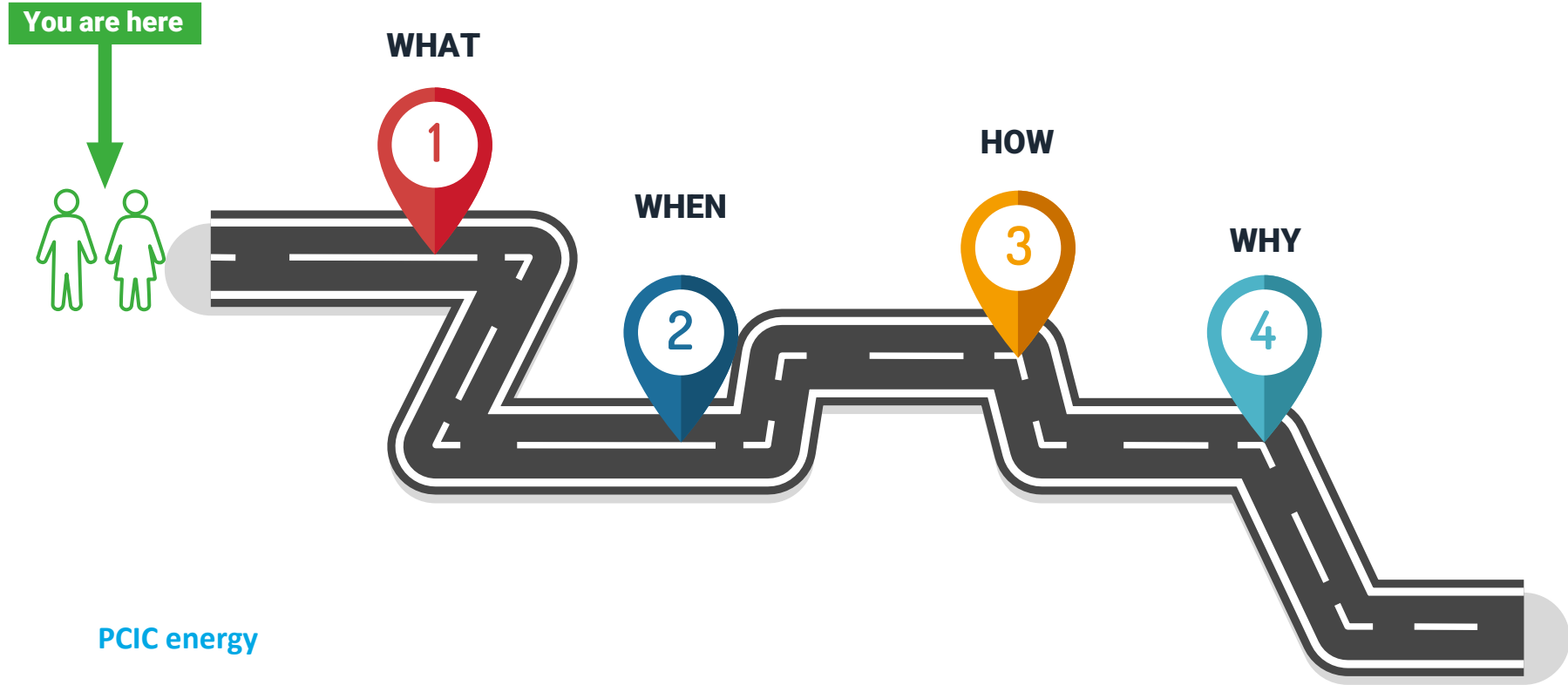




How digital can create value from carbon footprint reduction?

Jean Guilhem, 2B1st Consulting

Carbon Footprint Journey

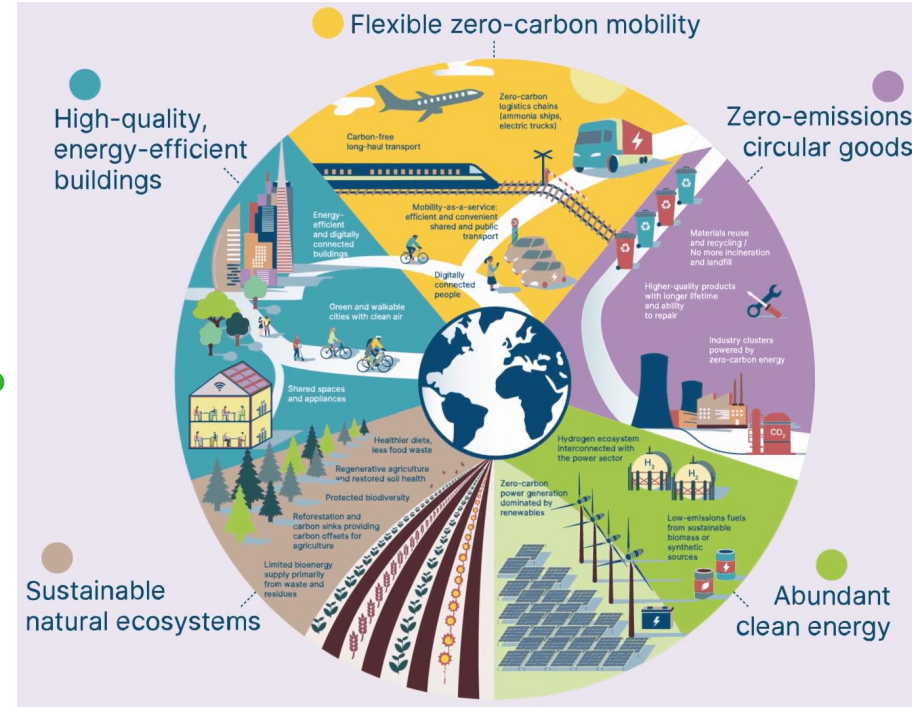


Summary

- Introduction
- Carbon Footprint definition and scope
- Net Zero 2050 and COP 28 implications
- Carbon footprint complexity
 - Projects construction
 - Operations
 - Example of carbon footprints
- Digital to tackle carbon footprint challenges
 - Calculations
 - Reductions
 - Use Cases
- Creating value from carbon reduction

Introduction

- Once upon a time....
As a company we did our Carbon Footprint calculations in 2022 and, it was an adventure
- How would it look like as an industry ?
Going for sustainable energy
And with the Net Zero 2050



Introduction

2019 is often taken as reference year
before energy transition started

- Energy among emissions

75% of emissions are linked to energy

GHG emissions, as of 2019, GtCO₂e/y

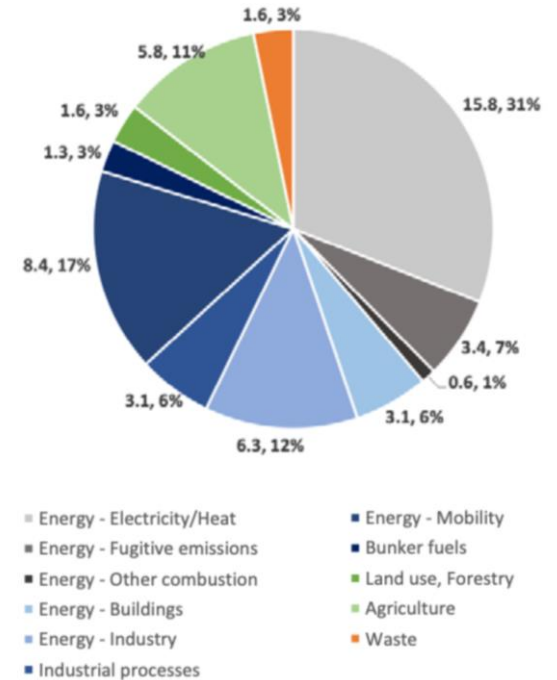
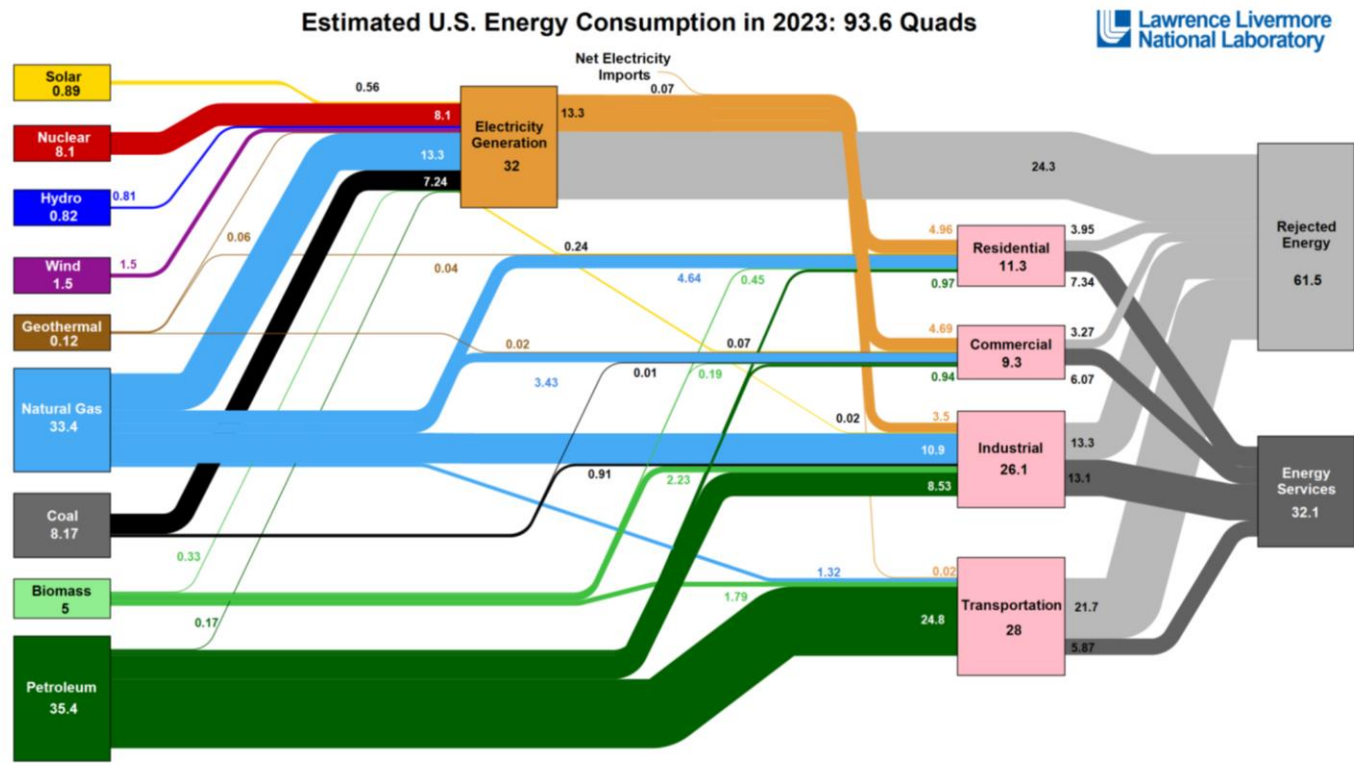


