

framatome

Supplier's Session

Framatome

Alexandre Honaiser

2022 LAS/ANS Symposium - Rio de Janeiro



Mudanças Climáticas e Consequências

A Causa:

Gases de efeito estufa produzidos pelas atividades humanas contribuem para o aquecimento global.

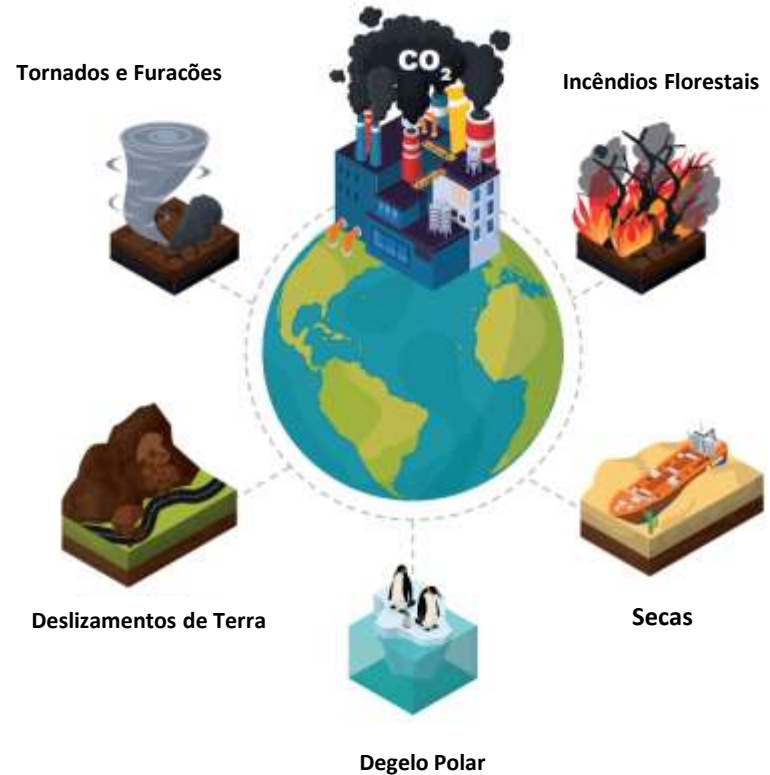
Dois terços das emissões desses gases são oriundos da produção de energia por combustíveis fósseis.

Consequências:

Aumento do nível do mar e da temperatura, eventos naturais extremos.

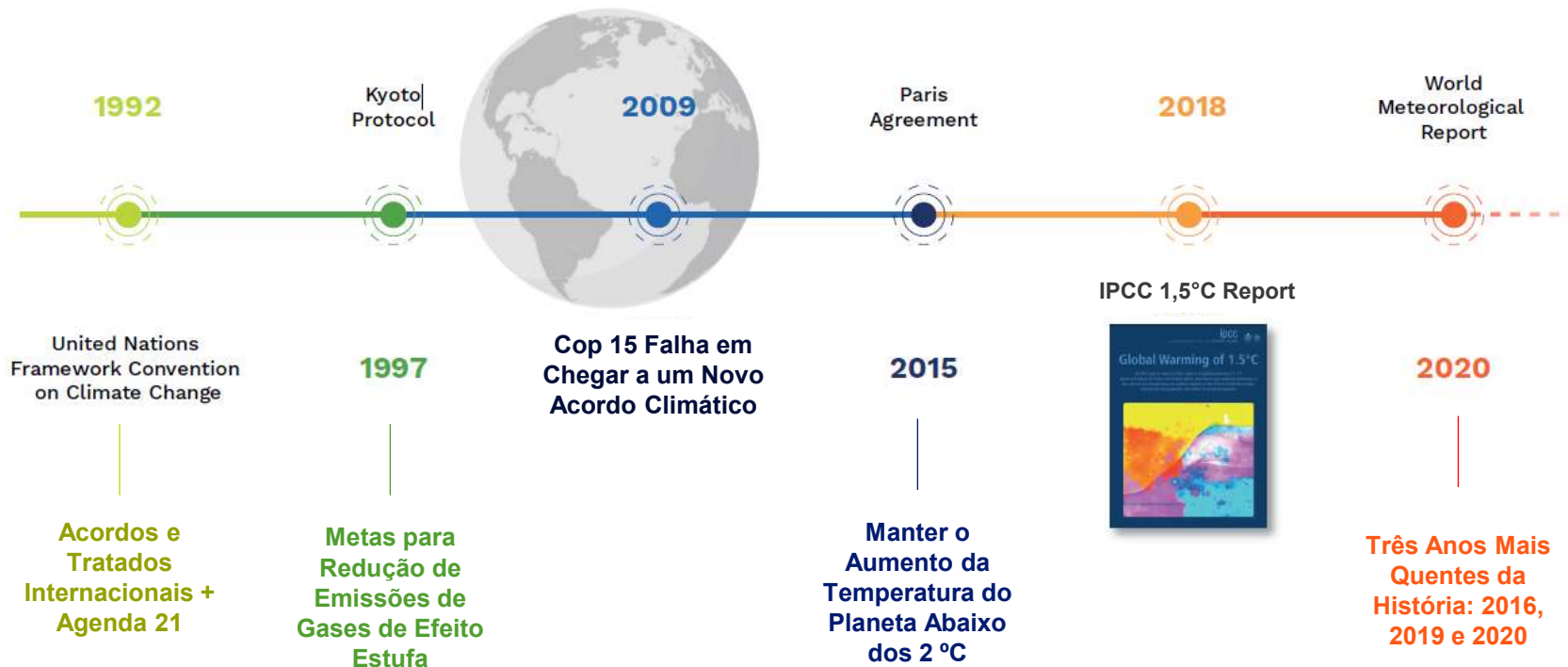
A Solução:

