Doutoramento em Alterações Climáticas e Políticas de Desenvolvimento Sustentável

SEMINAR ENERGY & CLIMATE CHANGE

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NOVA SCHOOL OF SCIENCE & TECHNOLOGY

CENSE center for environmental and sustainability research

SEMINAR ENERGY & CLIMATE CHANGE

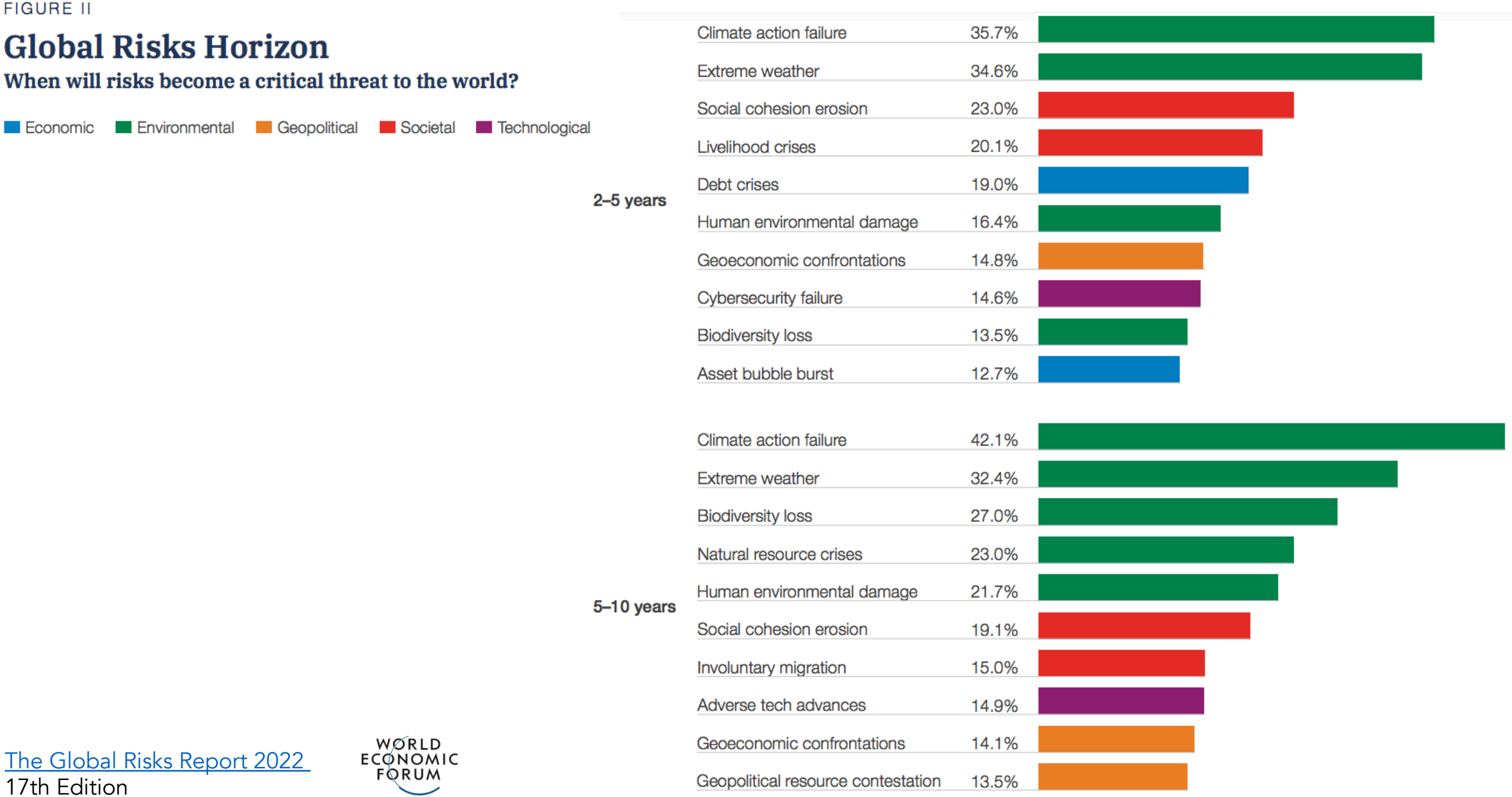
AGENDA

1. ENERGY & CLIMATE CHANGE: A COMPLEX, PERENNIAL AND INTERDISCIPLINAR RELATION
2. II. Scope and purpose of the course. Syllabus. Practicalities.

FIGURE II

Global Risks Horizon

When will risks become a critical threat to the world?