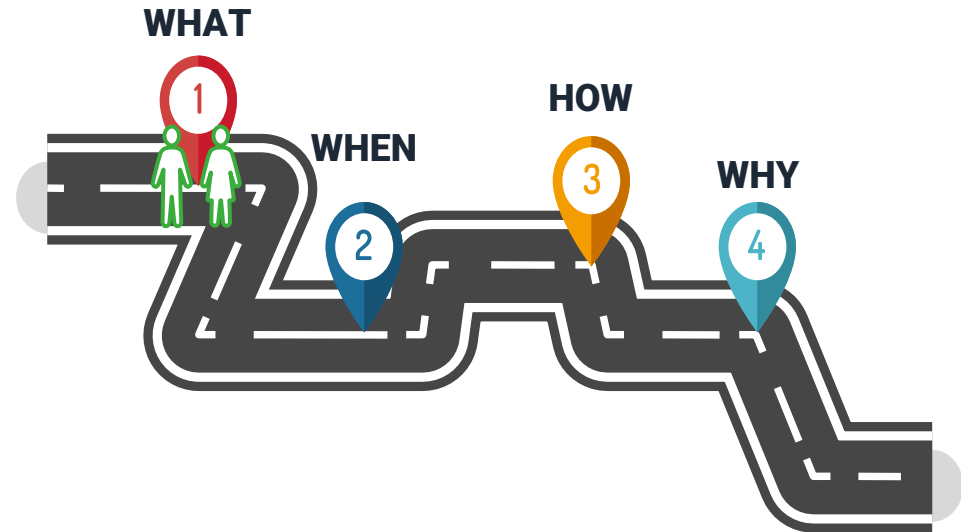
Figure 1 – Greenhouse gas emissions, per sector, as of 2019⁴

Room for improvements



Source: LLNL October, 2024. Data is based on DOE/EIA REGS (2024). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 49% for the industrial sector, and, 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

CARBON FOOTPRINT DEFINITION & SCOPE



What is Carbon Footprint ?

- Definition :

The **carbon footprint** of a company refers to the **total amount of greenhouse gases**, specifically CO₂ and other equivalent gases, that are directly or indirectly **emitted by the company's activities**.

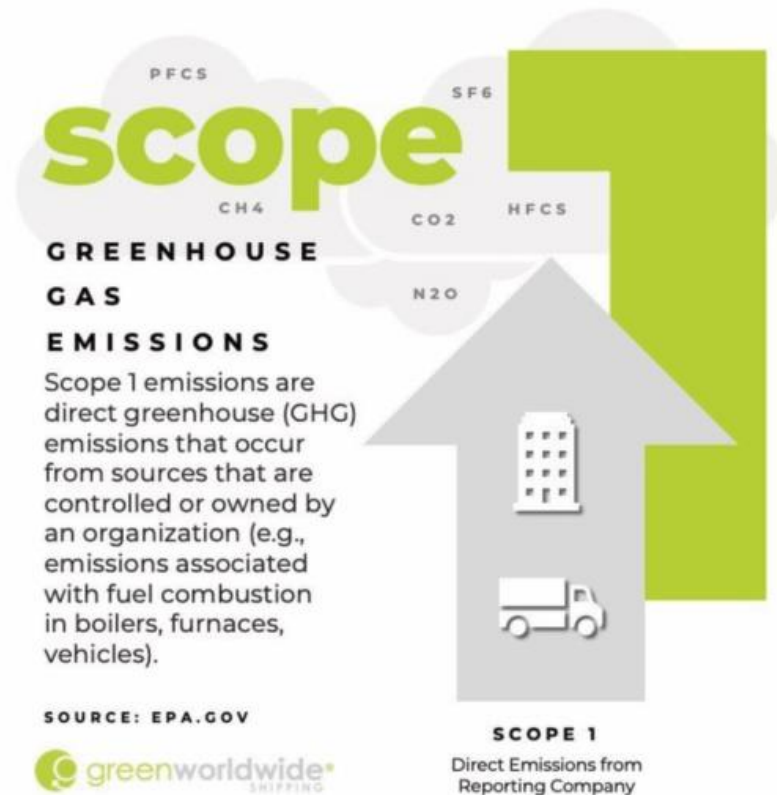


Greenhouse Gas	Global Warming Potential (100-year)	Atmospheric Concentration (Approximate)
Carbon Dioxide (CO ₂)	1	0.0415% (415 ppm)
Methane (CH ₄)	25	0.00018% (1.8 ppm)
Nitrous Oxide (N ₂ O)	298	0.00033% (3.3 ppm)
Sulfur hexafluoride (SF ₆)	23,500	Parts per trillion
Water Vapor (H ₂ O)	Not commonly quantified due to its short atmospheric residence time	2%
Ozone (O ₃)		
Chlorofluorocarbons (CFCs)	7000	Varies (typically measured in parts per trillion)
Hydrofluorocarbons (HFCs)	4000	
Perfluorocarbons (PFCs)	10,000	

Carbon Footprint Scope 1

Scope 1 : Direct emissions

- Carbon emissions from assets owned and controlled by the company
- E.g. fuel consumption from vehicles, fugitive emissions, venting, flaring, boilers, furnaces smokes, heating system



Carbon Footprint Scope 2

Scope 2 : Indirect emissions

- Carbon emissions generated by the purchased energies
- E.g. electricity, steam, heat, cooling

It reflects the environment impact of energies consumption in the company.



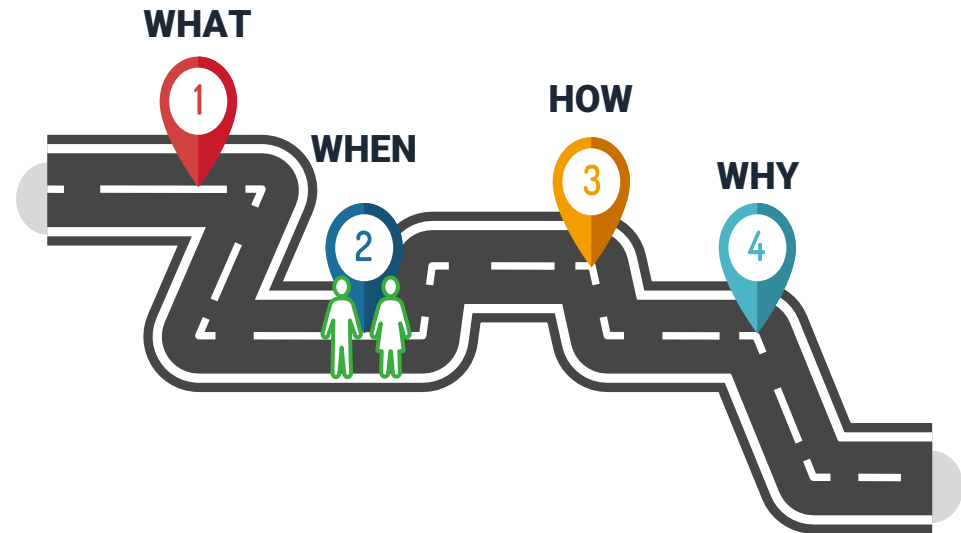
Carbon Footprint Scope 3

Scope 3 : Indirect emissions

- Carbon emissions from the value chain of the company.
- Both Upstream and Downstream
- Upstream : Purchased equipment and services, capital assets, energy related, transportation and distribution, waste generated, travels, employees commuting
- Downstream : Processing of sold goods, Use of produced goods, end-of-life products, investments, franchises



NET ZERO 2050 AND COP 28 IMPLICATIONS



Global Warming is already in Action

- Scientifically proven to be provoked by Human activity
- Already having long term impacts on our planet
- Global problem that we need to tackle



HOTTER
TEMPERATURES



MORE SEVERE
STORMS



INCREASED
DROUGHT



A WARMING, RISING
OCEAN



LOSS
OF SPECIES



NOT ENOUGH
FOOD



MORE
HEALTH RISKS



POVERTY AND
DISPLACEMENT

COP 21 changed the Direction



UN Climate Change

12 décembre 2015 · 🌐

...