Para amenizar as mudanças climáticas, é necessário realizar a transição energética e descarbonizar as fontes de energia.

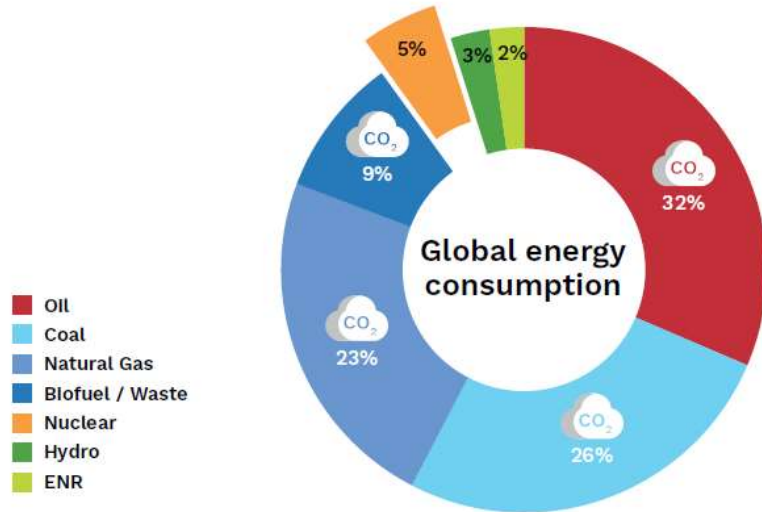


Combate à Crise Climática

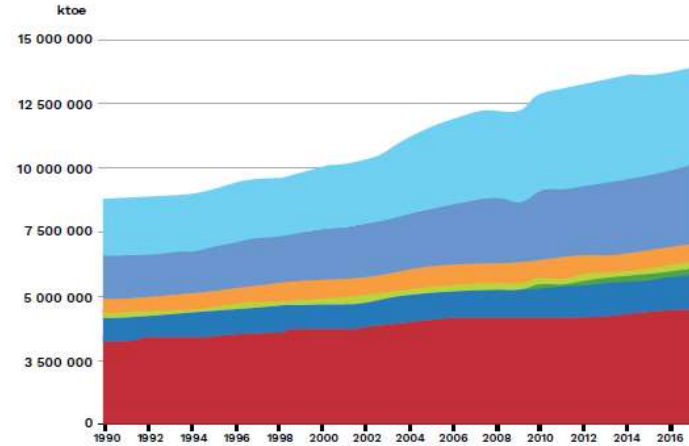
Um Panorama Histórico



A geração de energia é um grande contribuidor para emissão de CO2 em virtude do uso de combustíveis fósseis



