IEA - Bioenergy Task 39

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The main objective of this proposal is to develop and implement a methodology to evaluate the biofuels production in emerging economies countries taking into account concepts of sustainability

Specific objectives:

1 **-** Selection of the countries that are considered as emerging economies with a large population and in average lower energy consumption compared to developed countries.

2 **-** Identification of official data source for each country in terms of energy production, energy demand as well as the production of biofuels.

3 **-** Database construction of relevant data (energy matrix, feedstock availability, the energy expenditure of production, net energy content, energy conversion efficiency, among others).

4 **-** Identification of possible raw-materials and conversion technologies.

5 **–** Evolve the analysis including sustainability (Energy and Exergy-based performance indicators).

6 **–** Evaluate how incentives can alter sustainability and process (using Renovabio as a case study).

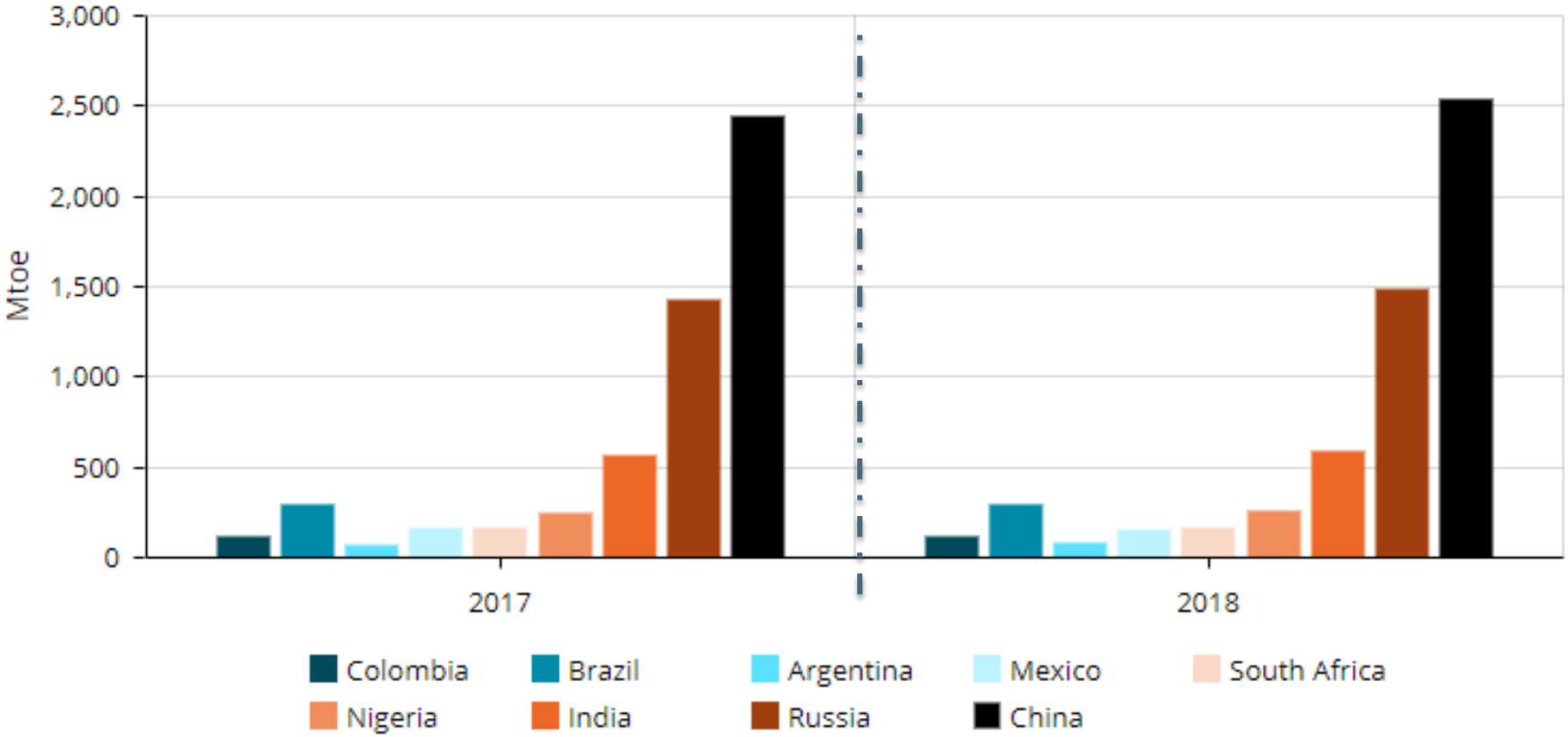
7 **-** Generation of periodic reports, (twice a year?) and scientific papers.