"History has been made in Paris, the City of Lights. The Paris Agreement confirms the irreversible transition to a low carbon, safer and healthier world."
– UN Climate Chief, Christiana Figueres.

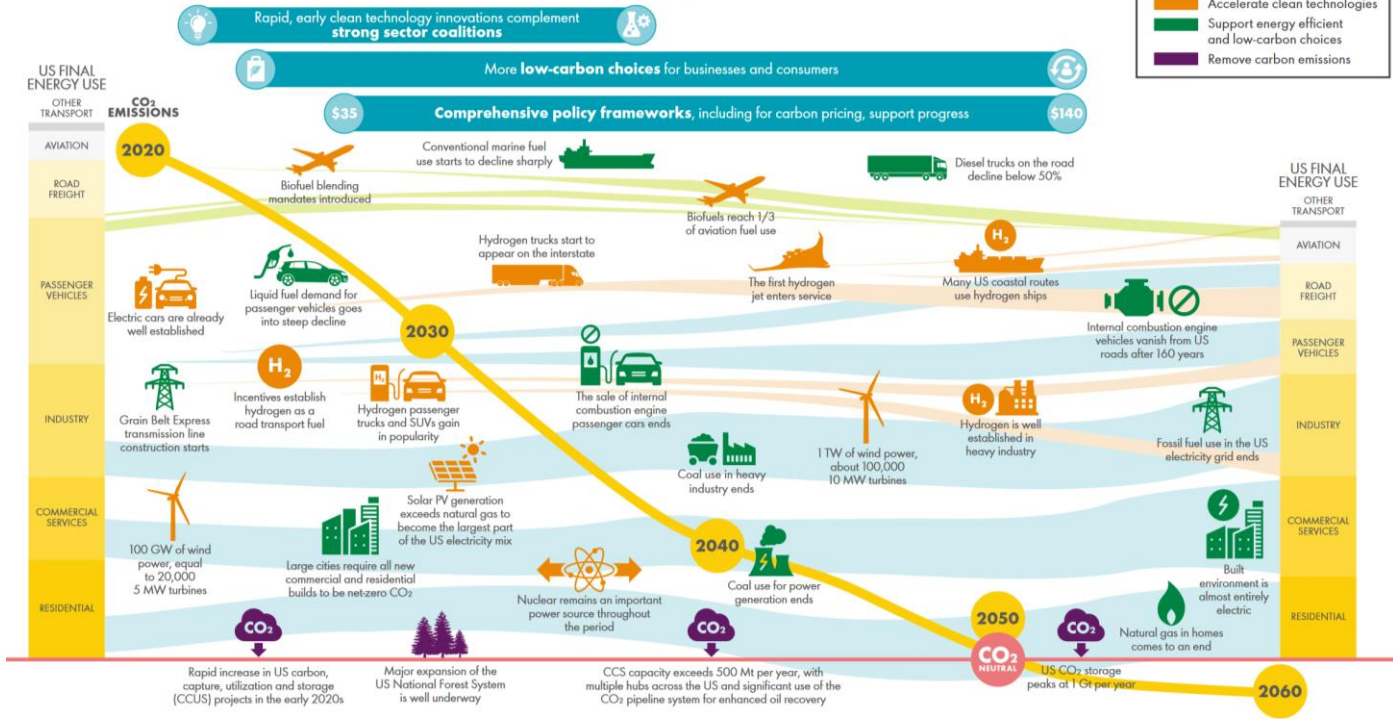
Read about the agreement > > <http://ow.ly/VOFG4>
#ParisAgreement #COP21

- Adopted by 196 countries
- Countries submit Nationally Determined Contributions (NDCs) every 5 years
- Goals :
 - Reach climate neutrality in 2050
 - Hold the increase of global temperature below 2°
 - Limit the warm to 1.5°

Net Zero 2050 – Vision by Shell

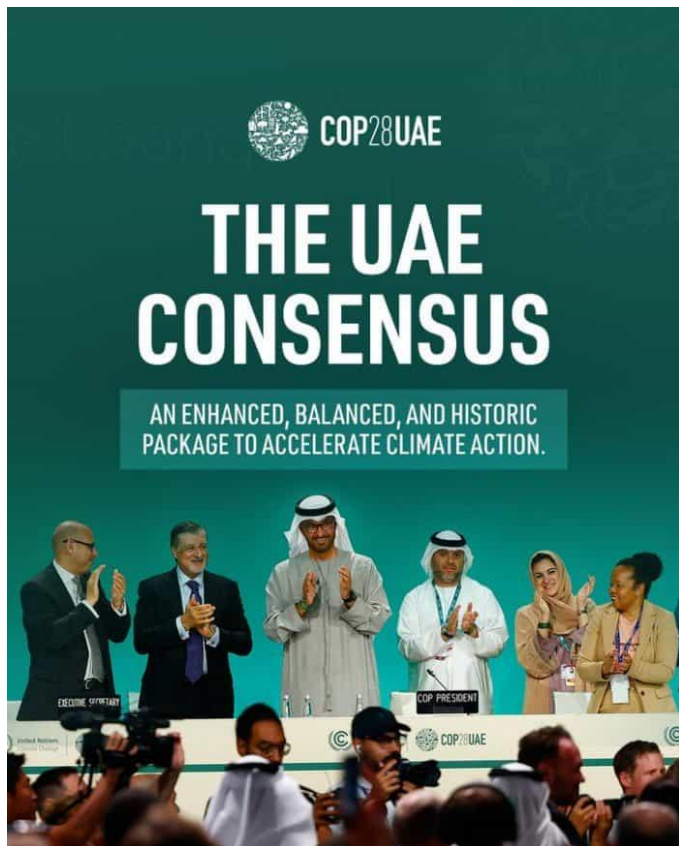
Shell Scenarios *Sketch*

A US net-zero CO₂ energy system by 2050



Disclaimer: Scenarios don't describe what will happen, or what should happen, rather they explore what could happen. Scenarios are not predictions, Shell strategy or business plans. Please read the full disclaimer for this scenario at www.shell.com/USsketch

COP 28 impacts on projects



PCIC energy

Methane & other Non-CO2 Gasses

- Support the reduction of methane and other greenhouse gas emissions to zero in 2030 across sectors : energy, farming, livestock, waste.

Decarbonizing the Energy System of Today

- Signed by 78 companies (63% of the total volume of production)
- Transition away from coal

Building the Energy System of the Future

- Tripling renewables and doubling annual energy efficiency improvements by 2030

Some Banks stop investing in fossil projects

Barclays drops funding for new oil and gas fields. How do other big European banks compare?

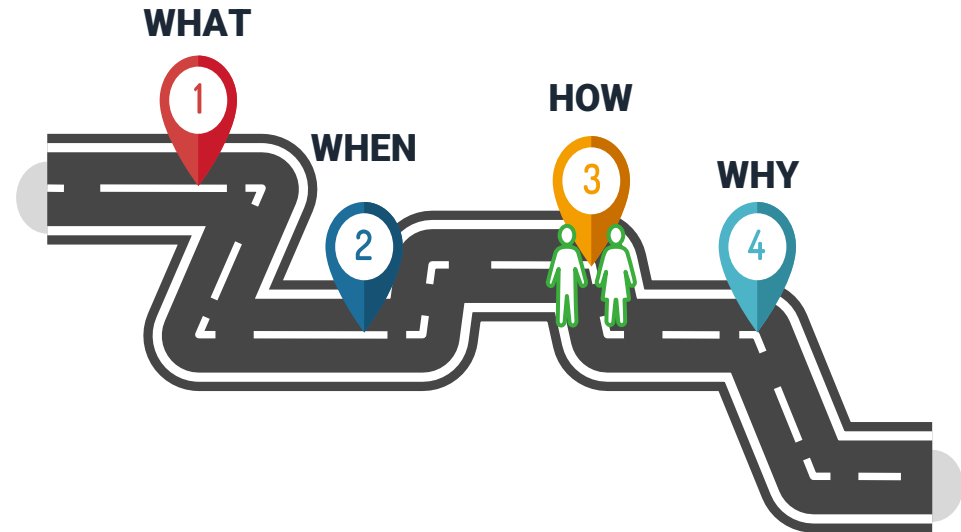
What does Barclay's new climate policy mean?

Released alongside a Transition Finance Framework plan, Barclays' climate statement commits it to **stop directly funding "upstream oil and gas expansion projects"** and, notably, infrastructure.

From 2025, it will **curb** broader financing to **non-diversified, pure extraction companies** if more than 10 per cent of their spending goes towards expanding long-term production.