90% do consumo global de energia é proveniente de fontes que emitem CO2

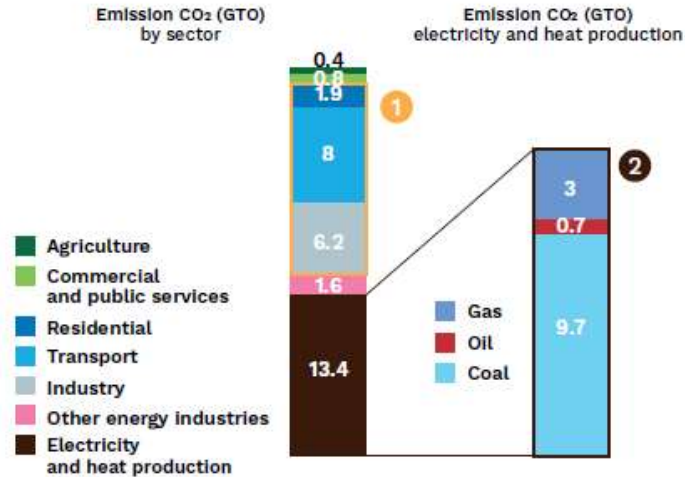


Demanda Crescente por Energia

Fonte: IEA Global Energy Review 2019

Energia de Baixo Carbono

A Solução para O Futuro



Emissão de CO2 por setor

Como “descarbonizar” a energia?

- 1- Busca por meios de transportes, aquecimento residencial e processos industriais elétricos;
- 2- Transição energética para fontes com baixa emissão de carbono: nuclear, solar, etc).

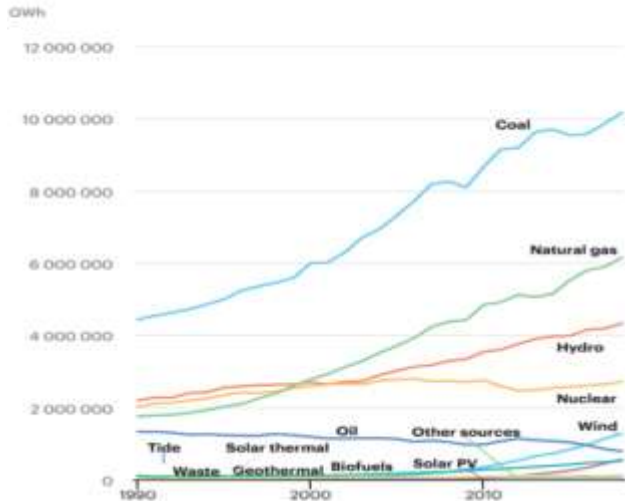
Fonte: IPCC rapport 1,5°C World Energy Outlook 2019

Nuclear

Uma Solução para o Problema

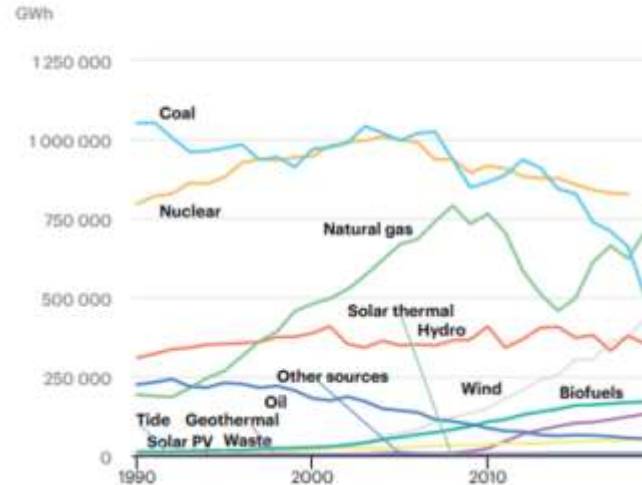
Nuclear é a segunda fonte
de geração de energia de baixo carbono **no mundo**