Total Energy Production (Mtoe) | *Selected countries*

Benchmark countries

2017 - 2018

Growth of more than 10 % per year , even in adverse economic scenario



Emerging economies – Selected countries

Enerdata, 2019

Selected countries | *Data sets*

Latin America	
	Brazil
	Argentine
	Colombia
	Mexico
Africa	
	South Africa
	Nigeria
Asia	
	India
	China
Europe	
	Russia









Key performance indicators (KPIs)

Total Energy Production (Mtoe)
Electricity domestic consumption (TWh)
Share of renewables in electricity production (%)
CO2 emissions from fuel combustion (MtCO2)
cNR: unit exergy cost of non-renewable (kJ/kJ)
cR: unit exergy cost of renewable (kJ/kJ)
cT: unit exergy cost total (kJ/kJ)
mCO2: CO2 emissions (gCO2/kWh)
Renewability exergy index
Global energy and exergy efficiency
Carbon Efficiency
Fuel selling price

Methodology: Techno-economic assessment and Life-Cycle approach together with Exergy Analysis

Scope: *Developing Countries with large populations and high energy demand.*

SYSTEM ANALYSIS

Integrated methodologies approach

Key performance indicators *(KPIs)*

Methodology: Techno-economic assessment and Life-Cycle approach together with Exergy Analysis

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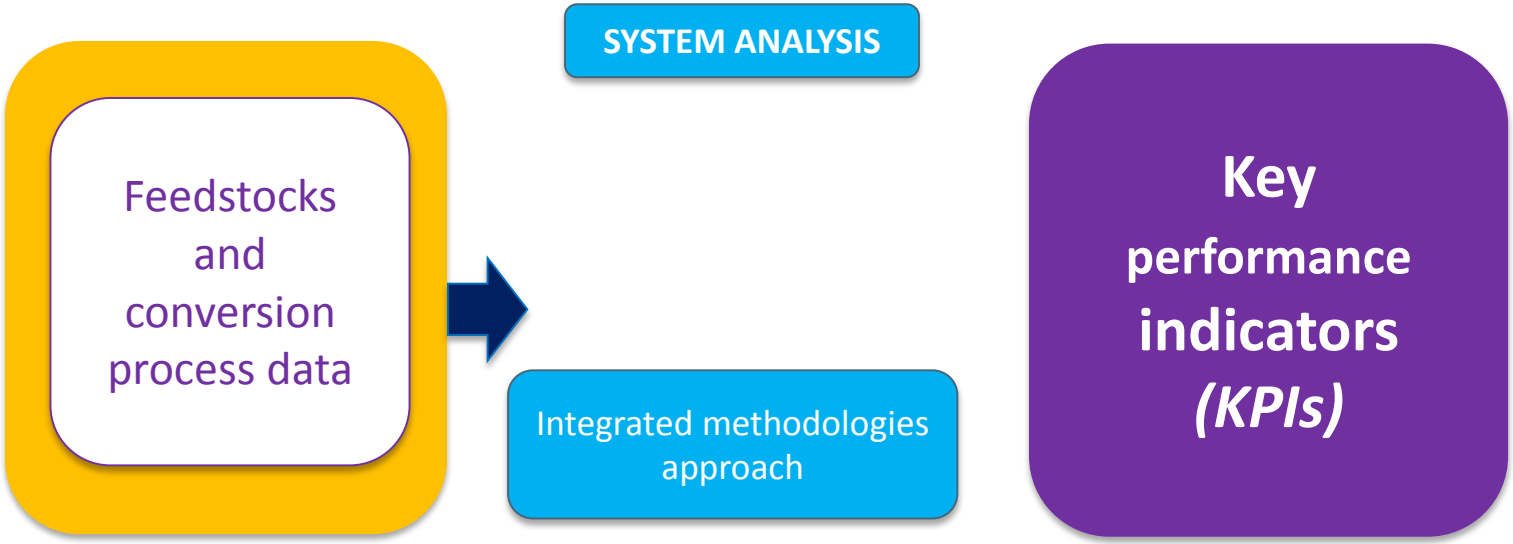