The bank is also cutting off finance to what it calls "**unconventional oil and gas**" extraction - signaling an end to "business appetite" in the Amazon biome and Arctic circle. **Oil sands exploration and fracking in Europe** are off the menu too, with immediate effect, though campaigners point out that the vast majority of fracking is happening elsewhere.

CARBON FOOTPRINT COMPLEXITY



What is Carbon Footprint for a project ?

- For a projects :

Construction



Referring to the emissions from
Feasibility Study to Commissioning



Operations



Referring to the emissions from
Operations to Decommissioning

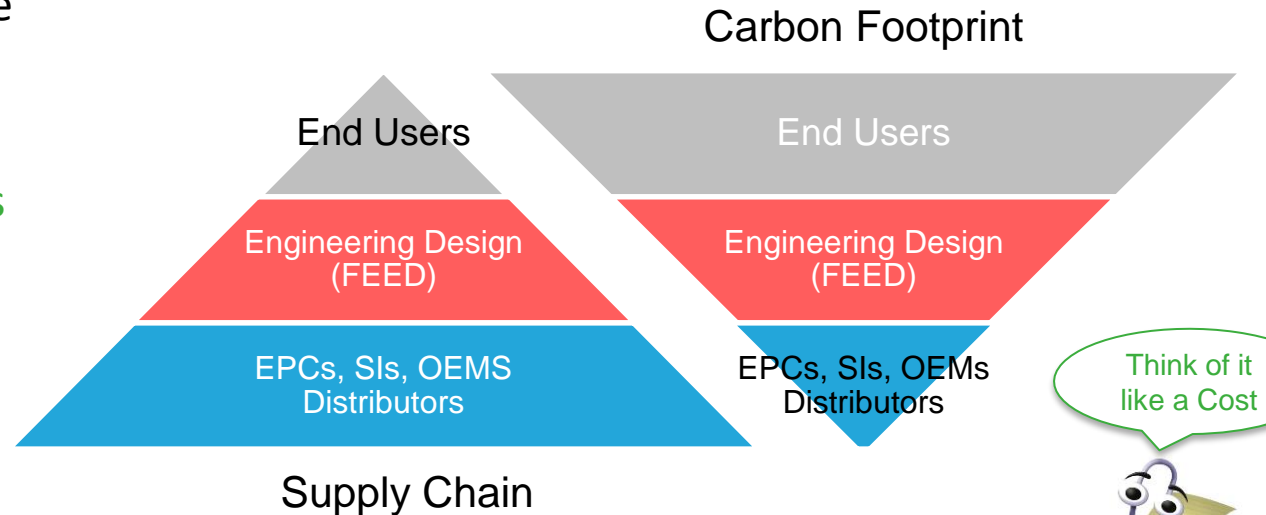
Think of it
like a Cost



Carbon Footprint from engineering & procurement

- Giant addition from the carbon footprint of :
 - Engineering hours
 - Each equipment (Manufacturing + Transportation)
OEMs, Suppliers, Sub-Suppliers,
 - Each solutions/service

-> collaborative process



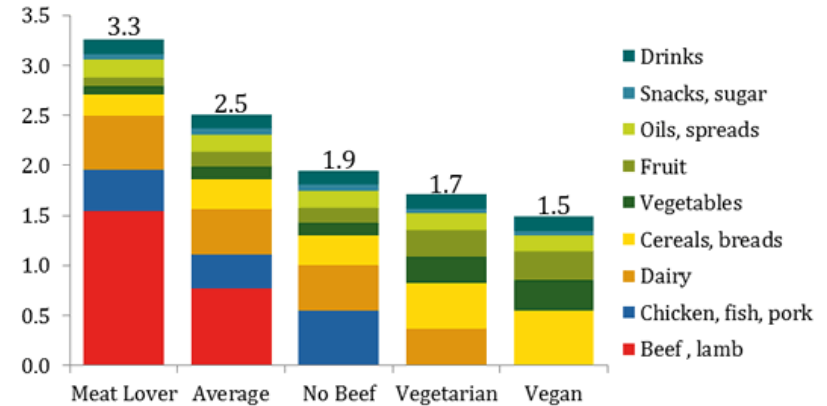
Carbon Footprint from project construction

- Include emissions from various natures :

- Engineering hours
- Modification of the land used
- Raw Material (steel, cement)
- Usage of construction engine
- Energy Consumption
- Transportation
- Food eaten by workers ->

- Multiply your data with their corresponding Emission Factor

Foodprints by Diet Type: t CO₂e/person



Note: All estimates based on average food production emissions for the US. Footprints include emissions from supply chain losses, consumer waste and consumption.. Each of the four example diets is based on 2,600 kcal of food consumed per day, which in the US equates to around 3,900 kcal of supplied food.

Sources: ERS/USDA, various LCA and EIO-LCA data



Carbon Footprint from Operations

- Surprisingly, it is less complex as there is only one actor:
 - Energy used or brought
 - Fugitive, Venting and Flaring
 - Personnel activities or maintenance
 - Spare parts
 - Decommissioning



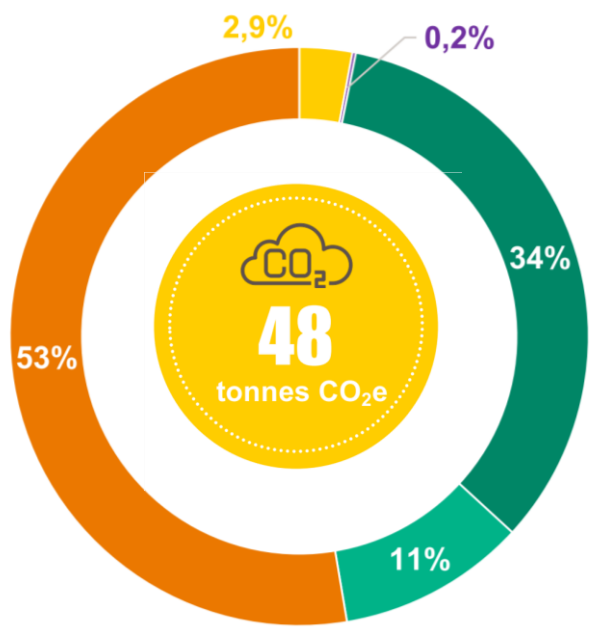
Aggregate the data

- Once collected, data need :

- Formatting
- Time span
- Legal Framework
- Greenhouse Gas Protocol (GHG Protocol)
- ISO 14064-1
- ISO 14064-3
- Carbon Trust Standard:
- Science-Based Targets Initiative (SBTi)
- CDP (formerly Carbon Disclosure Project)
- EU Emission Trading Scheme (EU ETS)
- And this is volumes of data of different nature

2B1st - Collecte des données - Diagnostic Decarbon'Action						
Période pour les données à collecter :			Année 2022 : du 1er janvier 2022 au 31 décembre 2022			
Postes d'émissions	Sous postes	Donnée recherchée	Source de la donnée en fonction du périmètre		Avancement de la collecte	Commentaires
Données générales	Chiffre d'affaires	€	Quot ?	Quot ?	729985	
	Nombre de salariés	Temps plein équivalent	Comptable	Jean	3,5	
	Nombre d'utilisateurs	Personne	Comptable	Jean	100	
	Caractérisation des sites : type, m2, mode de chauffage, climatisation, équipements	M² et parking	Outils	Jean	"Bureaux Annecy 20m²" "Bureaux Chamoni 43 m²" "Parking à annexe 1 place"	
Energie	Electricité	kWh	factures et leur conversion	France	Annecy 2000kWh Chamoni 1375 kWh	Estimation à partir des prix des factures.
	Gas	kWh (PC)	factures	France	5487 kWh	
Emissions fugitives	Climatisation : recharges en gaz frigorigènes	kg de recharges (ou, à défaut, présence de chaque climatisation et référence du fluide frigorigène)				
				France		
Achats de biens et services	Produits principaux					
	Produits annués					
	Matériaux généraux (emballage, ...)	données physiques (café / papier, etc...)	factures / comptabilité / nif	France		
	Outillage, consommables					
Utilisation	Achats de Services (hors sous-traitance)	€	factures / comptabilité / nif			
	Sous-traitance (des Web / Comptable)	€	factures / comptabilité / nif	France		
	Volumétrie de données échangées	ko / ToH	report OVIH	OVIH		
	Consos des serveurs OVIH	ko / ToH	report OVIH	OVIH		
Enr	Fin de vie des produits vendus	N/A				
Immobilisations	Matériel informatique	Nombre d'ordinateurs en cours d'amortissement + année d'achat + durée d'amortissement	Etat des immobilisations à fin 2022	France		
	Bâtiments et travaux	M2 des bureaux et type de bâtiment (bois / béton / acier...) + montants dépréciés (et considérés comme des immobilisations comptables) pour l'aménagement des bureaux (ex: année de mise en œuvre et durée d'amortissement)	Etat des immobilisations à fin 2022 + listing des bureaux (même ceux loués avec m2)	France		
	Soft & investissements dans les sites internet	Montant investi + année d'achat + durée d'amortissement	Etat des immobilisations à fin 2022	France		
	Equipements	amortissements	Etat des immobilisations à fin 2022	France		
	Vélos / voitures	Pour chaque type de véhicule (acheté ou en leasing) : date d'achat, modèle, durée d'amortissement.	Etat des immobilisations à fin 2022 + synthèse leasing	France		
Déplacements	Professionnels - flotte de véhicules	kilométrage + consommation moyenne (en précisant le type de carburant)	reporting spécifique	France		
	Professionnels - avion et train	Etat exhaustif des voyages effectués (nombre de personnes, destinations) -> pour calculer le nombre de "passage-kilomètre"		France		
	Professionnels - hôtellerie & restauration	nb repas / type de repas		France		
	Domicile-travail	à pied				
Déchets	Chiffres ventes des sites					
	Déchets banals triés	poids		France		
	Déchets dangereux			France		