Electricity generation by source, World 1990-2018



Nuclear é a primeira fonte
De geração de energia de baixo carbono **na Europa**

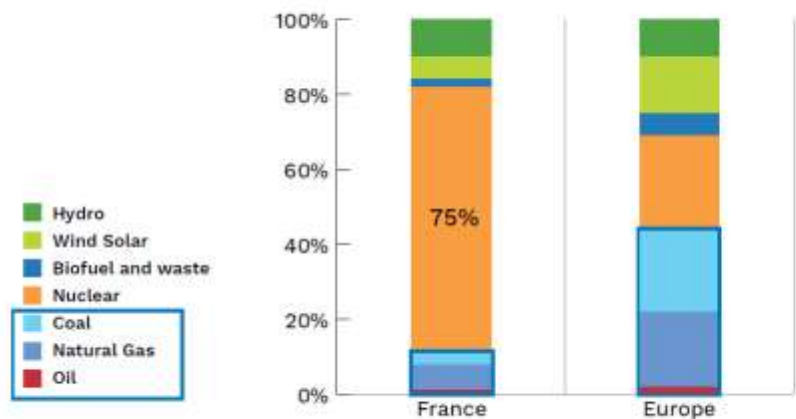
Electricity generation by source, European Union - 28 1990-2019



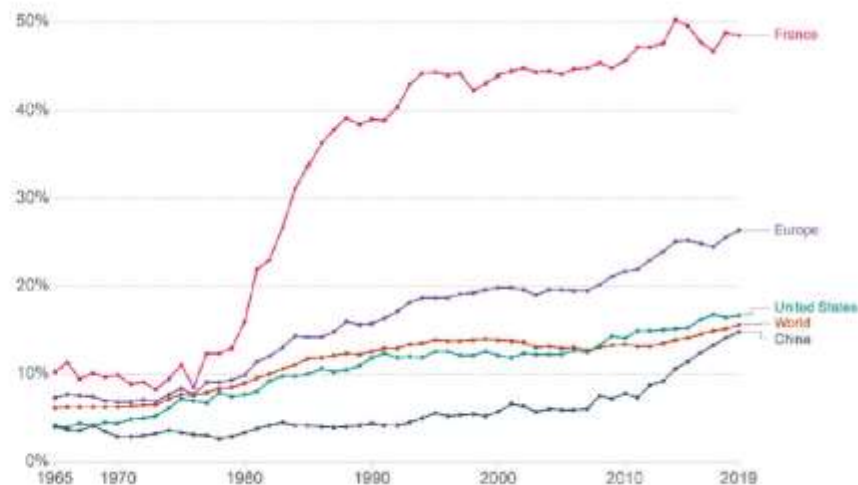
Fonte: IEA Global Energy Review 2019

França: um caso de sucesso na produção de energia elétrica de baixo carbono

Fontes de Produção de Energia Elétrica



Parcela da Produção de Energia de Baixo Carbono



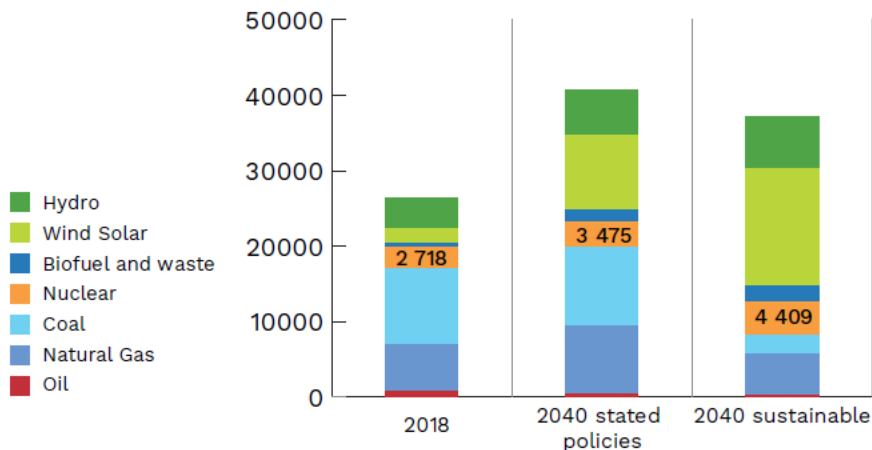
Fonte: IEA Global Energy Review 2019

O Nuclear no Futuro da Geração Energética

IPCC e AIE -> a energia nuclear é fundamental para atingir o objetivo de manter o aquecimento global em 1.5°C

