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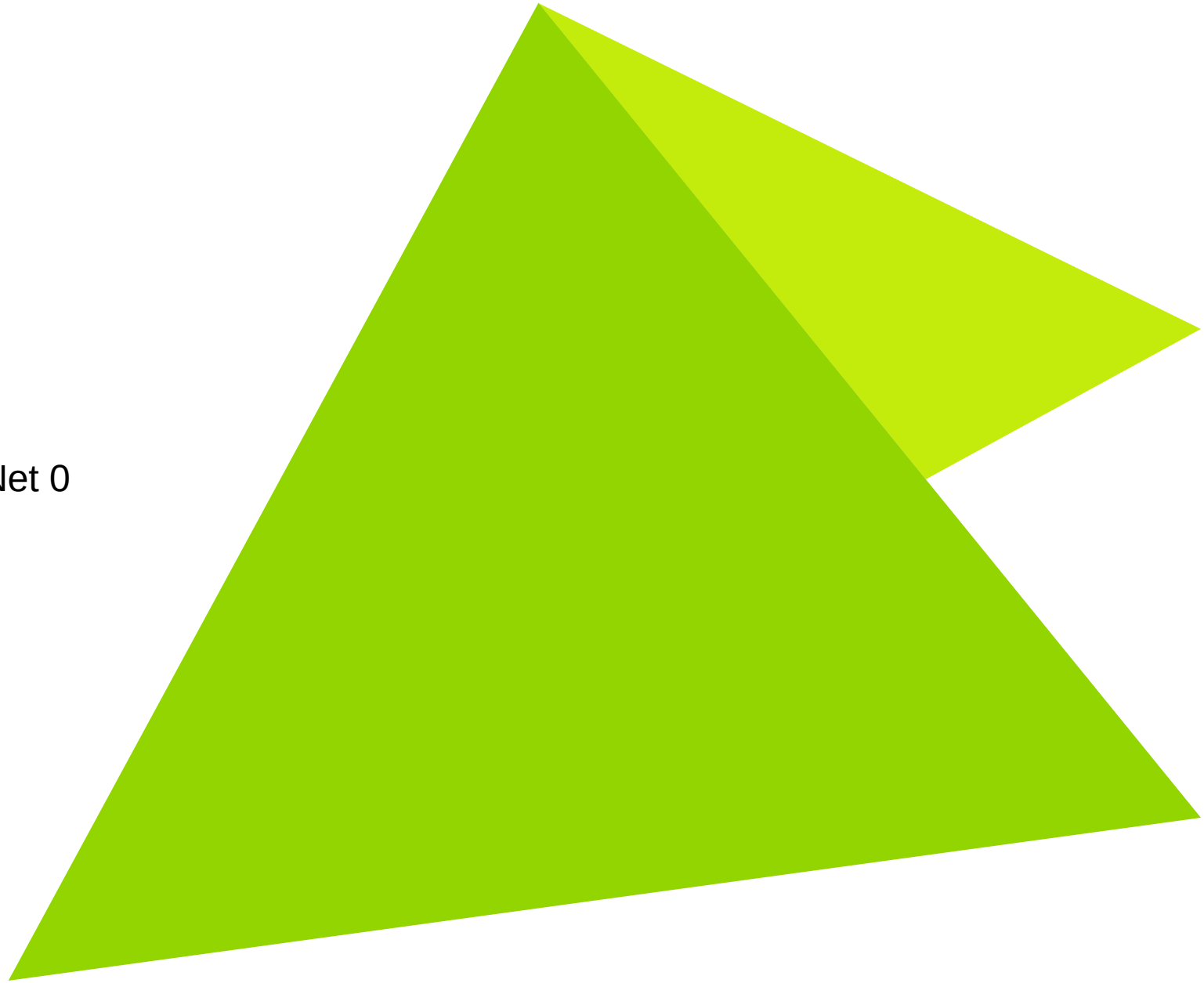
IPPSA

Energy Realities and the Pathways to Net 0



November 15, 2021

Fundamental Drivers and Policy Support

Fundamental drivers are accelerating the demand for deep decarbonization

- The recent IPCC report adds to growing momentum for cities, provinces/states and countries to plan for and implement changes which will achieve Net-Zero.
- Energy resilience is more important—and higher profile—than ever before. Recent events in California and Texas highlight the risk.
- Institutional Investors Setting Goals, Taking Action
- Understanding decarbonization pathways provides insights required to support policy and regulatory frameworks that address equity (affordability), unintended consequences such as potential stranded costs, and other manageable issues associated with the transition.
- Embracing new technologies such as renewables, advanced T&D infrastructure, RNG, H2, and carbon capture provide important pathways to meeting greenhouse gas (GHG) emissions targets.
- This requires long-term energy system planning and shared determination of all involved in the energy system.