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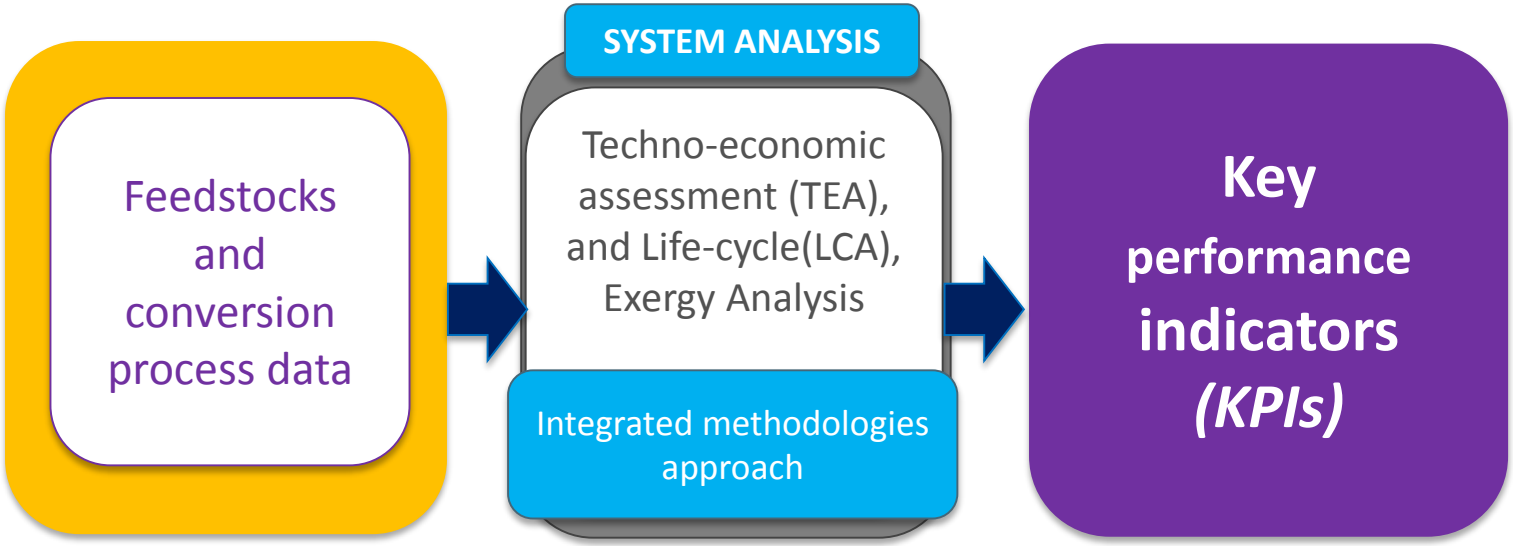