Cenários AIE

Mix de geração elétrica global para 2040 (TWH)



- Mais de 400 cenários analisados, com o aumento da capacidade nuclear entre 100% e 500%

“Para atingir o ‘objetivo 1.5°C’ até 2050, a maioria dos cenários requer um aumento significativo da produção de energia de baixo carbono.”

Fonte: IPCC rapport 1,5°C World Energy Outlook 2019

Um Sistema de Energia de Baixo Carbono



Para “descarbonizar” a produção de energia, é preciso:

- A “eletrificação” do consumo de combustíveis fósseis (carvão, petróleo e gás natural)
- A descarbonização da produção a partir de fontes renováveis (hídrica, eólica, solar) e **energia nuclear**

A energia nuclear é a única fonte de energia de baixo carbono que fornece eletricidade **firme, segura e competitiva**

Fatos sobre a Energia Nuclear

~450

Reatores em
Operação no
Mundo

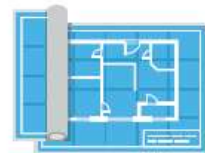


52

Reatores em
Construção

78

Plantas
Planejadas



30

Países que utilizam a
energia nuclear têm a
oportunidade para
expansão rápida

Entre 1971-
2018, a **energia
nuclear** evitou



Fonte: IEA Global Energy Review 2019

A Framatome e a Descarbonização

Ao fornecer produtos e serviços inovadores que prolongam a vida operacional das centrais nucleares, a Framatome possibilita a seus clientes uma continuidade da geração de energia de baixa emissão de carbono.

Reconhecemos a energia nuclear como parte fundamental das soluções para objetivos estabelecidos de redução da emissão de carbono ao redor do mundo.



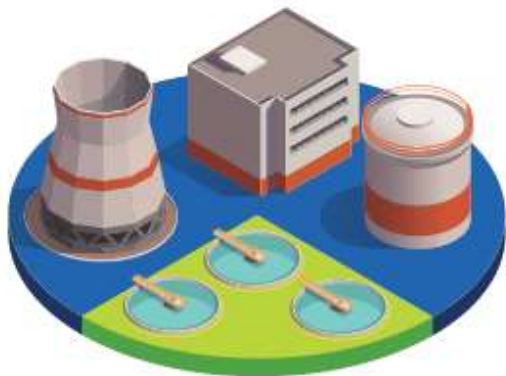
Covalion (powered by Framatome)

- Soluções com Hidrogênio



Framatome, temos orgulho de nossa história

Há 60 anos, nossos times desenvolvem tecnologias para geração de energia limpa, segura, competitiva e de baixo carbono em todo o mundo.

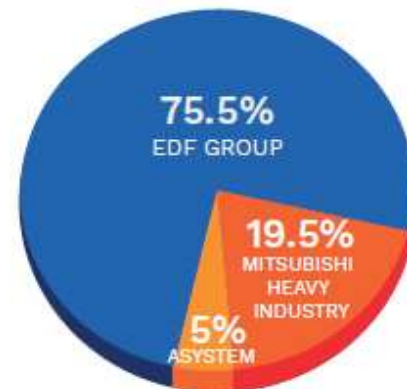


Serviços em aproximadamente

400 reatores



Mais de **14.000**
colaboradores em **20**
países



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Obrigado!