Climate Change is the Biggest Economic Opportunity of our time; It will require all hands-on deck – leveraging multiple solutions and integrating them into a least cost pathway to Net-Zero

Path to Deep Decarbonization

Low-Carbon Fuels will be an integral component of economy-wide decarbonization; determining their role in Alberta is critical.

Five Building Blocks to Deep Decarbonization

1

Implement Energy Efficiency

Implement energy efficiency measures to the maximum extent possible.

2

Decarbonize Electric Power

Decarbonize the electricity supply as much as possible.

Hydrogen resources will supply seasonal long-duration storage and provide on-call generation to support renewable generation and maintain system resilience.

3

Electrify Building and Transportation End Uses

Utilize the decarbonized energy supply to reduce the emissions of other sectors.

4

Employ Carbon Capture and Storage for Economical Production of Low-Carbon Hydrogen

Use low-carbon hydrogen to offset any remaining fossil fuel use.

CCS enables production of blue hydrogen, which leverages regional natural gas resources to cost effectively produce decarbonized hydrogen; green and pink H_2 are intrinsically clean.

5

Deploy Zero Carbon Fuels

Use zero carbon fuels to reduce the emissions of *hard to electrify* sectors.

Hydrogen will be utilized to power hard to electrify sectors including industry and heavy transportation.

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EU Perspective: H_2 and RNG Play a Role in the Decarbonized Energy System

*Gas for Climate was initiated in 2017 to analyse and create awareness about the role of renewable and low carbon gas in the future energy system, aiming for **full compliance with the Paris Agreement target** to limit global temperature increase to well below 2°C.*

In 2019, Navigant published the Gas for Climate study analysing how Europe can achieve climate neutrality by 2050 at the lowest societal costs. The study compared two scenarios:

1. **Optimized Gas scenario:**
   A combination of renewable electricity and gas are used to fully decarbonise the EU industry, buildings, and transport sectors.

2. **Minimal Gas scenario:**
   Full decarbonization with a minimal role for gas and existing gas infrastructure.

In the Optimized Gas scenario, biomethane and hydrogen scale up to about 2,900 million MWh, or about 270 bcm of natural gas energy equivalent, consisting of about 1,170 million MWh of biomethane and about 1,710 million MWh of (largely green) hydrogen.

Renewable electricity should be scaled up tenfold by 2050 to enable full decarbonisation.

GAS FOR CLIMATE
A path to 2050

The Gas for Climate group consists of ten leading European gas transport companies and two biogas consortia:

CIB · EBA · enagas · ENERGINET · fluxys · gasunie · GRTgaz · ontras · OGE · snam · SWEDEGAS · TERĒGA

Source: www.gasforclimate2050.eu

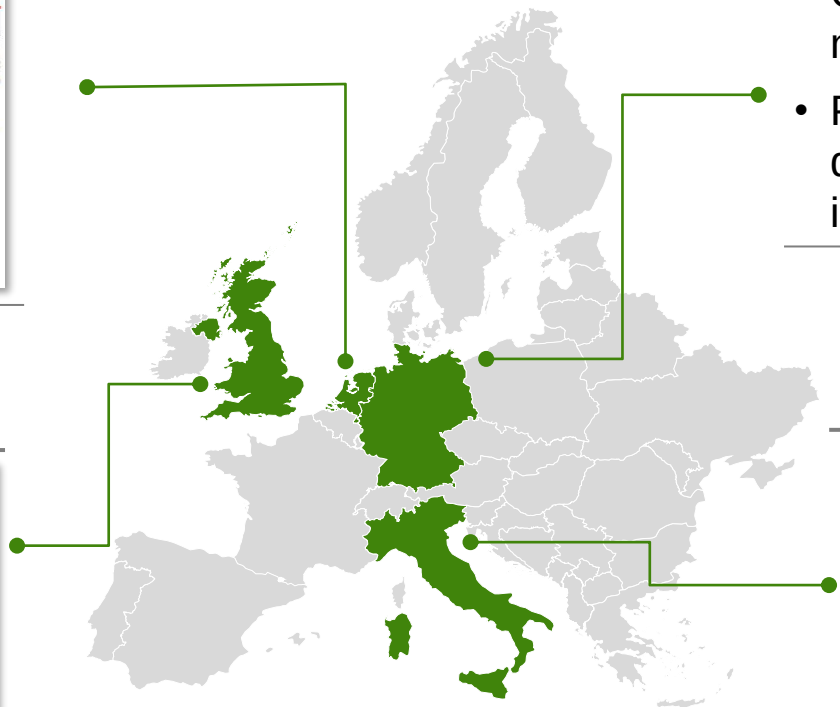
European countries are developing concrete national infrastructure plans targeting the first H_2 pipelines by 2030