The Global Risks Report 2022
17th Edition

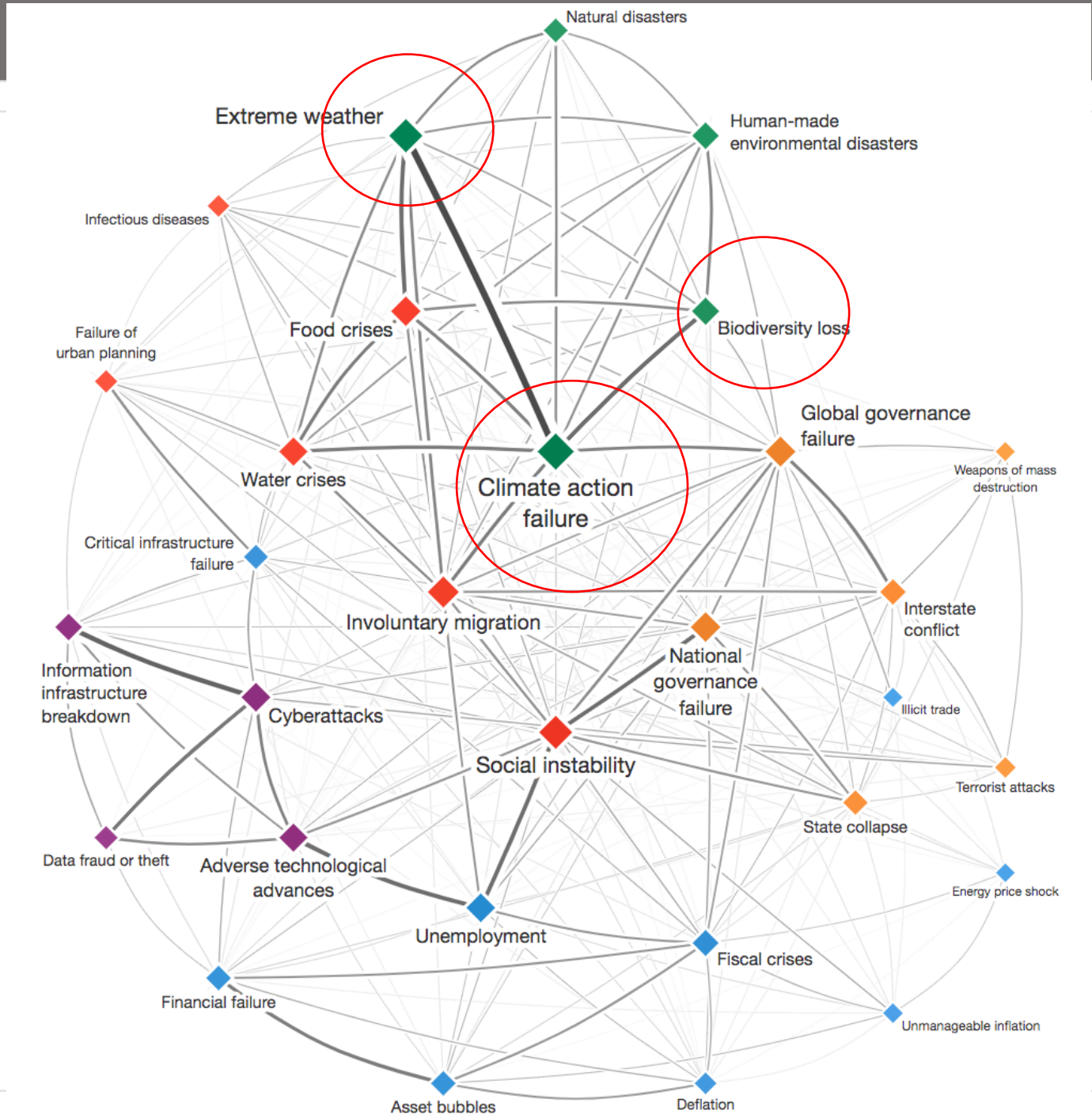
WORLD ECONOMIC FORUM

Global Risks Perception (2021)

WORLD ECONOMIC FORUM

The Global Risks Interconnections Map 2020

How are global risks interconnected?



ENERGY & CLIMATE CHANGE: A COMPLEX, PERENNIAL AND INTERDISCIPLINARY RELATION







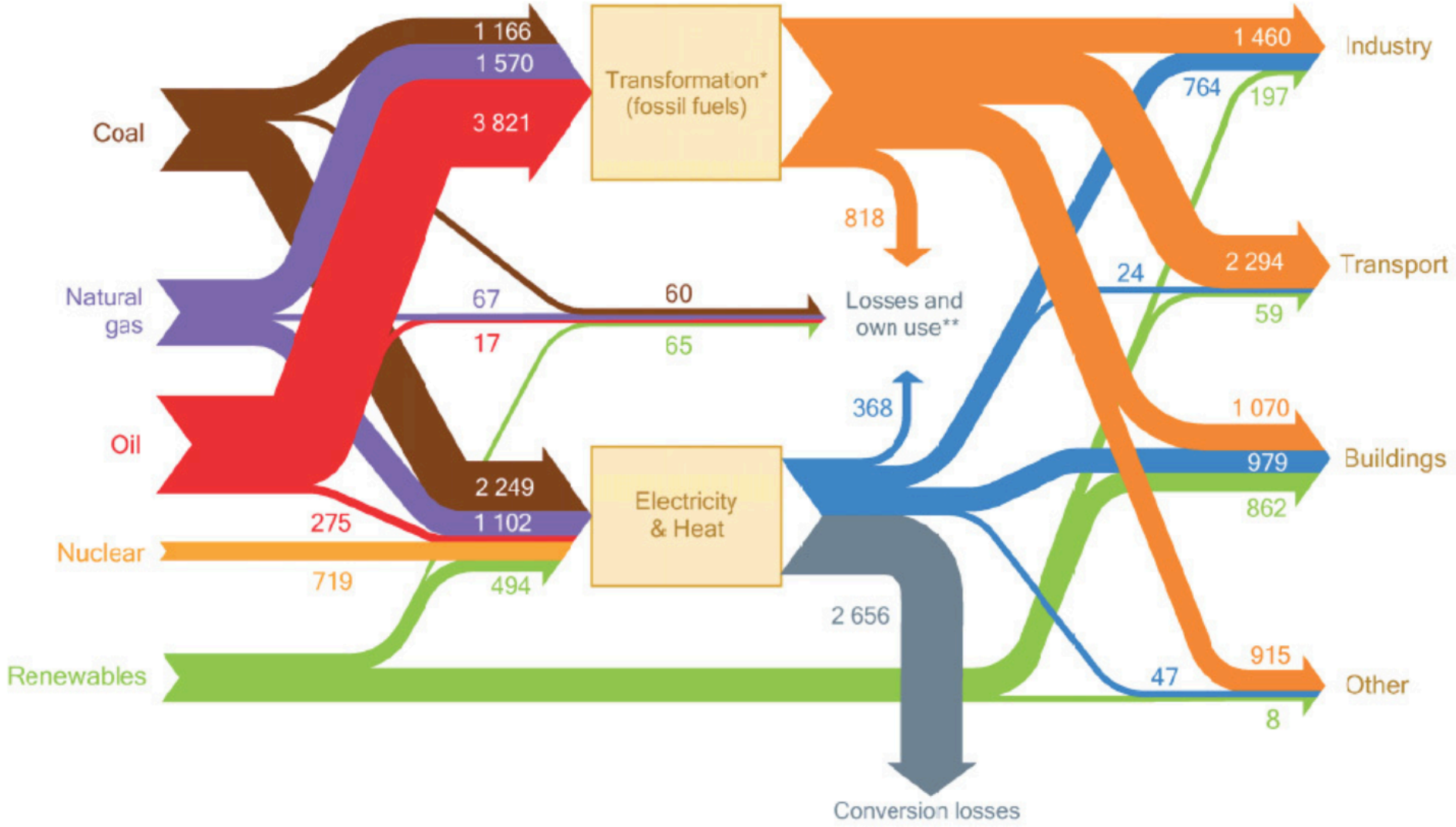


ENERGY & CLIMATE CHANGE: A COMPLEX, PERENNIAL AND INTERDISCIPLINARY RELATION

- Oil | coal
- Sun | water | wind
- Thermoelectric power plants
- Production of electricity from renewable sources
- Passengers mobility
- Heating / Cooling
- Biofuels
- Double windows
- Refrigerators & Freezers
- LED lamps
- Comfort | welfare