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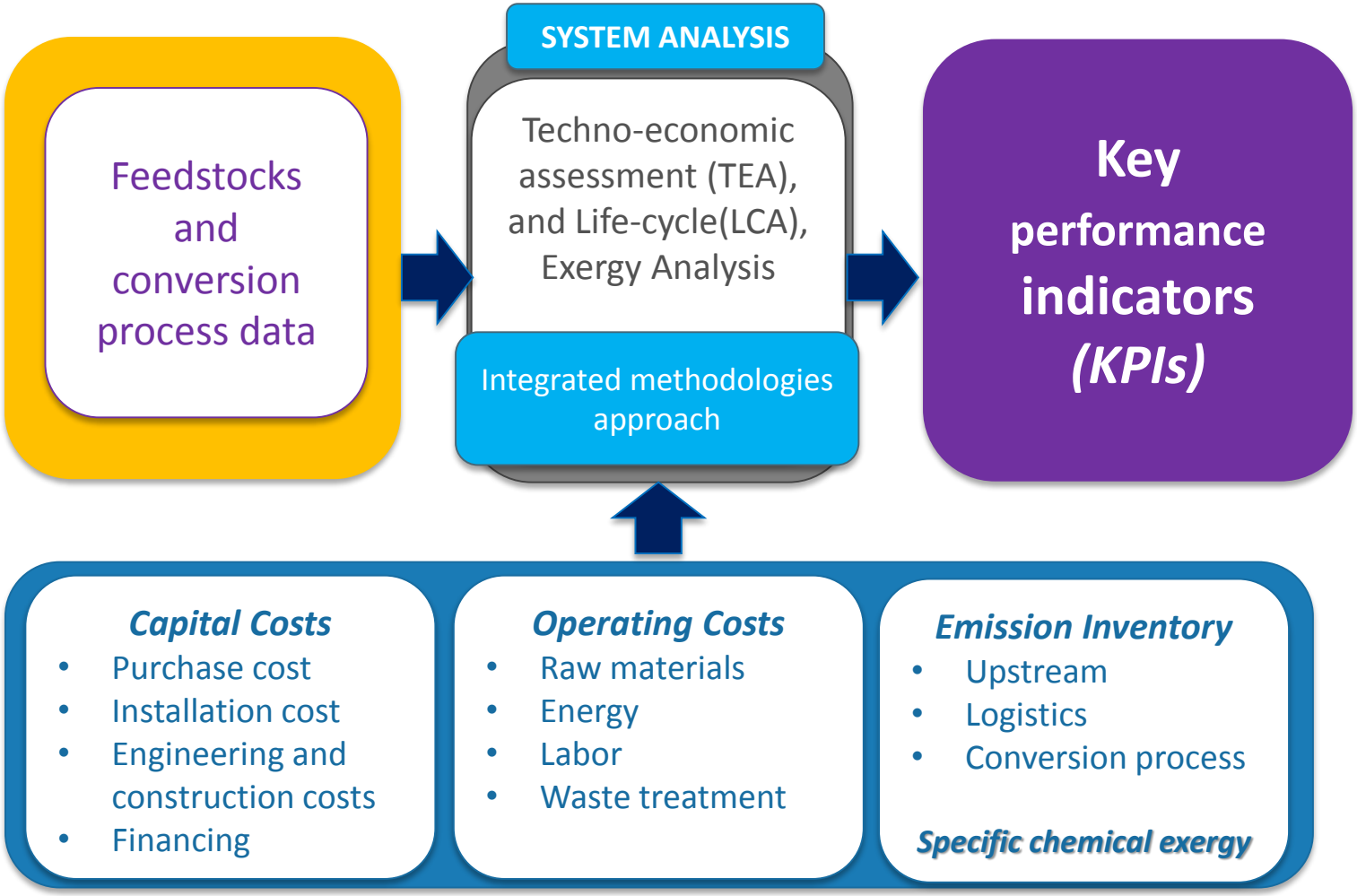


Conclusions

- The proposed approach coupling together Techno-economic Analysis, Life-Cycle, and Exergy appear to be a working tool to identify more clearly the most suitable energy source.
- As far as renewable energy is concerned, the procedure allows to identify beforehand the suitable feedstocks and possible conversion routes.
- CO2 emissions due to energy generation, including fuels, is increasing around the world, but more drastically in countries with emerging economies. The share of renewables in electricity production (%) is still very low.

Next Steps

- Database development.
- Update and expansion of the database of the energy matrix, including feedstock production and use for energy in each of the selected countries.
- Identification of possible raw-materials and conversion technologies in each of the selected countries.
- Evaluation of incentives using the Renovabio program as a case study.
- Generation of periodic reports and scientific papers.