Netherlands – HyWay27

- Gov't: Develop a national **H_2 backbone by 2027**
- **€1.5 billion** in dedicated H_2 infrastructure

UK – Project Union

- National Grid: Network to connect **5 industrial clusters**
- H_2 network of **2,000 km by 2030**

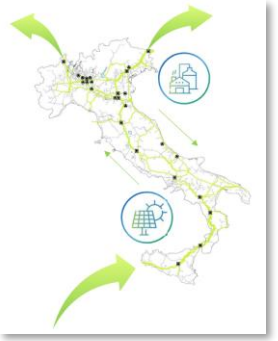


Germany – Wasserstoffnetz

- German TSOs: Plan for H_2 network of **5,900 km**
- Parliament: **Regulation** for dedicated H_2 transport infrastructure

Italy – Snam's Investment Plan

- **50% of 2020/24 investment plan** to prepare for a hydrogen-ready network
- Strategy: Italy as a **transit hub** with imports from N. Africa



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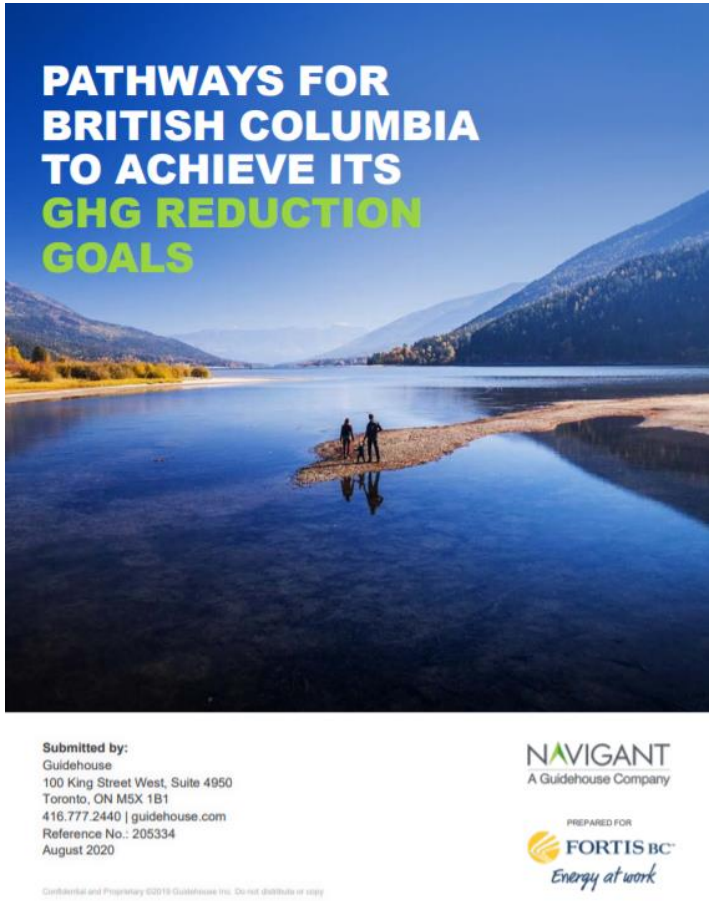
BC Perspective: When it comes to affordably meeting needs and addressing climate it's not either/or between the electric and gas systems: it's both/and.