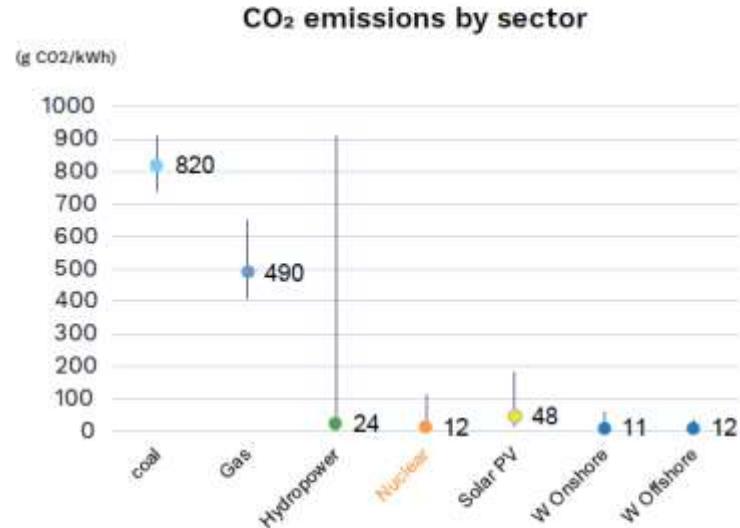


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Q1 Does nuclear power emit CO₂?

Nuclear only emits CO₂ during construction, start-up, dismantling and fuel fabrication.

There are no CO₂ emissions generated from nuclear power plant operations.



Source : IPCC - Climate Change 2014 - Annex III: Technology-specific cost and performance parameters. In:

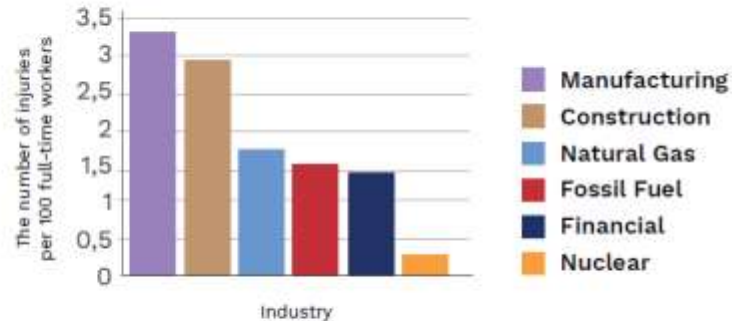
Q2 Is nuclear energy safe?

The safety record of the nuclear industry is unmatched by any other energy source or industry comparison.

Safety is engrained in the culture of every nuclear plant.

At Framatome, there is absolutely no room for compromise on safety and security in our industry and that is the way it must stay. Safety and security are the guarantees of Framatome's future. Its our license to lead.

Incidence rates of nonfatal occupational injuries and illnesses by industry



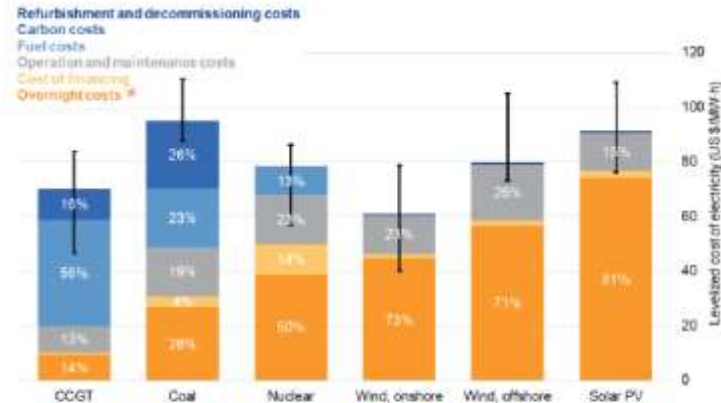
Source : U.S. Bureau of Labor Statistics 2018

Q3 Is nuclear energy competitive?

On a lifetime basis, nuclear power is an economic source of electricity generation, combining the advantages of security, reliability and very low greenhouse gas emissions.

Existing plants function well with a high degree of predictability. **The operating cost of these plants is lower than almost all fossil fuel competitors, with a very low risk of operating cost inflation.**

Plants are now expected to operate for 60 years – with some U.S. plants licensed to 80 years.



* Construction costs

Source IAEA (International Atomic Energy Agency) Climate Change and Nuclear Power 2020

Q4

Does nuclear energy require more materials for operations than other energy sources?

Nuclear Power is a concentrated energy source. The construction of one plant (mainly composed of concrete and steel) allows it to produce **abundant TWh*** considering its life time (Fuel is excluded).