- 2016 warmer year
- Reduction of the icy area of Greenland
- Heat waves
- Snowstorms
- Forest fires
- Less efficient power plants in summer
- Rational energy use behaviors
- Access to electricity
- Energy cost - competitiveness
- Electrical Gadgets
- Urban habits

Figure 2.8 ▷ **The global energy system, 2010** (Mtoe)



Explore your country here: https://www.iea.org/sankey/

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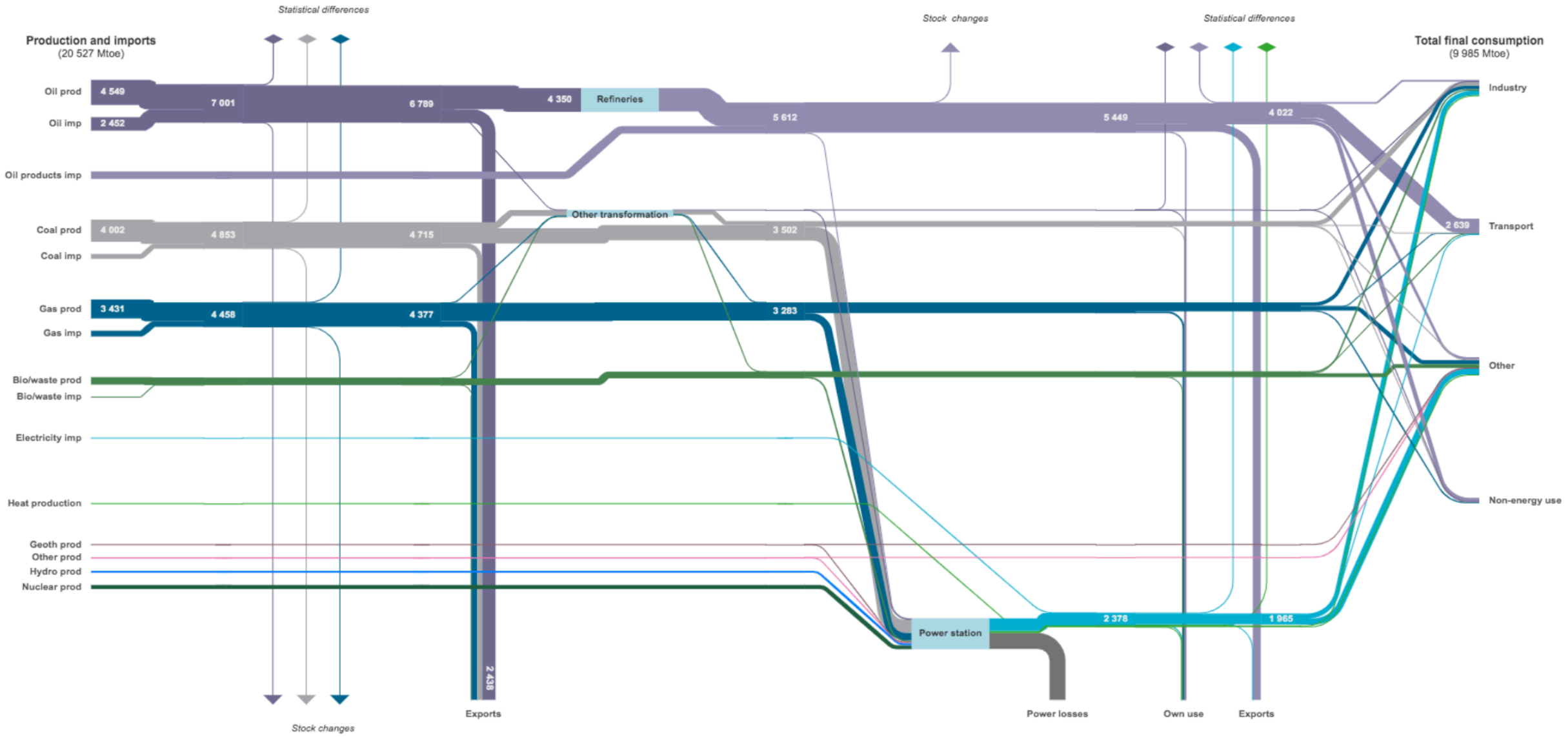
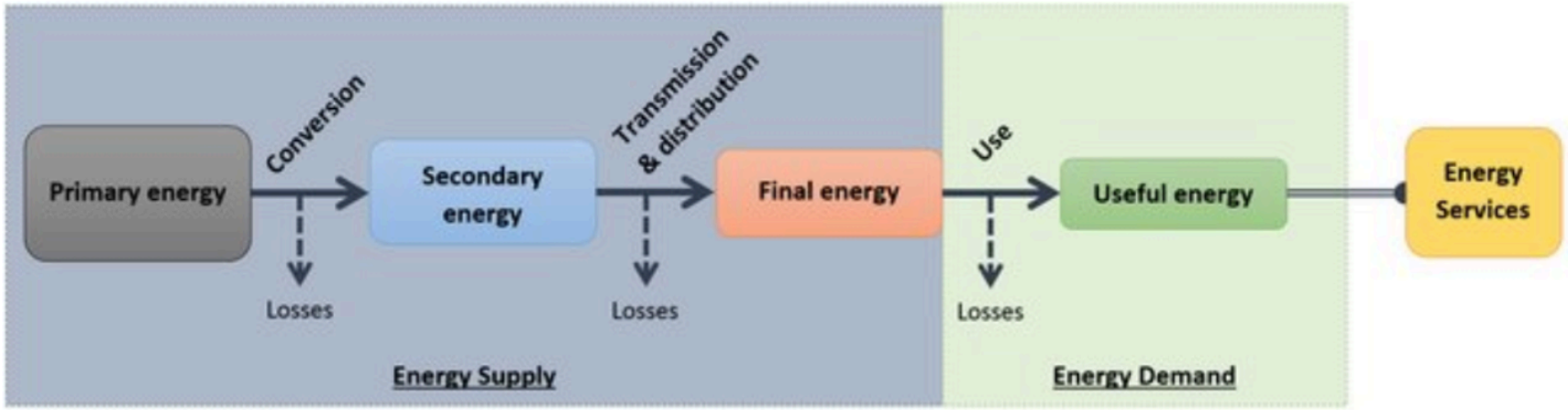
World