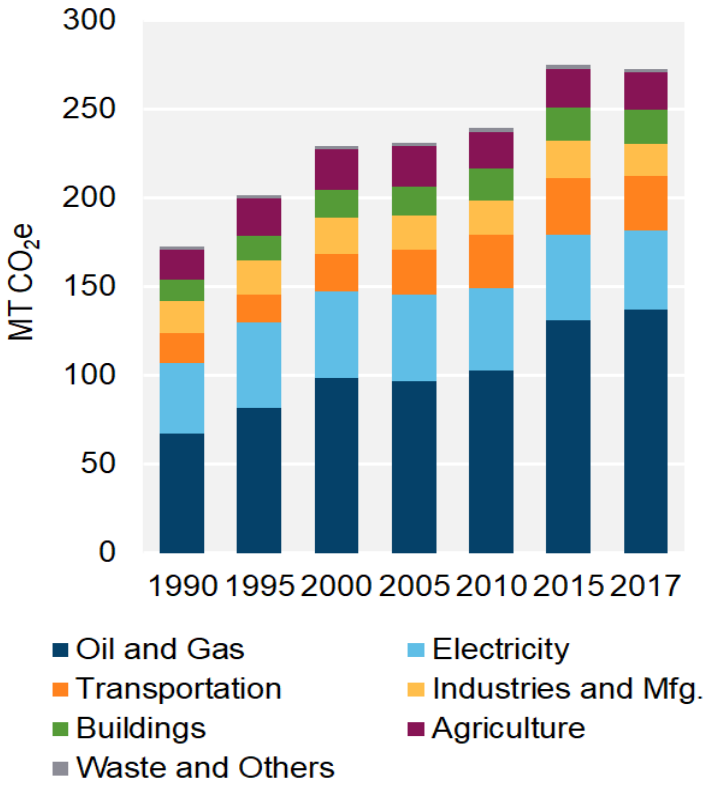
- Developed Electrification Pathway and a Diversified Pathway
- Analyzed GHG reductions, costs, impacts to consumers, reliability and risks

1. All critical energy sector players must work together to find solutions – for FortisBC this means evolving with innovation
2. When it comes to affordably meeting needs and addressing climate it's not either/or between the electric and gas systems: it's **both/and**
3. We need solutions that don't abandon but leverage critical energy infrastructure
4. We should be focusing on optimizing solutions not creating false competition
5. Building on our efforts to-date we plan to keep cutting the carbon intensity of the gas system, reducing waste and replacing more polluting fuels

