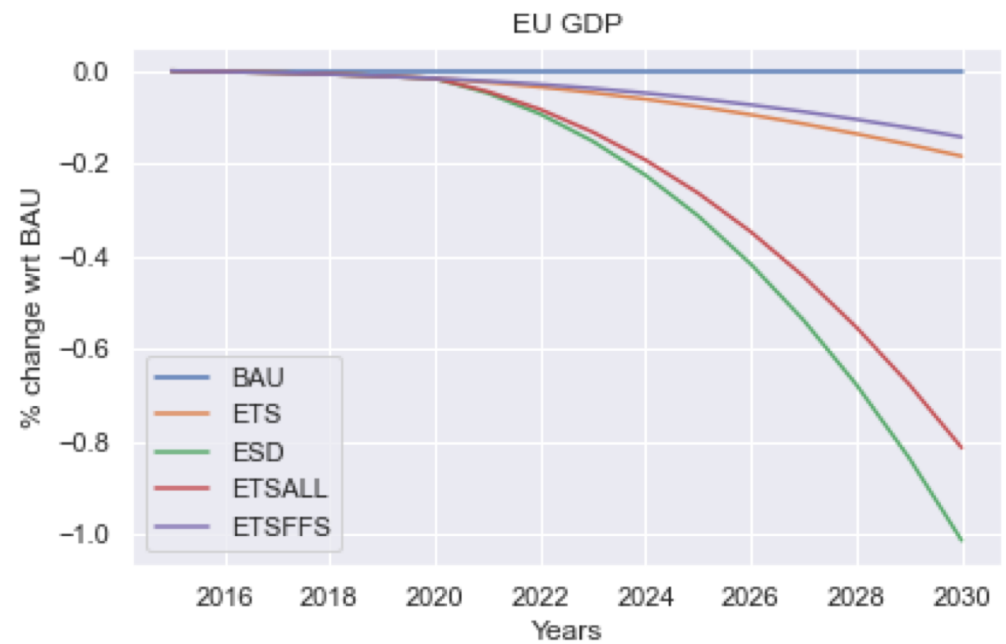
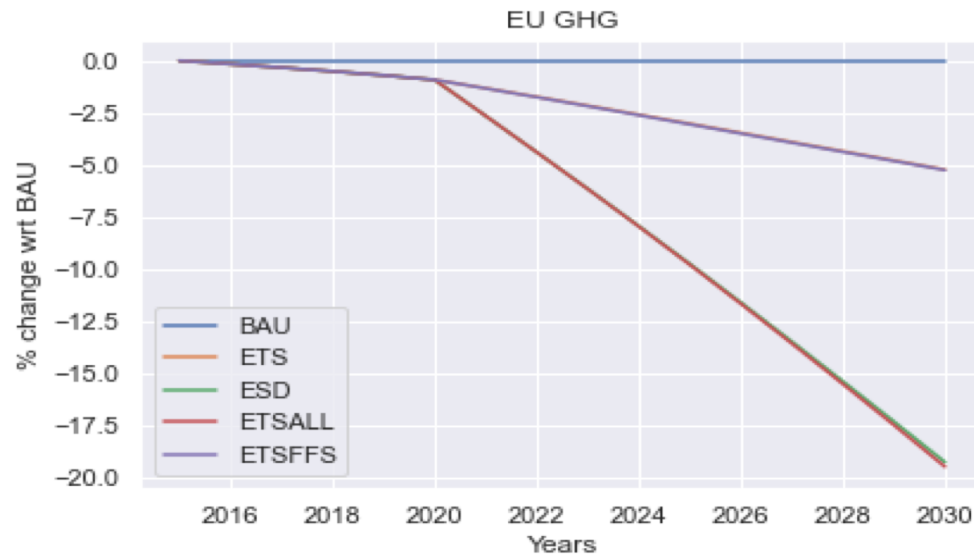