BALANCE (2019)

Millions of tonnes of oil equivalent



THE ENERGY SYSTEM



COAL OIL SOLAR HYDRO	HEAT STEAM	ELETRICITY OIL PRODUCTS	LIGHT HEAT MOVEMENT	See next slide

Primary Energy $\xrightarrow{\eta}$ Final Energy $\xrightarrow{\eta}$ Useful Energy -> Energy services

For a better understanding on energy services, read this paper Hass et al (2008)

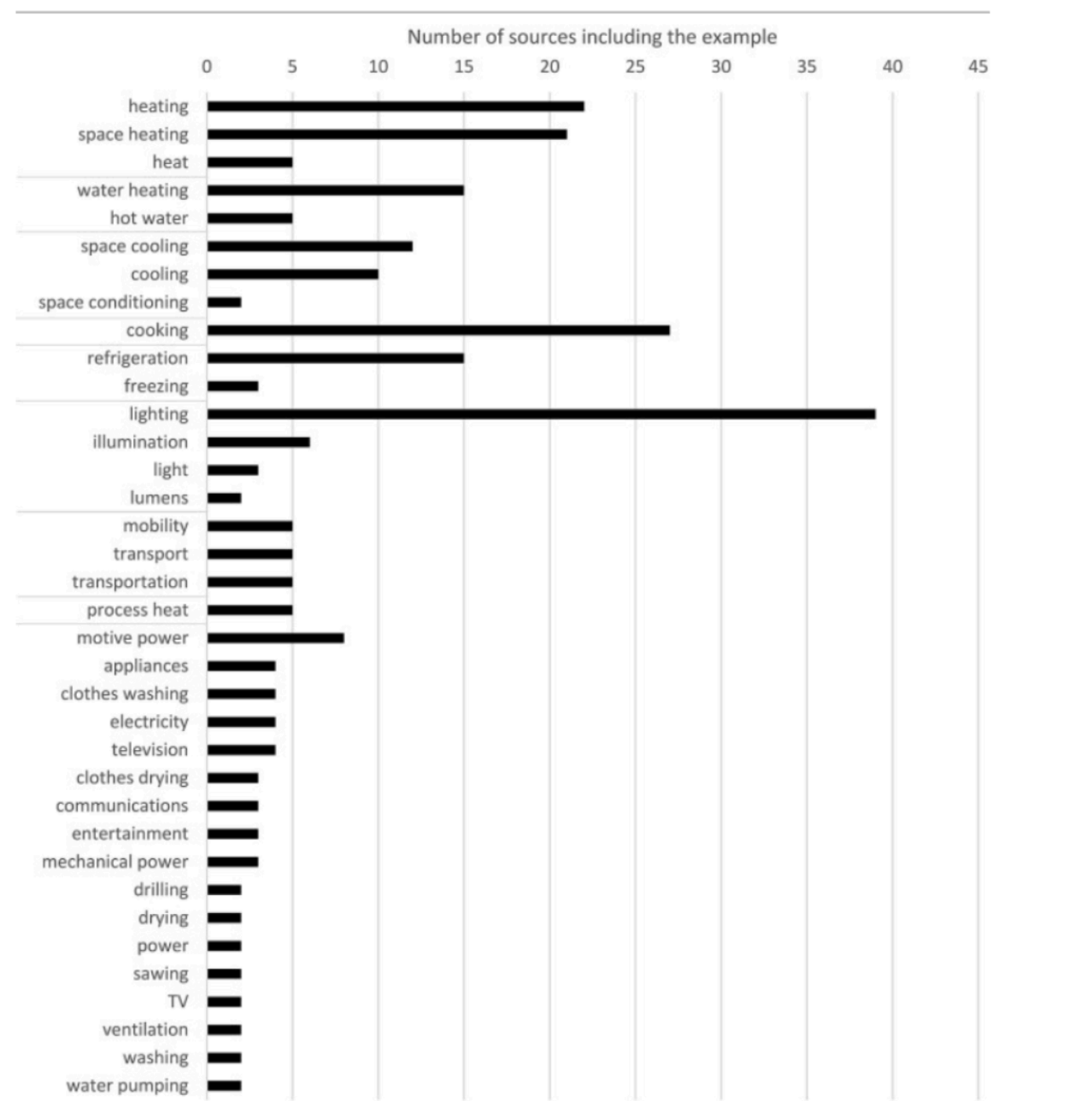


Fig. 2. Examples of energy services included in two or more sources. Source: (Fell, 2017)

The cost of importing energy in Portugal in 2019 (pré-covid) was approximately:

a) 17 billion €

b) 9 billion €

c) 0,5 billion €

In 2019, Portugal imported agricultural and food products worth € 11.2 billion

Tabela 5 - Peso da energia na balança de mercadorias FOB (2018 a 2020)

	Importação (10^6€)			Exportação (10^6€)			Saldo Importador		
	2018	2019	2020	2018	2019	2020	2018	2019	2020
Produtos energéticos (Total)	9 304	8 911	5 732	4 377	4 167	2 818	4 927	4 745	2 914
	12,4%	11,2%	8,5%	7,6%	7,0%	5,2%	28,6%	24,1%	21,2%
Total mercadorias FOB	75 011	79 603	67 549	57 807	59 903	53 783	17 205	19 700	13 767