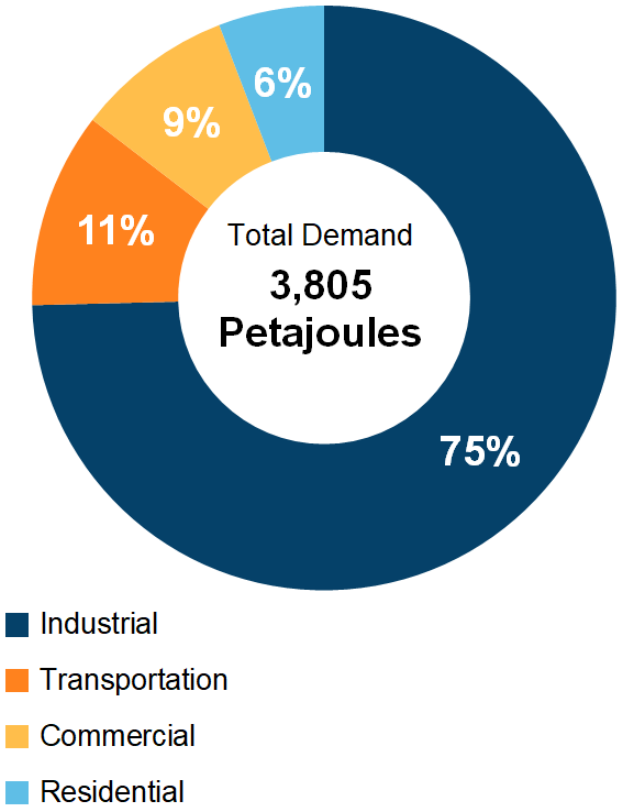
The Alberta Landscape

Initial focus on CCUS to support the continued role of O&G and AB Economy

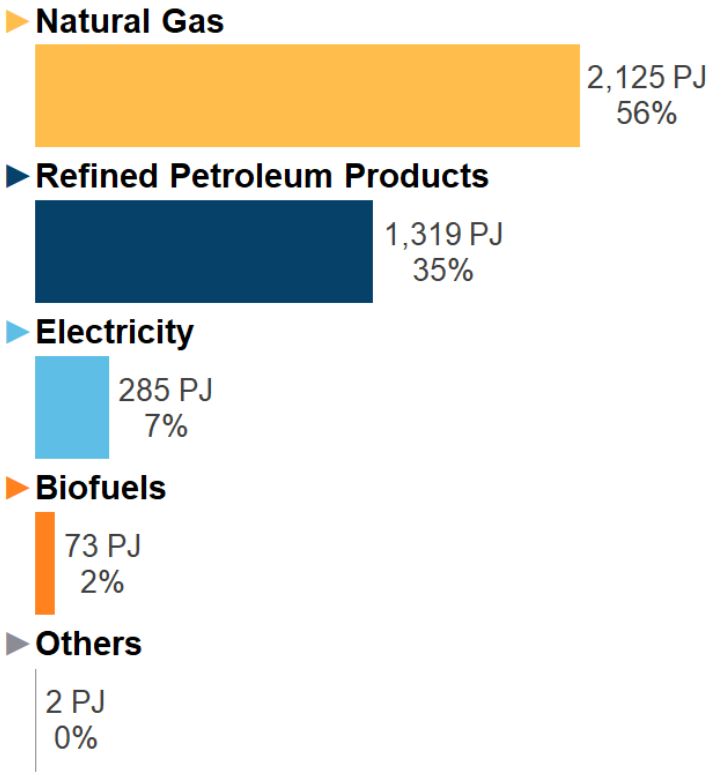
GHG Emissions by Sector (2017)



End Use Demand by Sector (2017)



End Use Demand by Fuel Type (2017)



Source: Canadian Energy Regulator

The Alberta Landscape

Achieving Net-Zero will require support from all sectors and co-ordination between Electric and Gas utilities and a focus on the role for O&G

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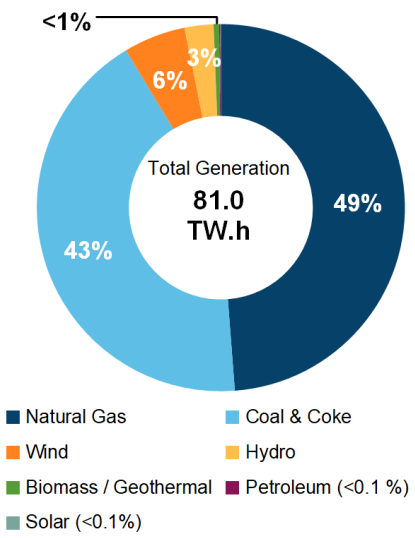
EMISSIONS REDUCTION ALBERTA



The H_2 Opp.

Canada's major oil sands producers unite to achieve net zero 2050 carbon emission goals

Pembina, TC Energy Launch Alberta Carbon Grid to Capture, Store Pipeline Emissions