Results: climate policy impacts



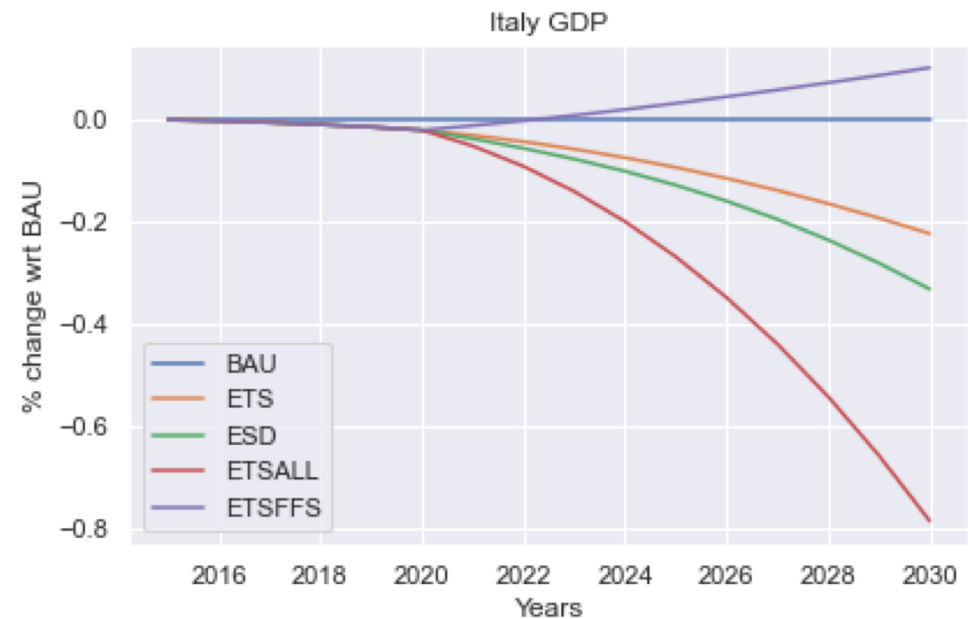
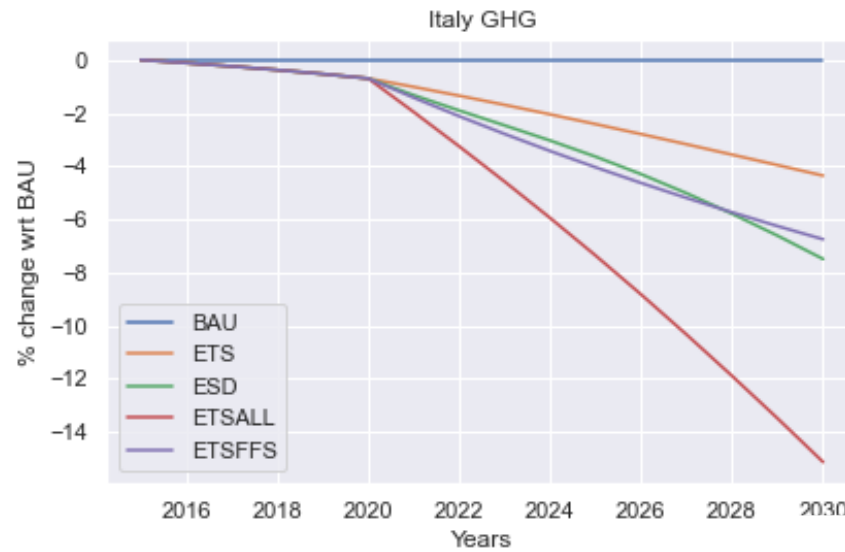
Results: climate policy impacts

EU28



Results: climate policy impacts

Italy



Results: carbon prices and trade of carbon permits

Carbon Prices, EU and Italy

<i>(EUR per tCO₂e)</i>	2020	2025	2030
ETS	11.4	21.5	36.3
ETS+ESD (ETS price):	11.4	21.6	35.4
domestic carbon tax Italy:	-	13.3	37.0
ETS ALL	11.4	34.9	73.6
ETSFFS	11.4	21.1	35.5