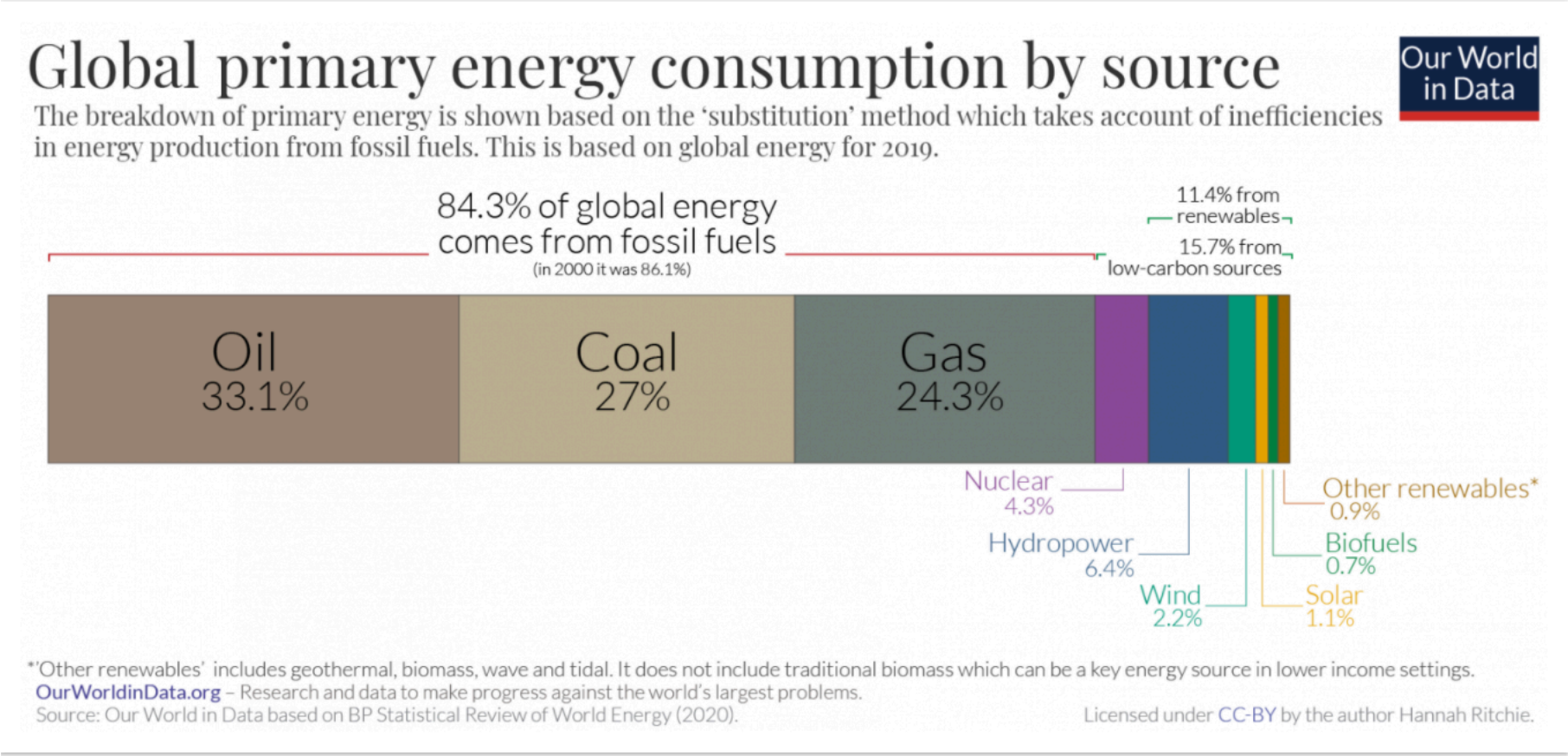
Fonte: DGEG e Gabinete de Estratégia e Estudos (GEE)

How much is the renewables share in global primary energy consumption?:

a) 30%

b) 10%

c) 5%



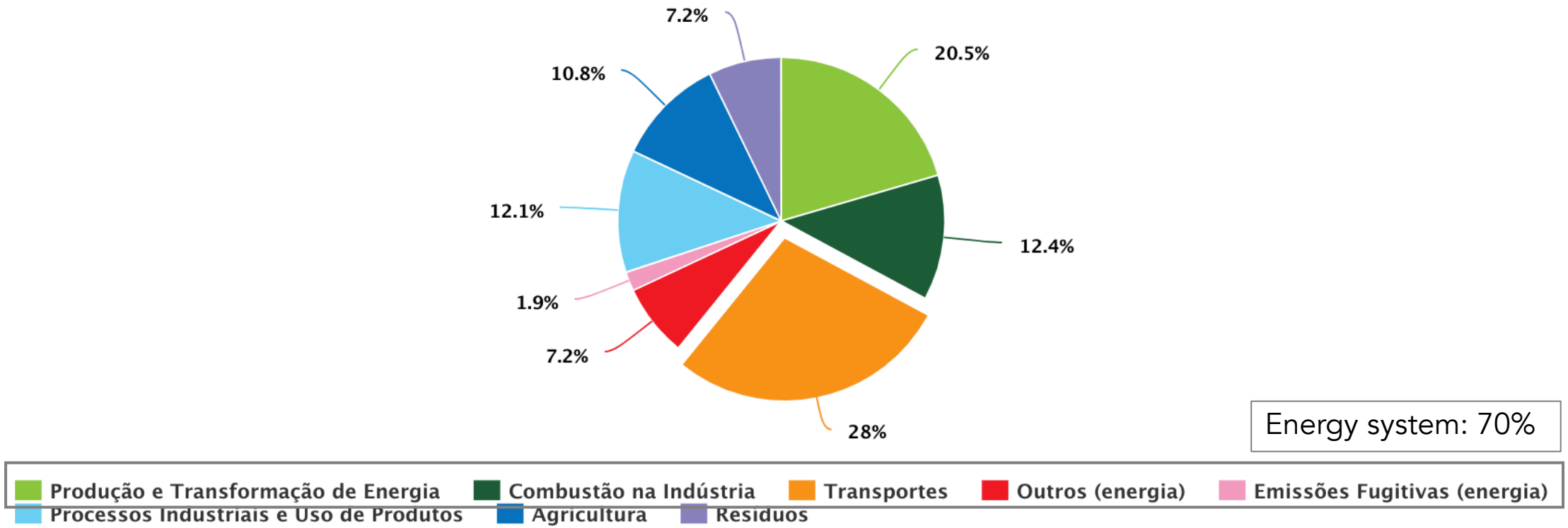
The energy sector contribution for the in Portugal's global greenhouse gas emissions balance is approximately:

a) 70%

b) 90%

c) 40%

Emissões sectoriais de dióxido de carbono equivalente, em Portugal, em 2019



Energy system: 70%

GRÁFICO INTERATIVO

Fonte: APA, submissão do inventário nacional realizada em março/abril de 2021 à União Europeia e à Convenção Quadro das Nações Unidas sobre Alterações Climáticas