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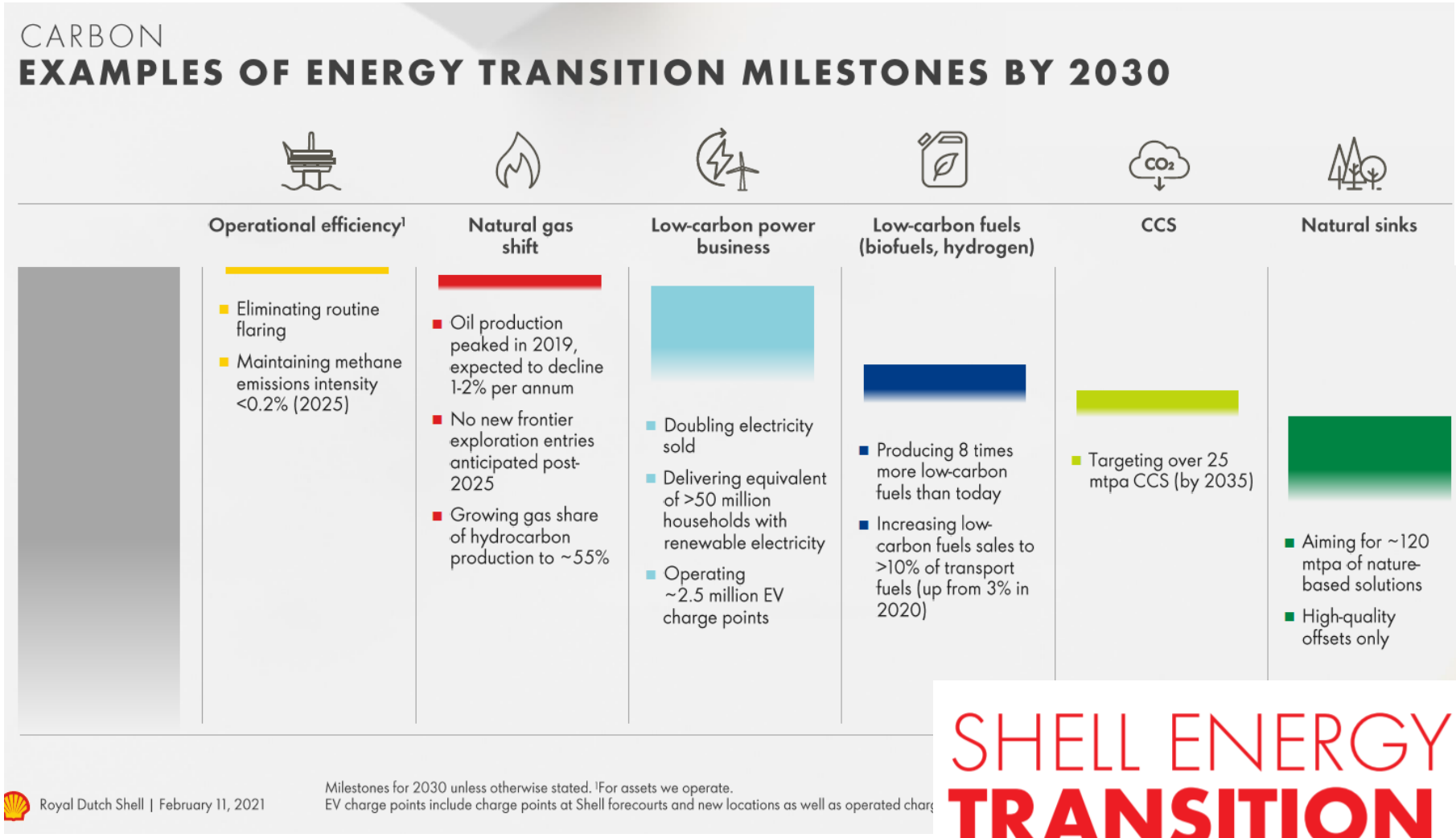
Finding a core role for O&G in the Net Zero Future

Don’t get caught on the sidelines, the energy transition is underway and Alberta O&G role as a competitor in a low carbon future needs to be secured.



Dutch Court Orders Shell to Reduce Emissions in First Climate Change Ruling Against Company