Data sources

Latin America

Brazil	MME - Ministério de Minas e Energia		http://www.mme.gov.br/
	EPE - Empresa de Pesquisa Energética		http://www.epe.gov.br/pt
	ANP - Agência Nacional do Petróleo, Gás Natural e Biocombustíveis		http://www.anp.gov.br/
Argentine	Ministerio de Energía de la República Argentina		https://www.argentina.gob.ar/energia http://www.energia.gov.ar/contenidos/verpagina.php?idpagina=3483 https://www.argentina.gob.ar/energia/hidrocarburos/balances-energeticos
Colombia	MME	Ministerio de Minas y Energía - MinMinas	https://www.minenergia.gov.co/
	UPME	Unidad de Planeación Minero Energética	http://www1.upme.gov.co/Paginas/default.aspx http://www1.upme.gov.co/InformacionCifras/Paginas/BECOENERGTICO.aspx
	ANH	Agencia Nacional de Hidrocarburos	http://www.anh.gov.co/Paginas/inicio/defaultANH.aspx
Mexico	SENER - Secretaría de Energía		https://www.gob.mx/sener
	SIE - Sistema de Información Energética		http://sie.energia.gob.mx/
	FIDE - Fideicomiso para el Ahorro de Energía Eléctrica		http://www.fide.org.mx/

Data sources

Africa

South Africa	Department of Energy	http://www.energy.gov.za/ http://www.energy.gov.za/files/energyStats_frame.html
Nigeria	Federal Ministry of Power, Works & Housing	https://www.pwh.gov.ng/index

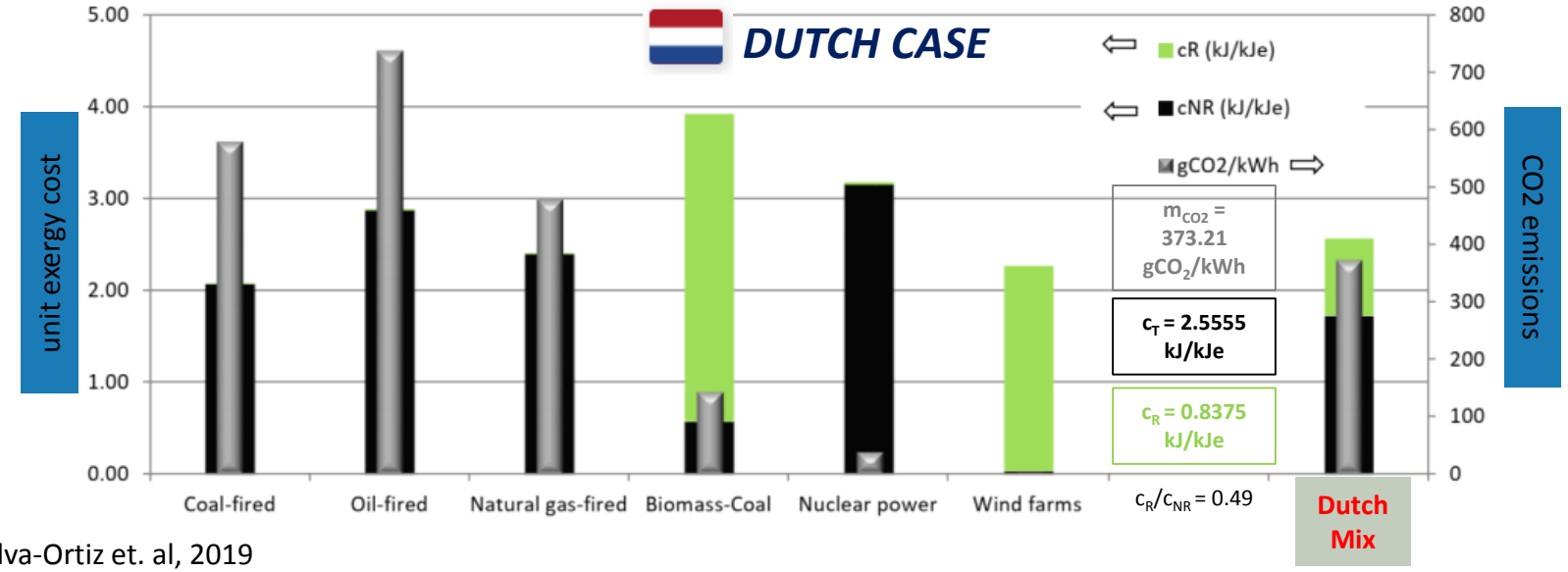
Asia

India	Ministry of Power Ministry of New and Renewable Energy (MNRE)	https://powermin.nic.in/ https://mnre.gov.in/
China	China Energy Portal	https://chinaenergyportal.org/ http://www.stats.gov.cn/english/Statisticaldata/AnnualData/