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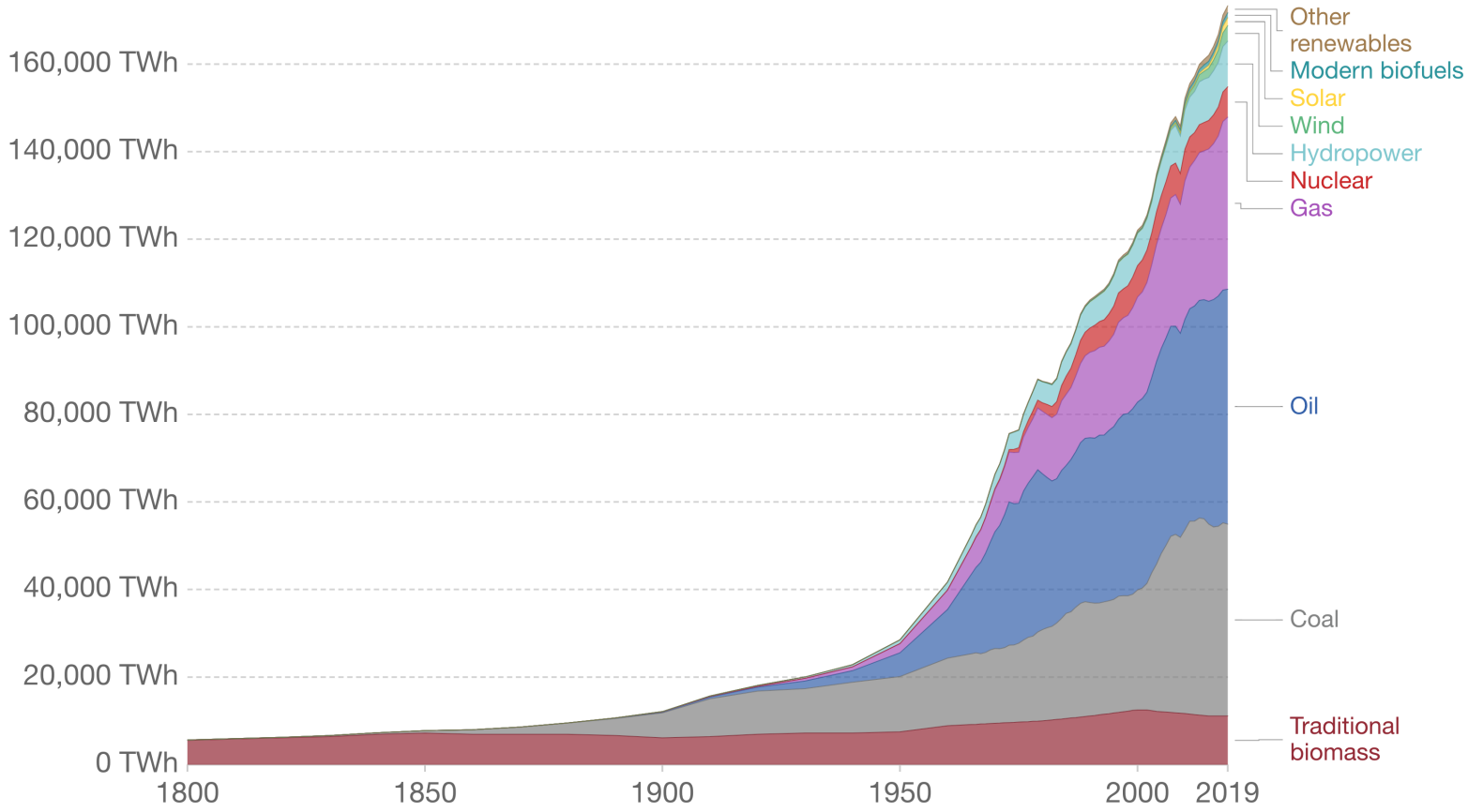
Global primary energy consumption by source

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.

Our World in Data



Source: Vaclav Smil (2017) & BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY

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A COMPLEX,
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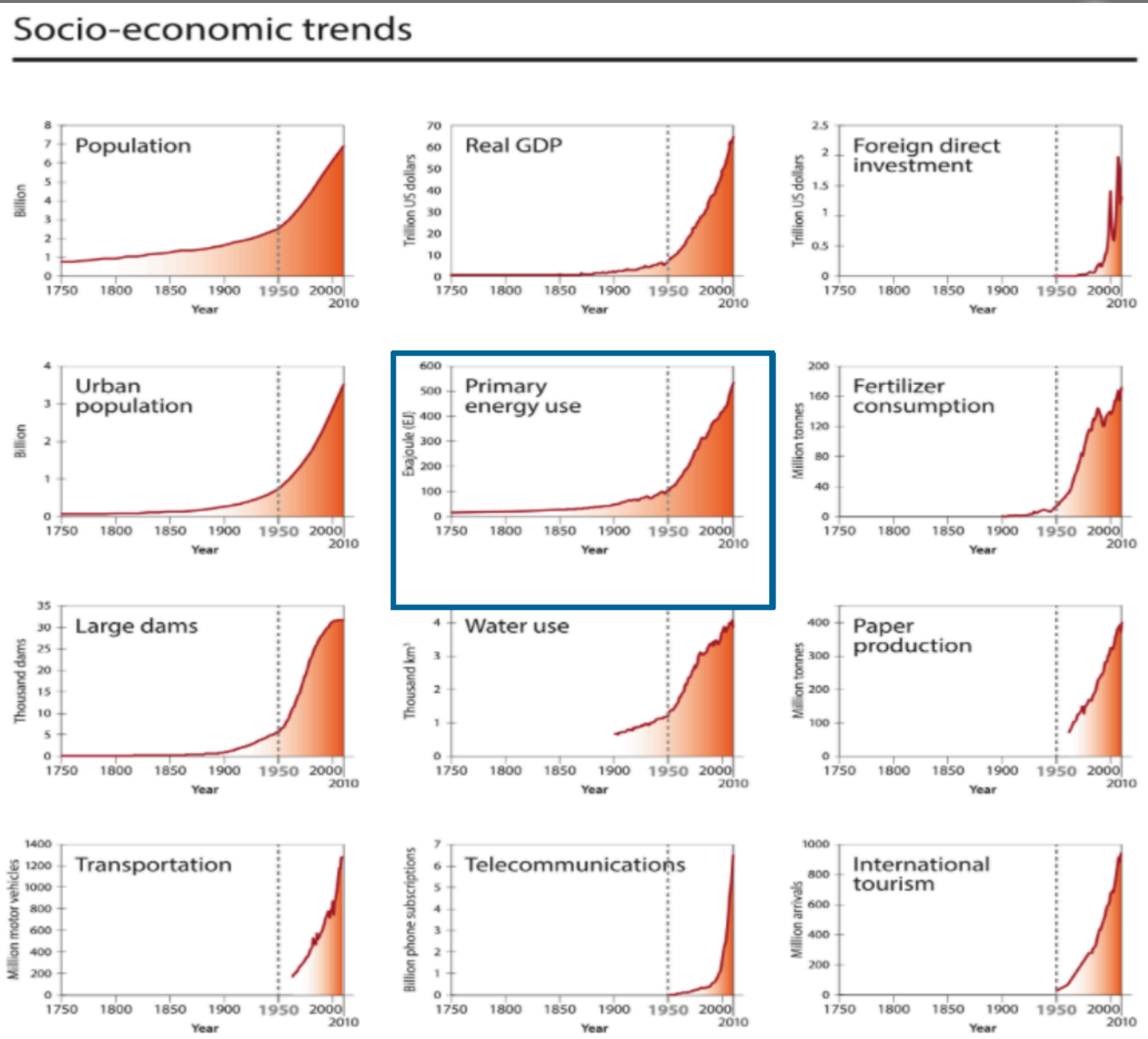
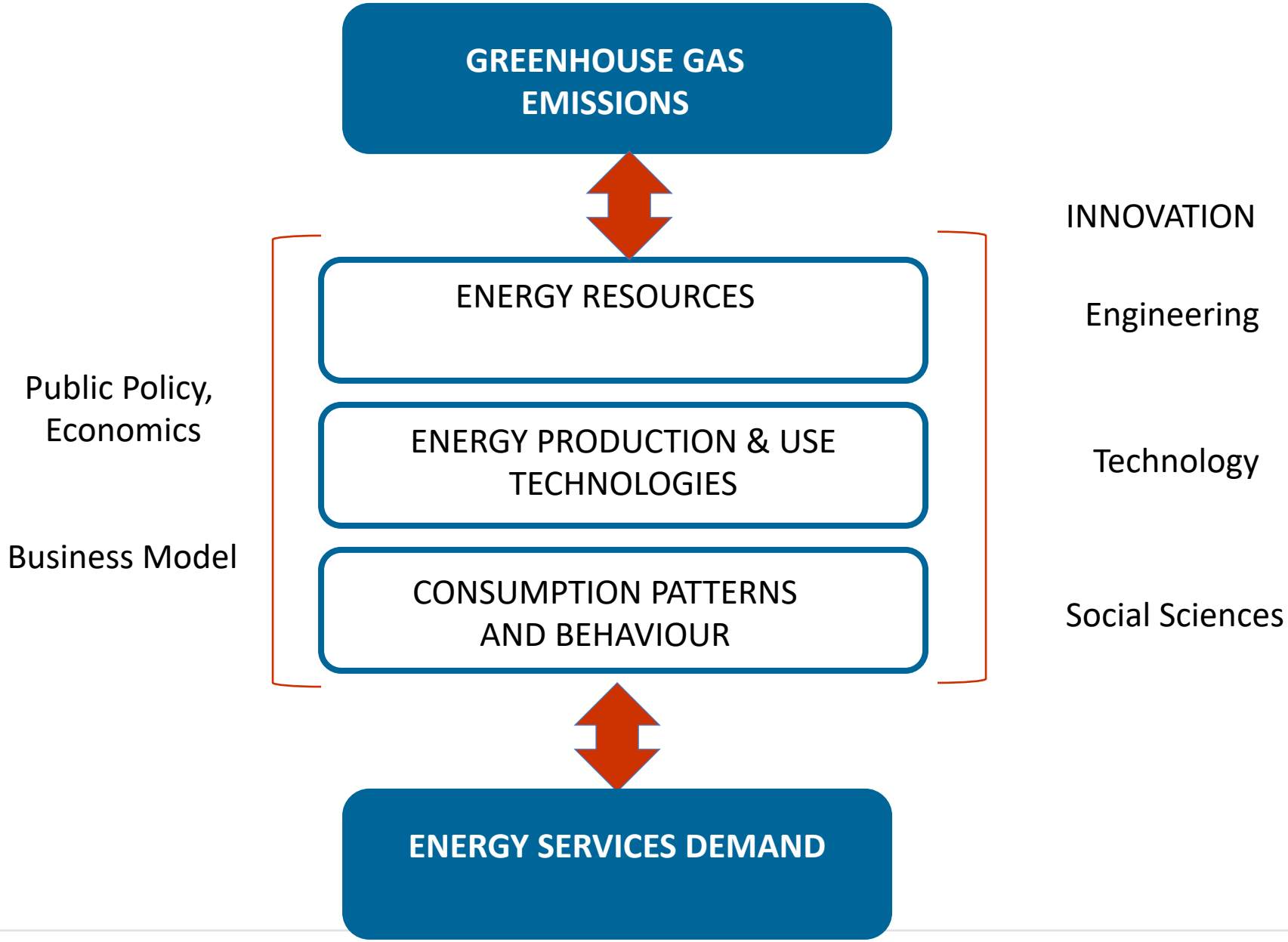
Explore more on the Great Acceleration here



ENERGY & CLIMATE CHANGE: A COMPLEX, PERENNIAL AND INTERDISCIPLINARY RELATION



ENERGY & CLIMATE CHANGE:
A COMPLEX, PERENNIAL AND
INTERDISCIPLINARY
RELATION

OUR CHALLENGE

How can we provide the benefits of energy services to the entire population of the planet without damaging the environment, without negatively affecting social stability, and without threatening the well-being of future generations?

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2. II. Scope and purpose of the course. Syllabus. Practicalities.

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PURPOSE OF THE COURSE:

1. deepen the intrinsic relationship between climate change and energy, taking the perspective of greenhouse gas emissions mitigation.
2. focus on technological, economic, environmental and social aspects.
3. train the reasoning and practices on medium to long-term prospective exercises

At the end of the course, students will be able to perform a critical and robust analysis on:

a. the impact of energy options on the problem of climate change from the perspective of systems analysis and in the medium to long term;
b. the importance of clean energy production to economic competitiveness, in particular within the regulatory framework to promote low-carbon economy;
c. prospect and develop a plan for the success of an economic activity in a neutral carbon economy pathway - EVALUATION.