In comparison renewable energy sources need a lot of materials to produce the same amount of energy

*Terra-watt hour

Range of materials requirements (fuel excluded) for various electricity generation technologies

Materials (ton/TWh)	Generator only			
	Coal	NGCC	Nuclear PWR	Biomass
Aluminum	3	1	0	6
Cement	0	0	0	0
Concrete	870	400	760	760
Copper	1	0	3	0
Glass	0	0	0	0
Iron	1	1	5	4
Lead	0	0	3	0
Plastic	0	0	0	0
Silicon	0	0	0	0
Steel	310	170	960	310

Upstream energy collection plus generator			
Hydro	Wind	Solar PV (silicon)	Geothermal HT binary
0	35	680	100
0	0	3,700	750
14,000	0,000	350	1,100
1	23	650	2
0	92	3,700	0
0	120	0	8
0	0	0	0
0	190	210	0
0	0	57	0
67	1,800	7,900	3,300

Key: NGCC = natural gas combined cycle;
 PWR = pressurized water reactor;
 PV = photovoltaic;
 HT = high temperature

DOE, Quadrennial Technology Review, An assessment of energy Technologies and research opportunities, September 2015

Q5

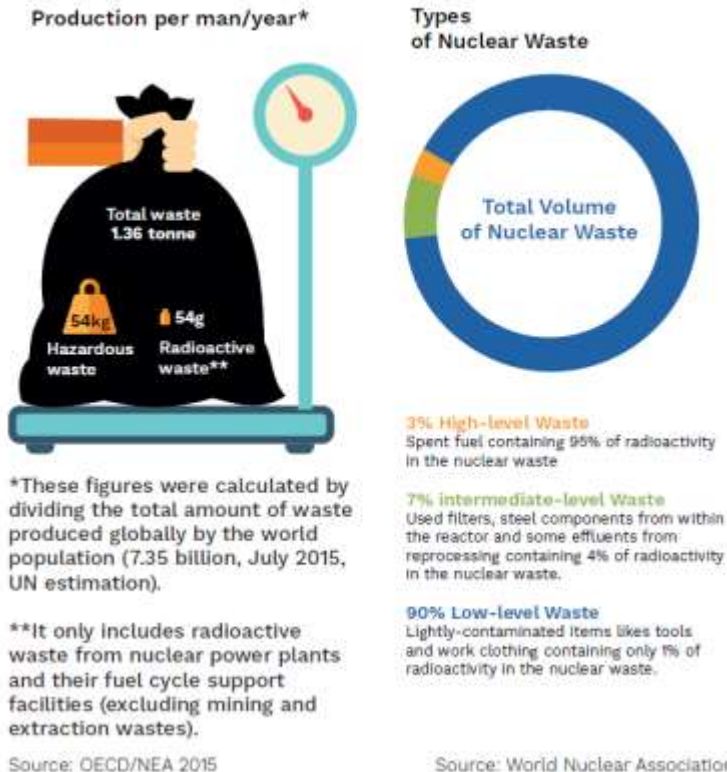
How is the nuclear industry managing its waste?

Unlike any other energy generating industry, the nuclear sector takes full responsibility for all of its waste.

- 3% of the total volume of waste, contains 95% of the total radioactivity.

The industry knows exactly where its used fuel is located, and knows it is safely contained:

- at existing generating facilities,
- in offsite controlled and regulated environments,
- or recycled - 97% can be recycled as fuel for certain reactors

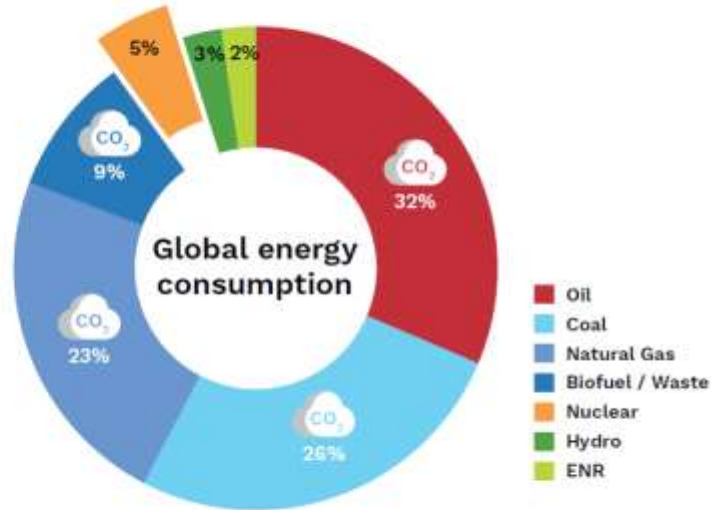


Q6 Can 100% renewable energy meet net-zero climate goals?