Example of 2B1st Carbon Footprint



- Office energy consumption
- Waste
- Acquired assets and services
- Capital
- Transport and trips

- IT, Telecoms, media
- Laptop, servers
- Insurance, admin

- Car
- Train
- Planes

	tCO2e	
Scope 1	13	27%
Scope 2	0,1	0,2%
Scope 3	35	72,8%
TOTAL	48	100%

Carbon Footprint from TotalEnergies

Indicators related to climate change⁽⁷⁾

GHG emissions - Scope 1+2		Operated domain				Equity interest domain			
		2023	2022	2021	2015	2023	2022	2021	2015
Scope 1									
Direct GHG emissions	Mt CO₂e	32	37	34* (33)	42	45	51	49	50
Breakdown by segment									
Upstream oil & gas activities	Mt CO ₂ e	12	14	14	19	19	22	23	22
Integrated LNG, excluding upstream gas operations	Mt CO ₂ e	<1	<1	<1	–	1	1	1	–
Integrated Power	Mt CO ₂ e	6	9	5	–	6	9	5	–
Refining & Chemicals	Mt CO ₂ e	14	15	15* (14)	22	18	20	19	27
Marketing & Services	Mt CO ₂ e	<1	<1	<1	<1	<1	<1	<1	1
Breakdown by geography									
Europe: EU 27 + Norway + UK + Switzerland	Mt CO ₂ e	19	23	20* (19)	22	18	21	18	22
Eurasia (incl. Russia)/ Oceania	Mt CO ₂ e	<1	<1	1	5	12	15	17	13
Africa	Mt CO ₂ e	8	9	9	12	7	7	7	9
Americas	Mt CO ₂ e	5	5	5	4	7	8	7	5
Breakdown by type of gas									
CO ₂	Mt CO ₂ e	31	36	32	39	43	50	47	
CH ₄	Mt CO ₂ e	1	1	1	2	1	1	1	
N ₂ O	Mt CO ₂ e	<1	<1	<1	<1	<1	<1	<1	
Scope 2									
Indirect emissions from energy use	Mt CO₂e	2	2	2* (2)	4	4	5	5	
<i>of which Europe: EU 27 + Norway + UK + Switzerland</i>	<i>Mt CO₂e</i>	<i>1</i>	<i>1</i>	<i>1* (1)</i>	<i>2</i>	<i>2</i>	<i>2</i>	<i>2</i>	
Scope 1+2	Mt CO₂e	35	40	37* (36)	46	49	56	54	
<i>of which oil & gas facilities</i>	<i>Mt CO₂e</i>	<i>30</i>	<i>33</i>	<i>33* (32)</i>	<i>46</i>	<i>44</i>	<i>48</i>	<i>49</i>	
<i>of which CCGT</i>	<i>Mt CO₂e</i>	<i>4</i>	<i>7</i>	<i>4</i>	<i>–</i>	<i>5</i>	<i>8</i>	<i>5</i>	
Direct emissions of biogenic CO ₂ ^(a)	Mt CO ₂ e	0.1	0.1			0.1	0.1		

* Excluding the COVID-19.

(a) Biogenic CO₂ emissions from the Company's biogas assets. In accordance with the GHG Protocol these emissions are not included in Scope 1.

Carbon Footprint from TotalEnergies

GHG emissions - methane		Operated domain				Equity interest domain		
		2023	2022	2021	2015	2023	2022	2021
Methane emissions ^(a)	kt CH ₄	34	42	49	94	40	47	51
Breakdown by segment								
Upstream oil & gas activities	kt CH ₄	33	41	48	92	36	43	48
Integrated LNG, excluding upstream gas operations	kt CH ₄	<1	0	<1	0	2	3	2
Integrated Power	kt CH ₄	<1	1	<1	0	<1	1	<1
Refining & Chemicals	kt CH ₄	1	1	1	1	1	1	1
Marketing & Services	kt CH ₄	0	0	0	0	0	0	0
Breakdown by geography								
Europe: EU 27 + Norway + UK + Switzerland	kt CH ₄	5	7	7	9	4	5	5
Eurasia (incl. Russia)/ Oceania	kt CH ₄	1	1	1	33	11	15	16
Africa	kt CH ₄	18	23	23	49	19	17	18
Americas	kt CH ₄	9	12	18	3	7	10	12

(a) Excluding biogenic methane emissions, equal to less than 1 kt CH₄ in 2023. Biogenic methane is nevertheless included in the calculation of Scope 1.

Other indirect GHG emissions		2023	2022	2021	2015
Scope 3^(a)					
Indirect GHG emissions	Mt CO ₂ e	355	389* (381)	400* (370)	410
<i>of which Europe: EU 27+ Norway + UK + Switzerland</i>	<i>Mt CO₂e</i>	<i>216</i>	<i>191* (187)</i>	<i>220* (202)</i>	<i>256</i>
Breakdown by products					
Petroleum products	Mt CO ₂ e	227	254* (246)	285* (255)	350
Biofuels	Mt CO ₂ e	4	4	–	–
Gas	Mt CO ₂ e	124	130	115	60

* Excluding the COVID-19 effect for emissions data from first half 2020 through first half 2022.

(a) Scope 3 category 11 (refer to the glossary or to point 5.11.4 of chapter 5 for further details). Petroleum products including bulk refining sales and biofuels; biofuels; Natural Gas excluding minority stakes in public companies.

https://totalenergies.com/system/files/documents/2024-03/totalenergies_universal-registration-document-2023_2023_en_pdf.pdf

Carbon Footprint from TotalEnergies, by Greenpeace

- TotalEnergies estimates its Carbon Footprint in 2019 to be for Scope 1,2 & 3:

455 MtCO₂e

- Greenpeace and other associations estimate this figure to be :

1 637 MtCO₂e

Why such a gap of x4? Lack of maturity

- Standard for calculation is different
- Greenpeace accounted twice the oil produced and traded by TotalEnergies
- The factor of carbon intensity for consumed gasoline is too low for TotalEnergies, and too high for Greenpeace

Tableaux de synthèse des résultats

Activités	Scope	Émissions (tCO ₂ e)	Total
Pétrole - Chimie	SC 1	78 623 622	1 249 939 902
	SC 3	1 171 316 280	
Gaz	SC 1	76 494 611	373 906 938
	SC 3	297 412 327	
Électricité	SC 1	5 418 160	13 801 160
	SC 3	8 383 000	
TOTAL			1 637 648 000

<https://cdn.greenpeace.fr/site/uploads/2022/11/Bilan-carbone-de-TotalEnergies-rapport-de-Greenpeace-France.pdf>

HUGE PROBLEMATIC

1st Problematic :

- How to reduce our carbon footprint while producing more energy?



2nd Problematic :

- Could a Carbon reduction be used as a competitive advantage?

Why is digital a solution?

- Carbon Footprint calculation is the 1st step toward sustainability

- Measure it to decrease it

But

- Data volume is a pain
- Data complexity is a killer

Thus

- Digital Technologies come to the rescue

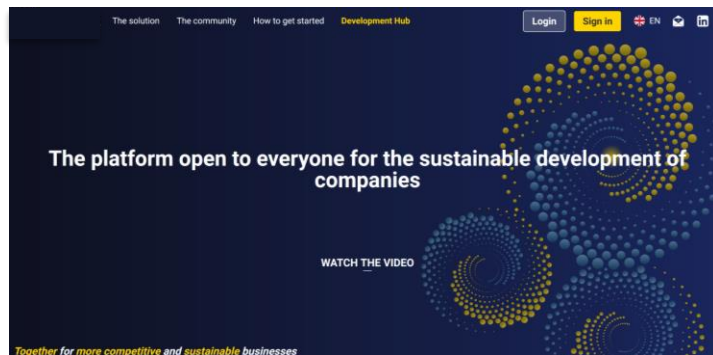
"The ability to effectively track your company's emissions data is crucial, as ultimately, you can't manage what you don't measure."

Nishadi Davis
Head of Carbon Advisory



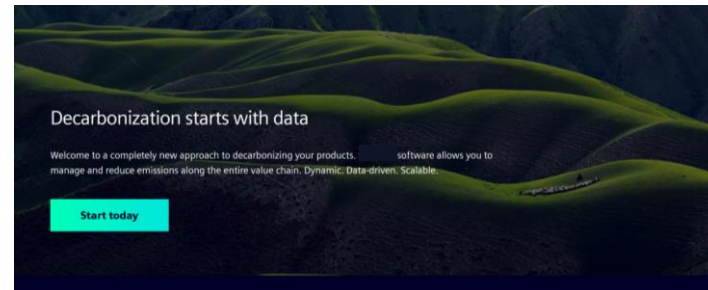
Digital Solutions in action

- For Data Acquisition :
Operator's platforms



Collect Carbon Footprint from all their suppliers.