Carbon Permits, EU and Italy *(million euro, negative buying)*

	2020	2025	2030
ETS	-1.8	-20.2	-64.2
ETS+ESD	-1.8	-23.5	-88.4
ETS ALL	-1.8	240.9	969.2
ETS FFS	-1.8	12.4	20.8

Results: production and trade

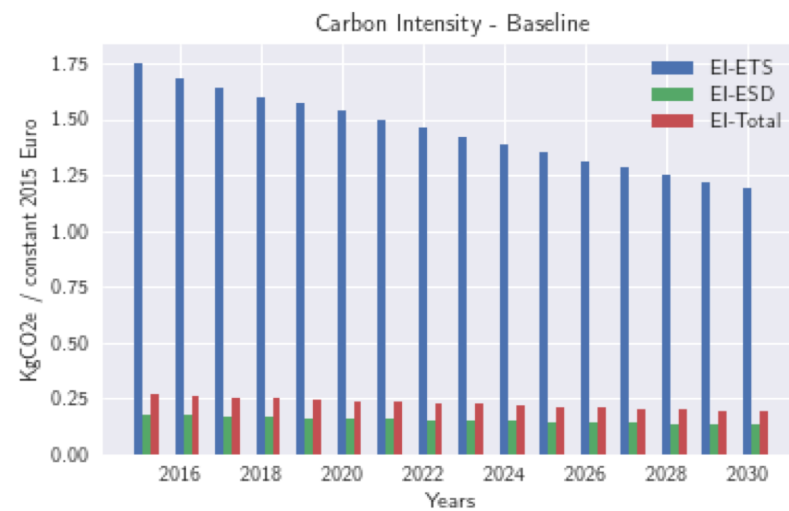
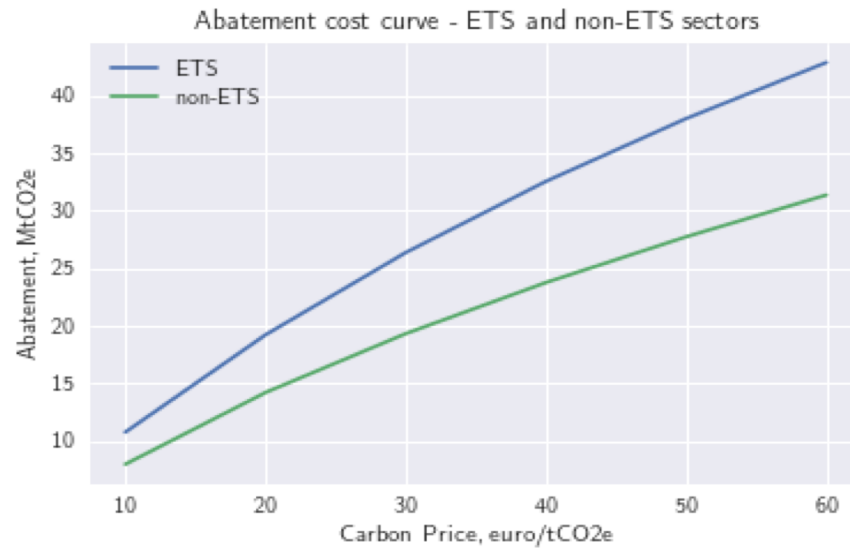
Italy

	ETS	ETS+ESD	ETS ALL	ETSFFS
agriculture	-0.1%	0.7%	-1.1%	-3.8%
industry	-0.5%	-0.8%	-1.8%	0.4%
services	-0.2%	-0.3%	-0.7%	0.3%
FF energy	-1.1%	-1.9%	-4.3%	-9.4%
FF electricity	-7.9%	-6.7%	-15.6%	-13.1%
RES	2.8%	3.0%	6.8%	13.8%
transports	-0.6%	-0.8%	-2.8%	-2.1%