100% renewable scenarios published around the world provided no proof of feasibility on:

- Security of supply
- Current and future needs
- Balance of the electricity system

Finding a dependable, zero-emitting, cost-effective alternative to nuclear power is challenging.



90% of energy consumption is from carbon-emitting energy sources. Renewable energy is only 5% of the mix.

Source IEA Global Energy Review 2019, www.iea.org

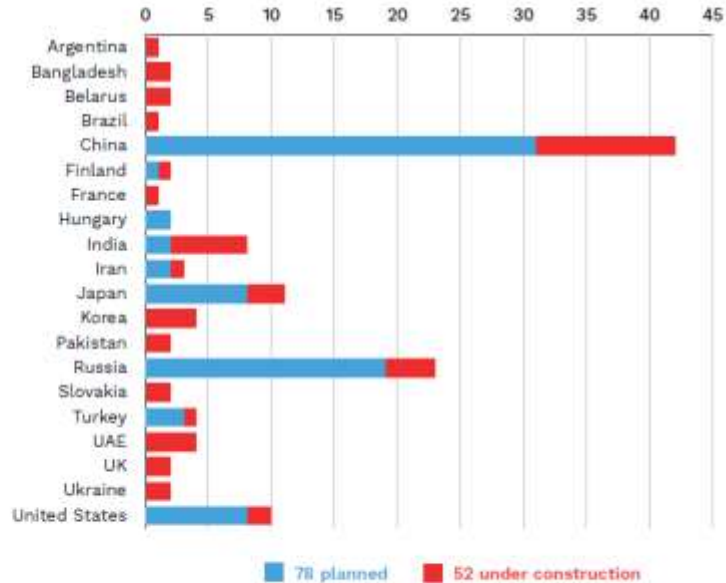
Q7

Are countries exiting from nuclear energy?

As Germany phases out of nuclear by 2022 with reliance on energy imports, the path forward is clear for many countries:

- U.S. Department of Energy confirms Nuclear energy as a clean energy, extends plant operations to 80 years
- China confirms ambition as nuclear world leader
- Poland, Hungary, Romania, UAE, Slovakia and Czech Republic consider entering or continue to develop nuclear power
- UK re-launched its nuclear program as a solution of energy independence

The world's new nuclear construction plan



Source: IAEA: Nuclear Power Plants in the world 2020

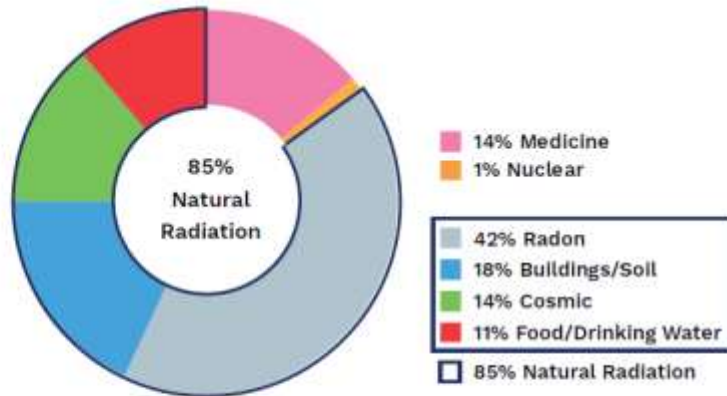


Does nuclear energy give off safe levels of radiation?

Radiation is a well-understood process, with natural sources accounting for most of the radiation a person receives each year.

Contrary to public perception, nuclear power accidents have caused very few fatalities and the use of nuclear energy does not expose members of the public to significant radiation levels.

Sources of Radiation



Source: World Nuclear Association