- For Data Acquisition :
Suppliers carbon calculator



Promote their catalog of solutions including the Carbon Footprint.

Digital Solutions in action

- **Carbon Footprint Calculation :**
Artificial Intelligence software :
enter the natural information, it
calculates the CO2 equivalent
number
Automatically prepares the
reporting
Aligned with legal requirements



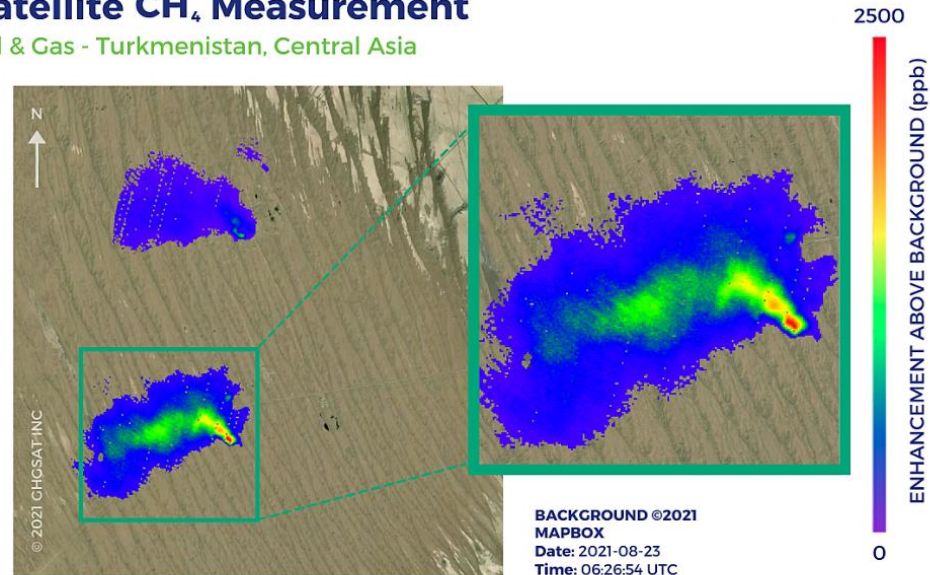
Digital Solutions in action

- **Data Transparency :**
Methane leakage detection
by satellite
For onshore and offshore
Tag CO₂ and CH₄ emissions
Also flaring or venting

Starts to be used by Operators
and NGOs

Satellite CH₄ Measurement

Oil & Gas - Turkmenistan, Central Asia



Digital Solutions in action

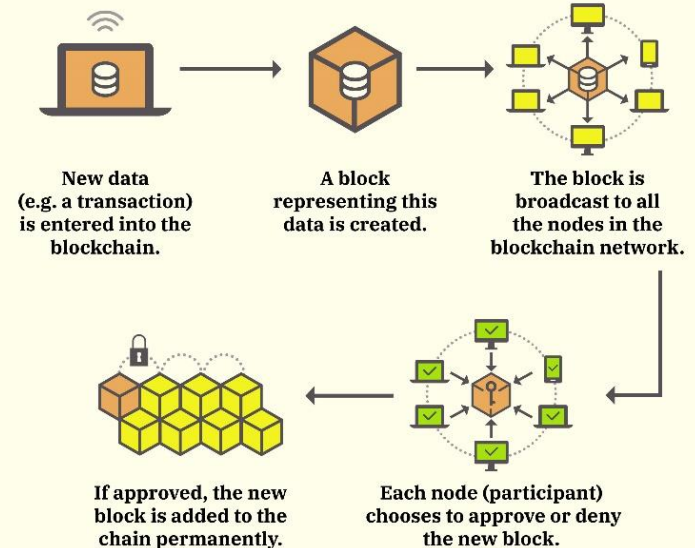
- Data Transparency

Use Blockchain to monitor operators' carbon footprint

Create trust around self declarations of operators

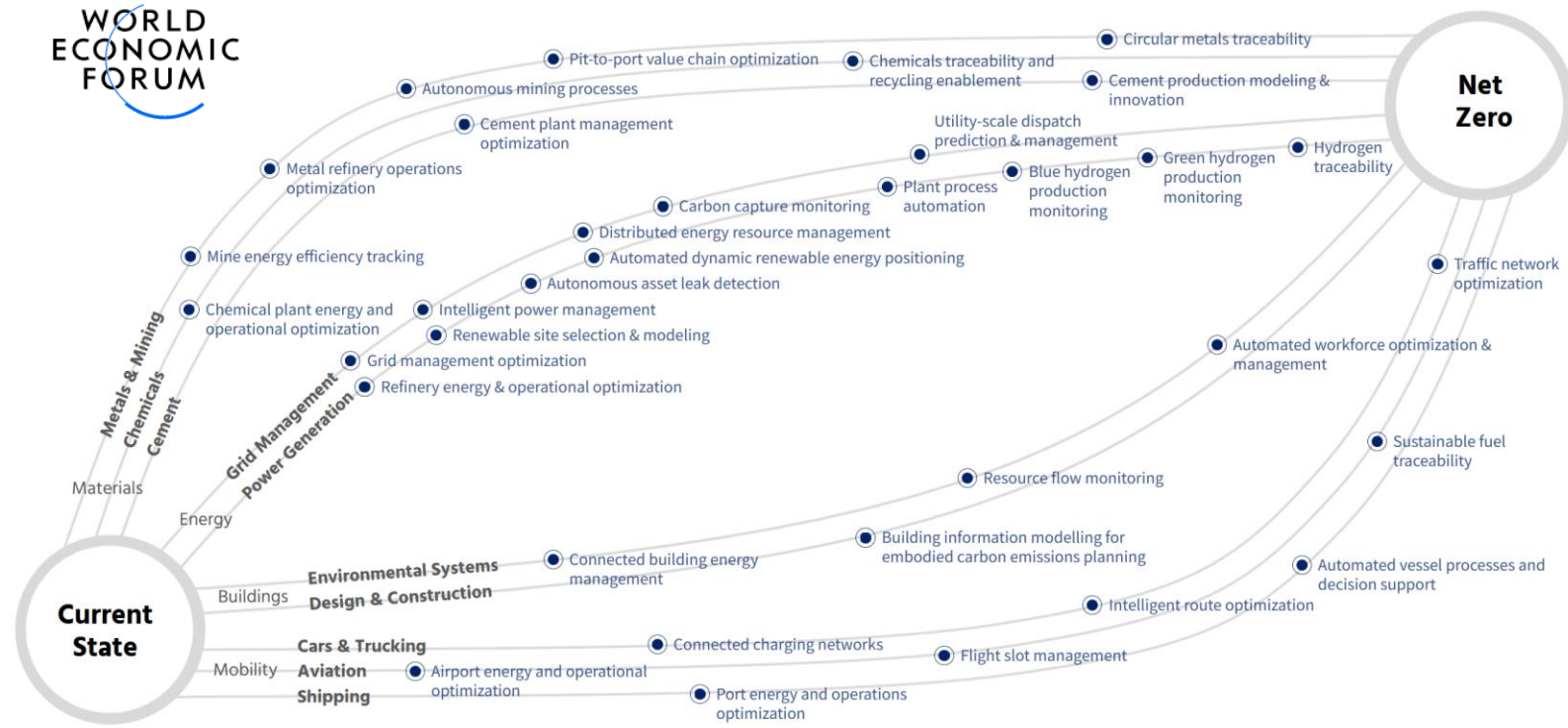
Generate Carbon Credits

Blockchain Process

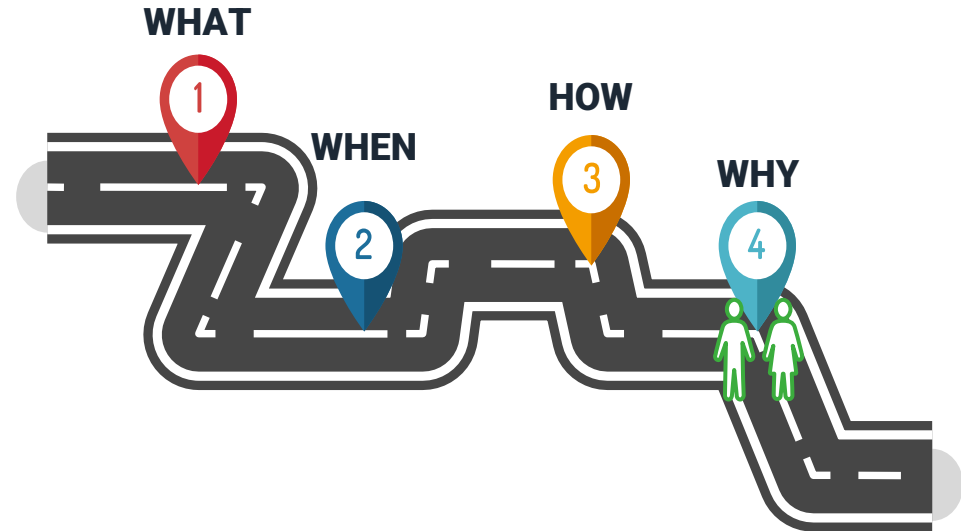


Digital Solutions in action

- World Economic Forum estimates Digital Technologies can reduce Carbon emissions by 20%