June 30, 2021

SHELL ENERGY
TRANSITION STRATEGY

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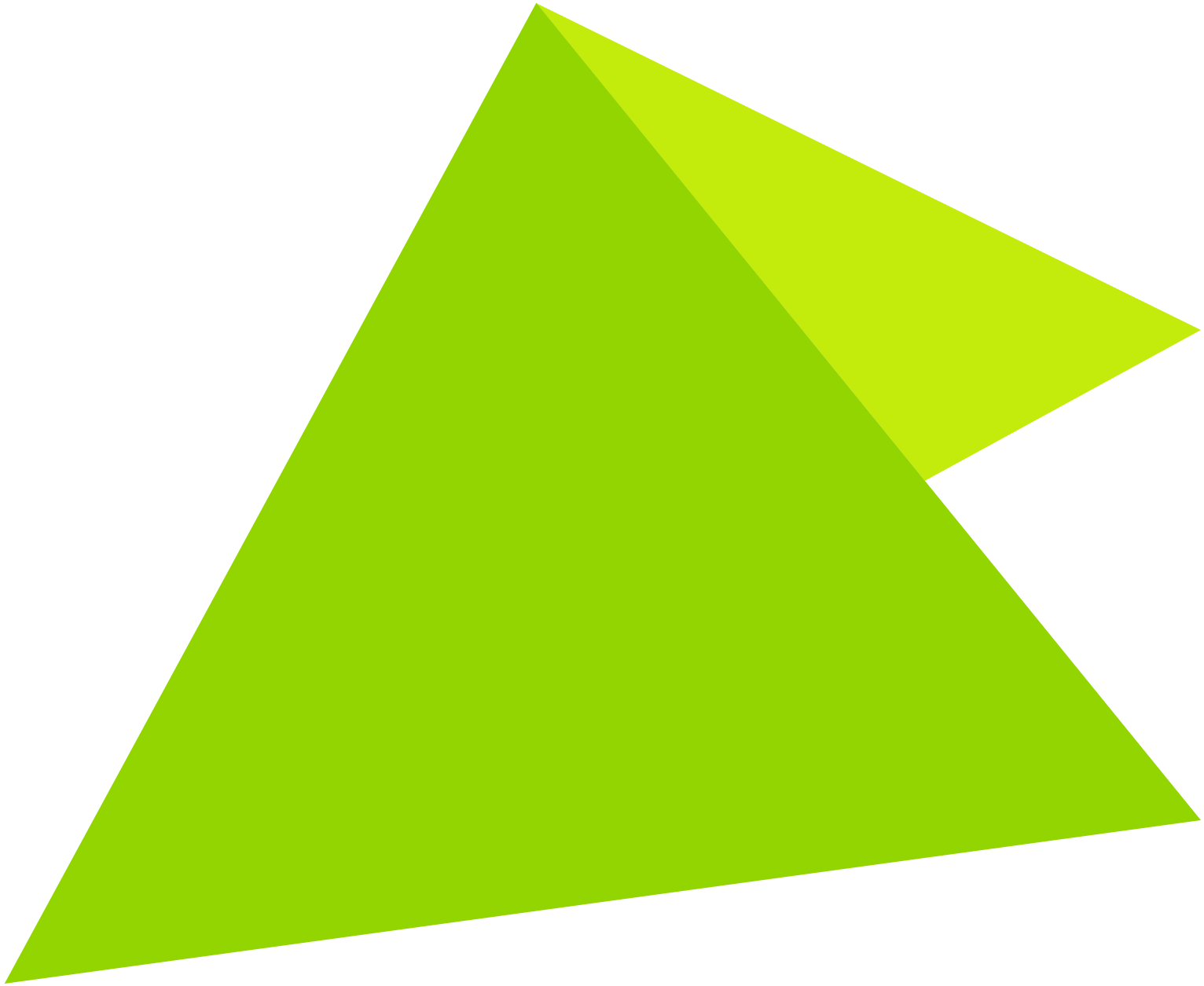

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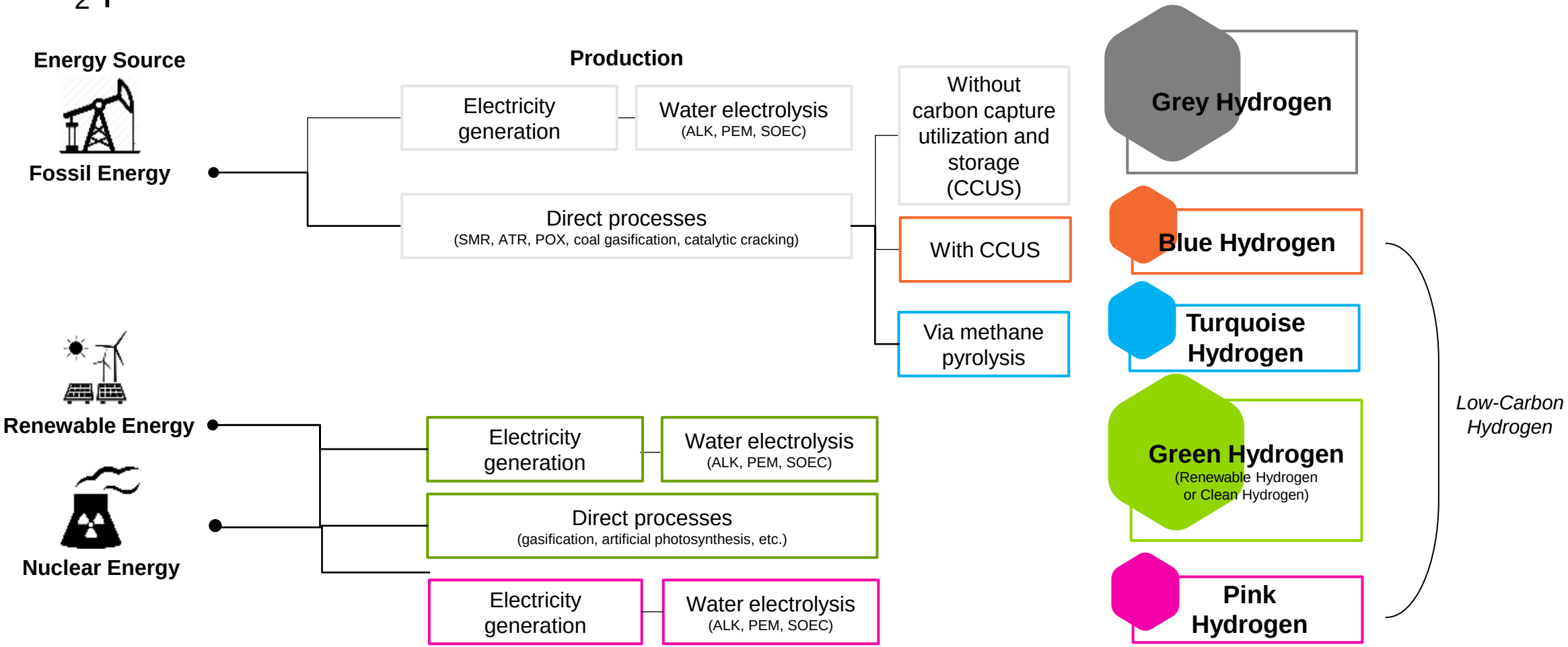
H_2 Generation Is a Major Emissions Driver