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1	04/03 6ª Feira	16h-18h	Session reserved for students meeting with the Scientific Committee on practical aspects of the PhD Program, and choice of tutors.	Comissão Científica
2	11/03 6ª Feira	16h-18h	ENERGY & CLIMATE CHANGE: A COMPLEX RELATION, PERENE AND INTERDISCIPLINARY. Framework and purpose of the course in the PDACPDS. Practicalities and seminar program. Basic concepts of the energy systems.	J. Seixas, FCT NOVA
3	18/03 6ª Feira	16h-18h	**Current state of the global energy system :** main energy carriers, energy production and consumption regions; energy access; concepts of energy and carbon intensity.	S. Simões
4	25/03 6ª Feira	14h-16h	**Global balance of CO_2 emissions** associated with energy and industrial processes. Estimates of the Global Carbon Budget (http://www.globalcarbonproject.org/) and its relationship to the global energy system and changes in land use. Future scenarios for greenhouse gas emissions: RCPs (Representative Concentration Pathways). Global emissions based on consumption vs. production.	S. Simões
5	02/04 Sábado	09h-11h	**Renewables:** Economic, environmental and energy security of endogenous vs. imported resources. Renewable technologies. Sustainability issues related with renewables. Land & water use, critical raw materials. Discussion: Where to place 7GW of solar PV in Portugal till 2030?	S. Simões
6	08/04 6ª Feira	16h-18h	**Energy concepts:** Primary/final energy; Sankey diagrams; energy efficiency; Energy services; Energy carriers; Final energy supply cost curves; learning curves of energy technologies. Definition and usefulness of LCOE. System value of Renewables. Global renewables' market.	S. Simões
7	22/04 6ª Feira	16h-18h	**Drawdown** - Climate Solutions for a New Decade	João P. Gouveia, FCT NOVA
8	30/04 Sábado	09h-11h	**Green hydrogen**: technological options, costs and the role for a carbon neutral energy system	P. Fortes, FCT NOVA
9	06/05 6ª Feira	18h-20h	**CARBON PRICING.** Regulatory framework in the European Union: 2020 - 2030 targets. Fit for 55. European low-carbon Roadmap 2050. Paris Agreement, and its implications.	S. Simões
10	13/05 6ª Feira	16h-18h	**Debate Como perspetivar o futuro da energia e alterações climáticas?** Baseado no artigo *An energy vision: the transformation towards sustainability — interconnected challenges and solution s*	students / S. Simões
11	21/05 Sábado	11h-13h	**Hands-on energy data**: access to energy databases, Portuguese and European (PORDATA, DGEG, EUROSTAT). i) How to find and explore energy statistics and emissions of greenhouse gas (GHG) emissions for Europe and Portugal; ii) How to make energy conversions; iii) How to build indicators and charts with added value; iii) How to analyze economic sectors, and interpret their performance in terms of energy consumption and greenhouse gas emissions.	S. Simões
12	27/05 6ª Feira	16h-18h	**Integrated assessment of energy systems**: The energy system addressed by the systems analysis approach. How to envisage the future energy system? Implications for the decision making in the medium and long term. Concept and formulation of cost-effectiveness within the integrated energy systems. Hands on Climate Mitigation Simulation	S. Simões
13	03/06 6ª Feira	16h-18h	Mentoring with each students' group : discussion on the approach and methods adopted by the students, expected results to be obtained with the final work; assessing preliminary results, if any.	S. Simões
14	17/06 6ª feira	18h-20h	**Smart and Sustainable cities**: concept, components and implications for the energy systems. The concept of Positive Energy Districts, and implications for future planning at the city level.	João P. Gouveia, FCT NOVA
	2 julho, 14h	14h-16h	Avaliações: apresentação dos trabalhos pelos alunos.	S. Simões / J. Seixas

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Challenge: Within the scope of your personal interests, select an economic activity:
Fashion I Communication I Food and Beveragel Industry I Health services I Mobility I Other

Assuming your country will be in the midst of a pathway to achieve a carbon neutral economy by 2050 (as stated in the Paris Agreement) or earlier, how do you envisage the selected activity will picture by 2030?

Team work I Think out of the box I Innovate
What is the challenge for the activity? Who are the challenge owners?
What do you envisage the activity must/should deliver in the future?

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Suggestion of script for development:

- firstly, **formulate (and detail) the problem** as far as you are able;
- **characterize the activity at present** [for example, production / import technologiesl type of markets and consumers l competition from other markets? l energy consumption profile l indicators of carbon intensity]
- **envisage the activity up to 2030** [technological options l product change - greenl change of consumers l energy consumption profile l indicators of carbon intensity]
- **systematize opportunities for the mitigation** of the selected activities (identify needs of R & D, act on consumption preferences, the product value chain, among others)
- **identify and anticipate constraints and barriers** to the desired mitigation, and explain how to overcome them.

Tips: Start now; try to be objective and quantify what is possible; do not try to be exhaustive (you can not do it within just one course); explore examples that already exist in other countries; be creative.

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EVALUATION:
Criteria [points/100], the goal of the exercise is to promote:

1. Your ability to reason about the problem, in a structured and integrated way (for example, within the value chain of the activity, including the international dimension if applicable); [25]
2. Consistency and creativity in the scenario design in 2030 taking into account the expectations of a 450 ppm scenario (aggressive reduction of GHG emissions); [20]
3. Show knowledge about technological mitigation options, in particular regarding the energy component; [20]
4. Demonstrate robustness of analysis and arguments, focusing on aspects of cost effectiveness, carbon economics, competitiveness, among others. Demonstrate ability to synthesize information and data processing; [20]
5. Quality of presentation document & clear and concise oral presentation [15]

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How the work will be developed?

- Groups of 3 students (please send me an email with the group members until end of march)
- Coaching session to each group, on the work development (one class dedicated to this, end of may)
- Oral presentation: 30 min/group [15 min for oral presentation + 15 min Q&A]
- **Deliverable: at the day before the oral presentation at maximum, students will send to me the presentation by email.** Presentation in pdf format: maximum 10 slides + word document with 3 pages at maximum (only if needed for complementary information).

Oral presentation:
2 July 2022, friday, 14:00h, ICS (tbd)

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In 2020, forest area represented 30.8% of the total land area; between 1990 and 2020, there was a net loss of 178 million hectares of forest areas (FAO, 2020).

THANK YOU

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