CARBON FOOTPRINT VALUE CREATION



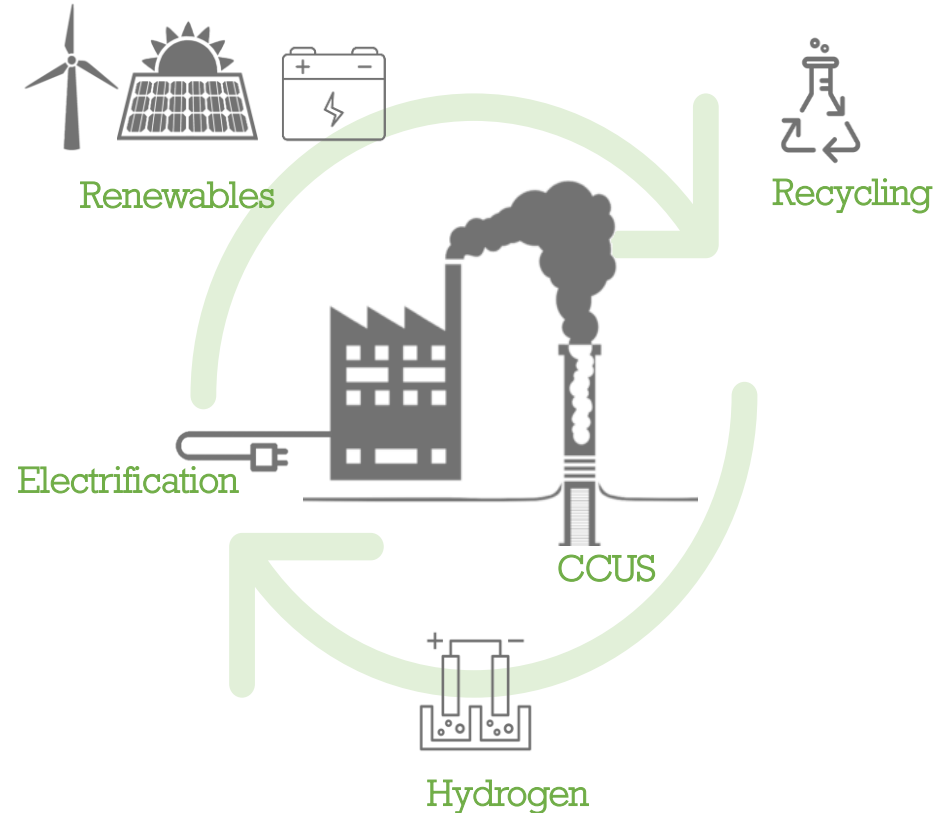
From threat to opportunity

- Today, carbon Footprint is clearly a threat
- But all the companies are the same in front of this challenge
- Now the game is to turn this into an opportunity
 - Decrease to the maximum the carbon footprint of energy
 - While producing more energy



Produce cleaner Oil & Gas

- Hub Key Modules
 - Wind or Solar Power Generation
 - Electrolyzation Unit – H₂ Production
 - Carbon Capture or Waste Recycling
 - Valorization Unit (eFuel, eAmmonia, eMethanol, RNG, Renewable Diesel, SAF)
- Hub Key Know-How
 - Modules Integration
 - Integrated Process Automation
 - Power Balance Management System
 - Electricity Quality Insurance
- Hub Key Performances
 - Integrated Operations Optimization
 - Financial – Business Model Viability



Access Projects



PRESS RELEASE

Papua New Guinea: TotalEnergies launches integrated engineering studies for the Papua LNG project

Paris, March 7, 2023 –TotalEnergies, operator of the project, announces the launch of the fully integrated Front-End Engineering and Design (FEED) for the Papua LNG project.

Following pre-FEED studies, in order to maximize synergies and minimize the costs, Papua LNG partners have selected a concept including four electrical LNG trains (e-trains) with a total capacity of 4 Mt/y.

- Reduce emissions to do the project
- TotalEnergies had to change design to get the authorization
- Pushed 2 changes in design
- Reduced carbon footprint

Up to
80%



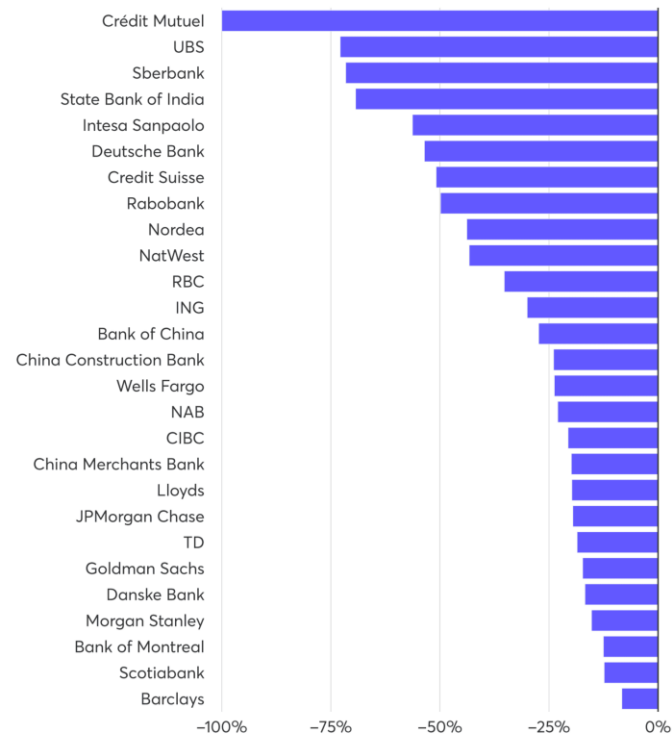
of products' environmental impacts are determined at the design phase

Access fundings

- In Some European countries, it become complex to finance Oil & Gas projects
- Those projects increase Banks carbon footprint
- Banks want to become Carbon Neutral
- Oil & Gas projects are packaged with decarbonation projects to present neutral carbon footprint
- Oil & Gas Operators have become largest investors in decarbonation

Banks that have decreased fossil fuel financing

Percent change in fossil fuel financing, 2016 to 2020. Of the world's 60 largest banks, 27 have **decreased** their financing in the fossil fuel sector.



Not all Oil & gas are the same

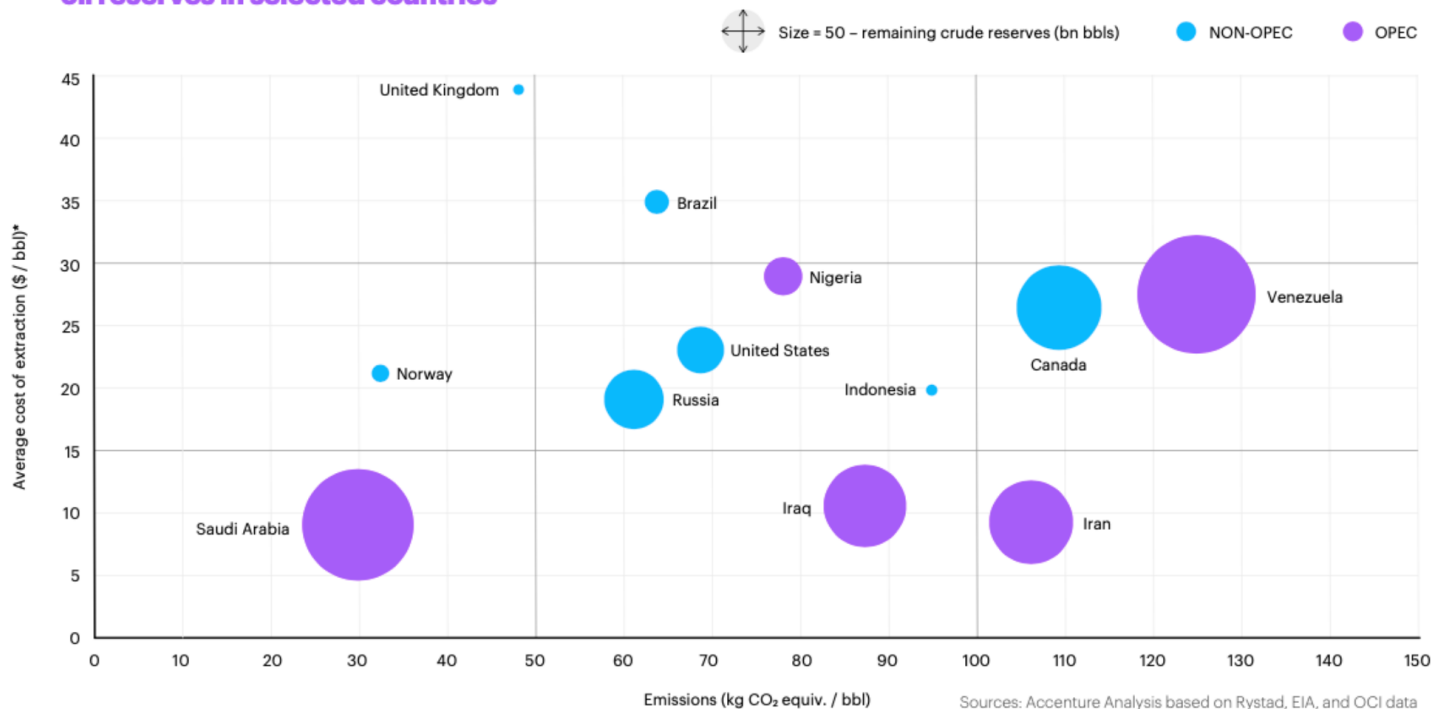
Abated or Unabated Oil & Gas

- Evolution of EU toward a phase out of “Unabated” fossil energy by 2035
 - « Unabated fossil fuels » refers to fossil fuels produced and used without interventions that substantially reduce the amount of GHG emitted throughout the life-cycle; for example, capturing 90% or more from power plants, or 50-80% of fugitive methane emissions from energy supply.
 - According to:
IPCC Summary for Policymakers Headlines Statements
Footnote 55
April 4th 2022.
- EU Proposition pushed to COP 28
- Key Outcome: Legal Status of CCUS for Public funding.