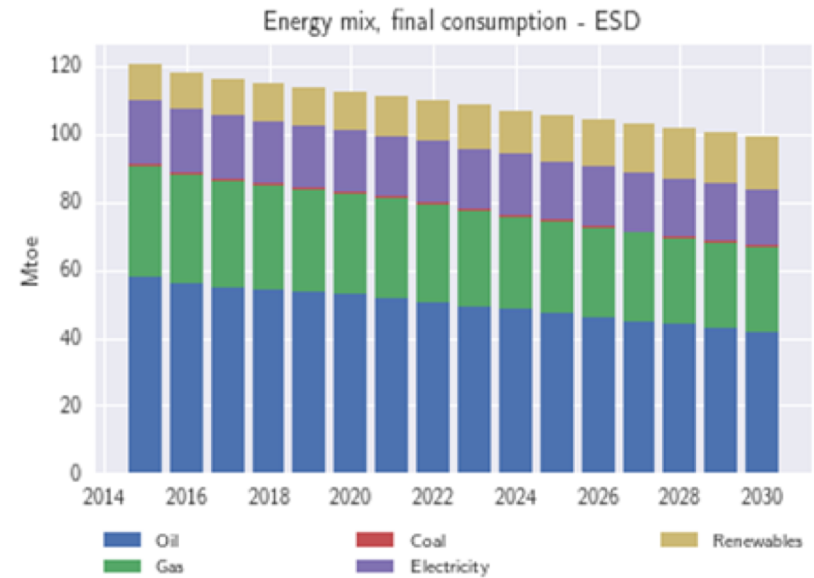
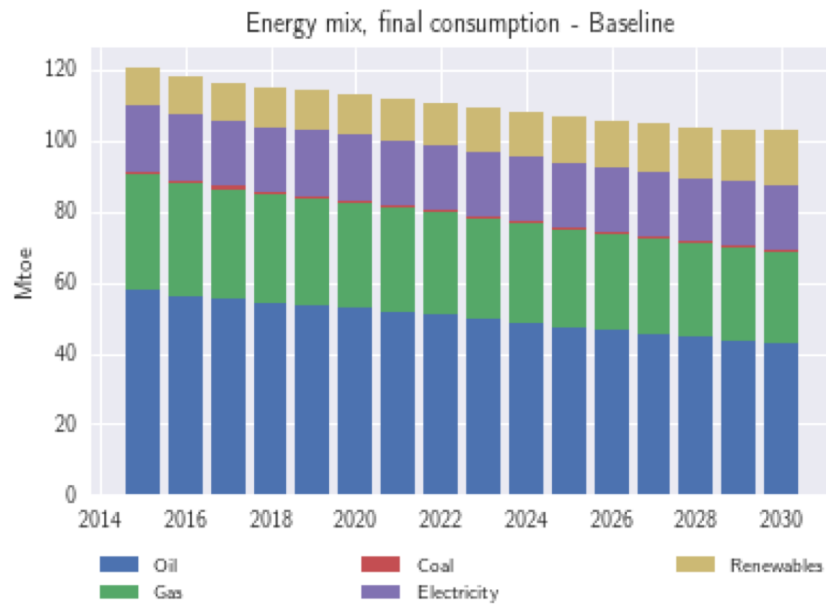
Discussion

- The burden-sharing is based on a GDP per capita rule and does not take Member State abatement costs into account.
- Results show that when more industries are covered in ETS market it will lead to a higher GDP performance and less ETS price in general.
- Since the trading price is related to the marginal emission reduction cost of enterprises, the coverage of enterprises with low emission reduction cost can bring lower prices.
- Several flexibility instruments can enhance cost-effectiveness.

Results: marginal abatement cost curve



Results: energy mix



**THANK YOU
FOR
YOUR ATTENTION!**

01 Riso	35 Metalli ferrosi (ferro e acciaio)
02 Grano	36 Metalli non ferrosi: produzione e fusione di rame, alluminio, zinco, piombo, oro e argento
03 Altri cereali	37 Prodotti in metallo fabbricati: prodotti in lamiera, ma non macchine e attrezzature
04 Frutta e Verdura	38 Veicoli e motori
05 Semi oleosi	39 Altri accessori per veicoli e motori
06 Zucchero di canna	40 Elettronica
07 Piante	41 Altri macchinari ed equipaggiamenti
08 Altri semi	42 Altra manifattura
09 Allevamento di bovini, ovini e cavalli	43 Trasmissione e distribuzione di elettricità
10 Altri prodotti animali	44 Elettricità da Nucleare (Carico Base)
11 Latte	45 Elettricità da Carbone (Carico Base)
12 Lana, seta e cotone	46 Elettricità da Gas (Carico Base)
13 Legname	47 Elettricità da Eolico (Carico Base)
14 Pesca	48 Elettricità da Idroelettrico (Carico Base)
15 Carbone	49 Elettricità da Petrolio (Carico Base)
16 Petrolio	50 Elettricità da Altre fonti (Carico Base)
17 Gas	51 Elettricità da Gas (Picco di carico)
18 Altri minerali	52 Elettricità da Idroelettrico (Picco di carico)
19 Carne bovina	53 Elettricità da Petrolio (Picco di carico)
20 Altre carni	54 Elettricità da Solare (Picco di carico)
21 Oli vegetali e grassi	55 Fornitura di acqua
22 Prodotti caseari	56 Costruzioni
23 Riso processato	57 Commercio
24 Zucchero di canna	58 Altri Trasporti
25 Altri prodotti alimentari	59 Trasporto su acqua
26 Bevande e Tabacco	60 Trasporto Aereo
27 Tessili	61 Comunicazioni
28 Abbigliamento	62 Servizi finanziari
29 Pelle e Pellame	63 Assicurazioni
30 Prodotti del legno	64 Altri servizi commerciali
31 Cartario	65 Ricreazionale ed altri servizi
32 Prodotti petroliferi	66 Pubblica amministrazione
33 Chimica, prodotti della gomma e della plastica	67 Servizi immobiliari
34 Altri prodotti minerali	