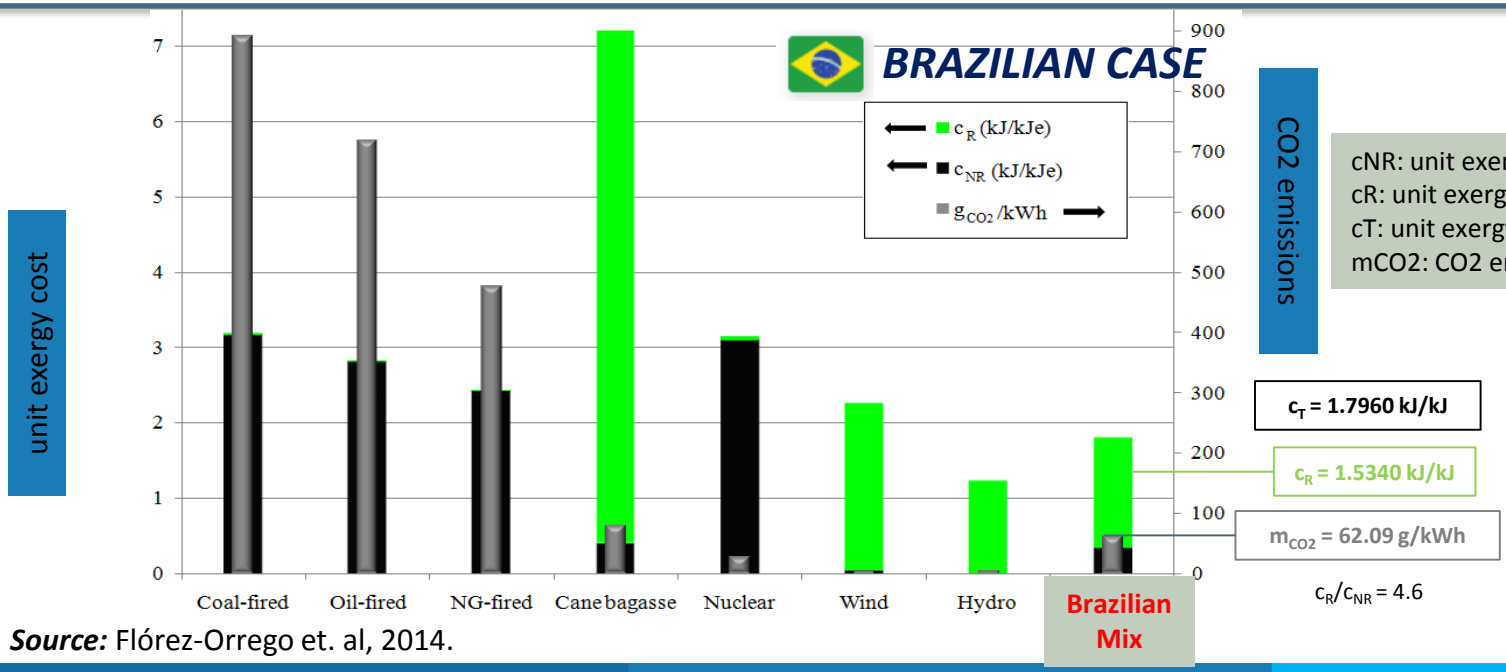
Europa

Russia	Ministry of Energy of the Russian Federation	https://minenergo.gov.ru/en https://minenergo.gov.ru/en/activity/statistic

Unit exergy cost and CO_2 emissions of the electricity generation



Source: Silva-Ortiz et. al, 2019



cNR: unit exergy cost of non-renewable (kJ/kJ)
cR: unit exergy cost of renewable (kJ/kJ)
cT: unit exergy cost total (kJ/kJ)
mCO2: CO2 emissions

Source: Flórez-Orrego et. al, 2014.