Competitive advantage to have less emissions

Emissions versus extraction costs for oil reserves in selected countries

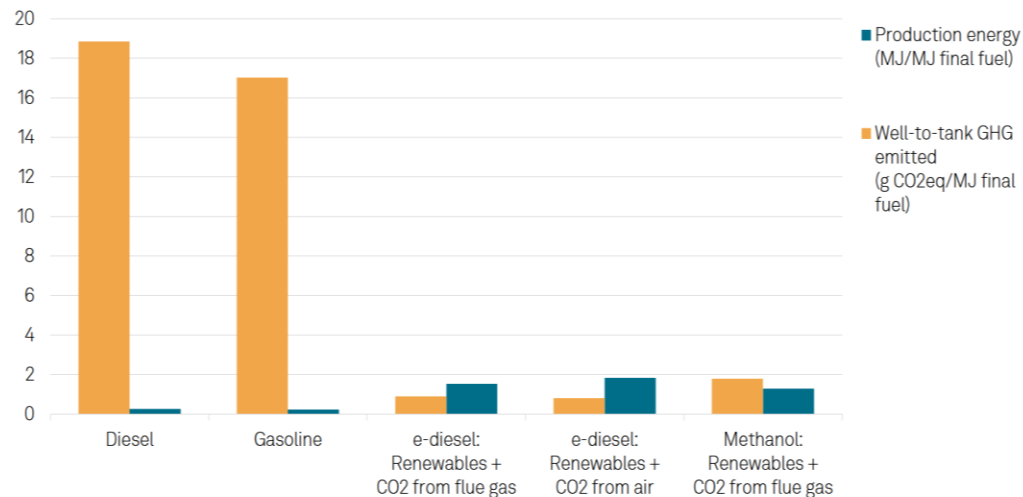
*Average cost of extraction includes CAPEX, production, transportation and taxes



Produce Alternative fuels

- Efficient answer to climate change
 - Reduce massively carbon emissions
 - Close the loop of carbon
- Solution for Sovereignty
 - Reduce dependency on imports
 - Create local jobs and value
- Good acceptance
 - Not everything can become electric
 - Requires little adaptation

Low-carbon e-fuel production emits less CO₂, but has 6x the energy input of fossil fuels

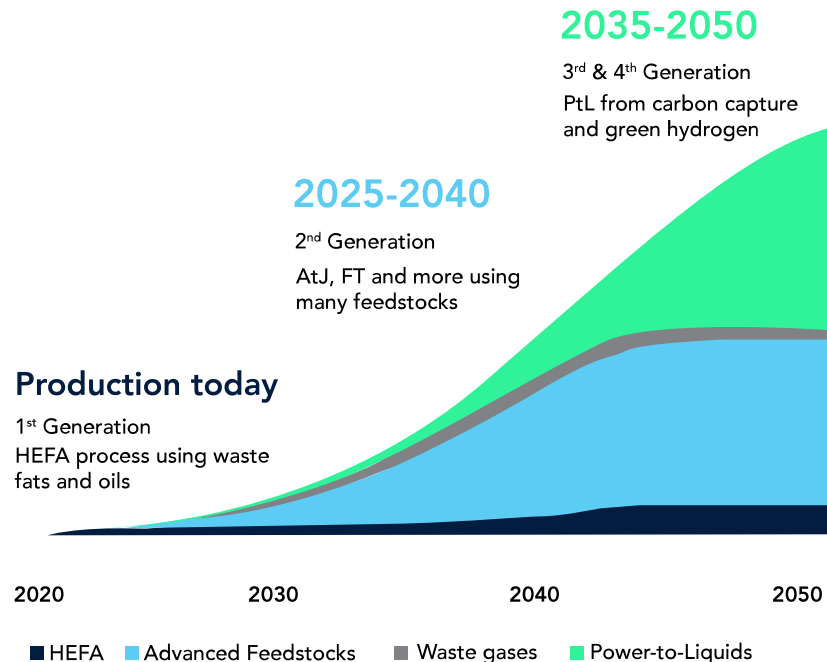


g—Metric gram. GHG—Greenhouse gas. MJ—MegaJoule. Source: Prussi, et al., S&P Global Ratings.

No way out of decarbonation

- Airline decarbonation has little solution outside of SAF
 - Electrical plane are too heavy
 - Hydrogen is too dangerous
- EU is highly aggressive on airline emission reduction
- Airlines companies driving projects, and pushing price to passengers
- Already possible on many airlines
- SAF Demand of 600 million t/y in 2050

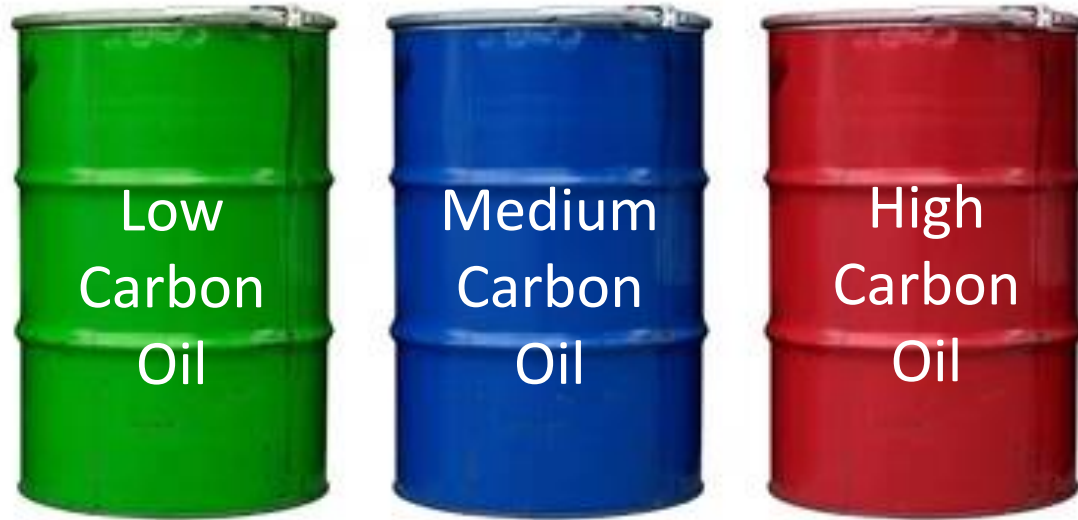
Figure 1: The three generational waves SAF production



Source : ICF 2023

More Value from Less Emissions

Traders are going to account the associated emissions.



Each carbon grade will have a different price

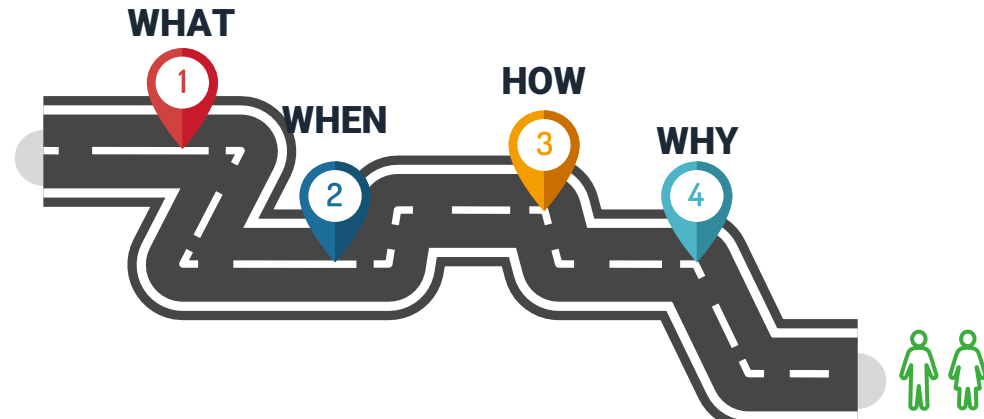
Conclusions

The transition toward a sustainable energy system has started

Either we lead this change, or we will suffer from it

And there is value to be created by decarbonizing

Digital / Electric / Automation solutions toolbox is the compass to drive toward less emissions



Questions

Any question or remark?