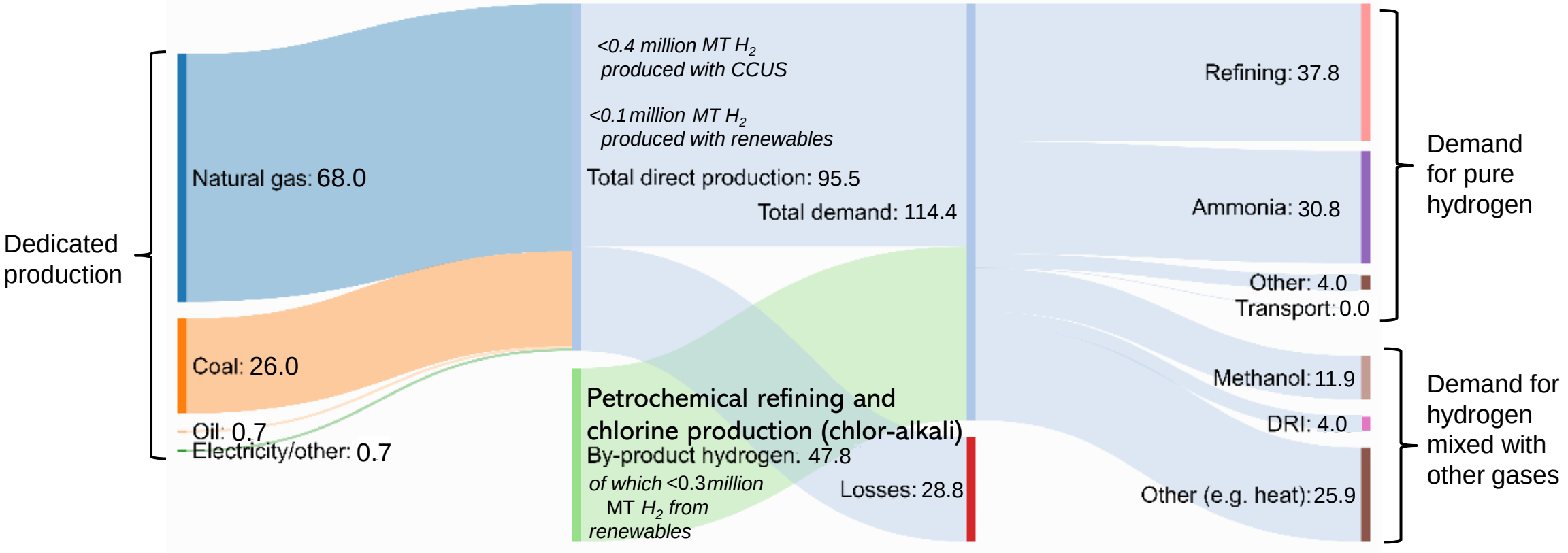
Cost, complexity, and GHG emissions intensities vary significantly, depending on the H_2 production method.



Hydrogen Production and Demand Today

Fossil-fuel hydrogen is a key feedstock for refining and fertilizer industries.

Today's global hydrogen value chains
(2018, in million metric tons of H_2)



Source: IEA, Future of Hydrogen