

# The Change Book

Neste Market  
and Innovation  
Outlook



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# Neste at a glance

- We create solutions for combating climate change and accelerating a shift to a circular economy
- We refine waste, residues and innovative raw materials into renewable fuels and sustainable feedstock for plastics and other materials
- We are the world’s leading producer of renewable diesel and sustainable aviation fuel, developing chemical recycling to combat the plastic waste challenge
- As a technologically advanced refiner of high-quality oil products with a commitment to reach carbon-neutral production by 2035, we are also introducing renewable and recycled raw materials such as waste plastic as refinery raw materials.

## Our businesses



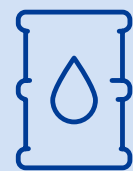
Renewable  
aviation



Renewable  
polymers  
and chemicals



Renewable road  
transportation



Oil products



Marketing &  
services

## One Neste

### CLIMATE COMMITMENTS

- Carbon-neutral production by 2035
- Reducing the use phase emission intensity of sold products by 50% by 2040 compared to 2020
- Reducing customer’s GHG emissions with our renewable and circular solutions by at least 20 million tons CO<sub>2</sub>e by 2030

### VISION

Leading the way  
towards a sustainable  
future together

### PURPOSE

Creating a healthier  
planet for our children

### PROMISE

Change runs on  
renewables

### VALUES

We care. We have  
courage. We cooperate.

## Driven by our purpose

We are  
**~4,900**  
dedicated professionals  
committed to our  
purpose

In 2020, our  
customers reduced  
**10 Mt**  
greenhouse gas emissions  
with our renewable  
products

In 2020,  
we reached  
**1,416 M€**  
comparable operating profit  
of which 94% came from  
renewable products



## FOREWORD BY THE CEO

# Let's talk change

I'm a stubborn climate optimist, and reading this report will give you a good understanding why. We have what it takes to defuse an accelerating climate crisis. It requires utilizing all the solutions we have to reduce emissions in all sectors of all industries. It means the end of business as usual, and the beginning of business as an agent of innovation and change.

Changing one company, industry or even a society at a time is a good start, but the real shift is achieved when we manage to turn change into opportunities for others to thrive on, going from "think global, act local" to "think systemic, act pragmatic". This is how our separate paths towards net-zero emissions merge into a collective speedway. The effects will ripple across all areas of life, connecting consumers and circular economies and driving an industrial emissions revolution. It will also turn the tide for travel and transport, sectors where emissions continue to grow.

We are way past celebrating commitments. Pledges of carbon neutrality are important,

**Let's stop wasting time arguing about which technology might provide a silver bullet to the climate crisis when the data makes it clear that all sustainable solutions are needed.**

but there is risk embedded in making lofty promises with lengthy timeframes. Tomorrow never comes. Let's stop wasting time arguing about which technology might provide a silver bullet to the climate crisis when the data makes it clear that all sustainable solutions are needed. Instead, let's focus on establishing greater clarity around long-term policy targets and regulatory frameworks to lay the groundwork for accelerating change even further.

Scaling up the wide range of low emission technologies available today, in ways that provide the best possible result for each industry, is the way forward. At the same time, keep the wires of innovation glowing red by increasing investments in R&D and expanding cooperation to bring change to

even the hardest-to-transform industries – Neste's own refineries belonging to one of them. This report is packed with concrete examples of how we can do this, with its ethos inspired by our strategy: "Faster, Bolder and Together."

The pages ahead contain validated, measured outlooks and data for anyone aiming to create a renewable and circular future. More than that, they start discussions and ask questions that I hope lead to meaningful conversations and cooperation that let us create a healthier planet for our children, together.

**Peter Vanacker**  
President and CEO, Neste

# Accelerating a global transformation

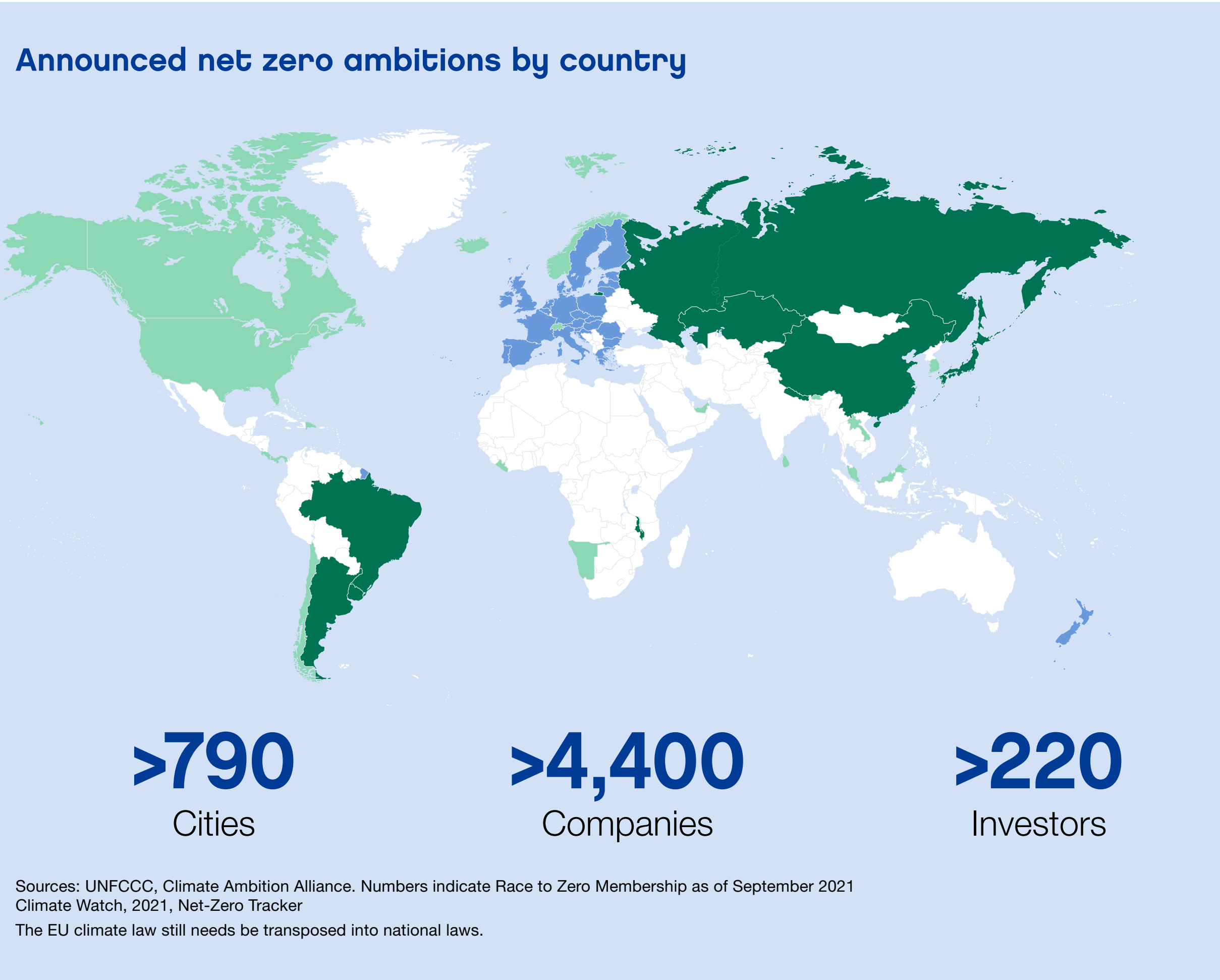
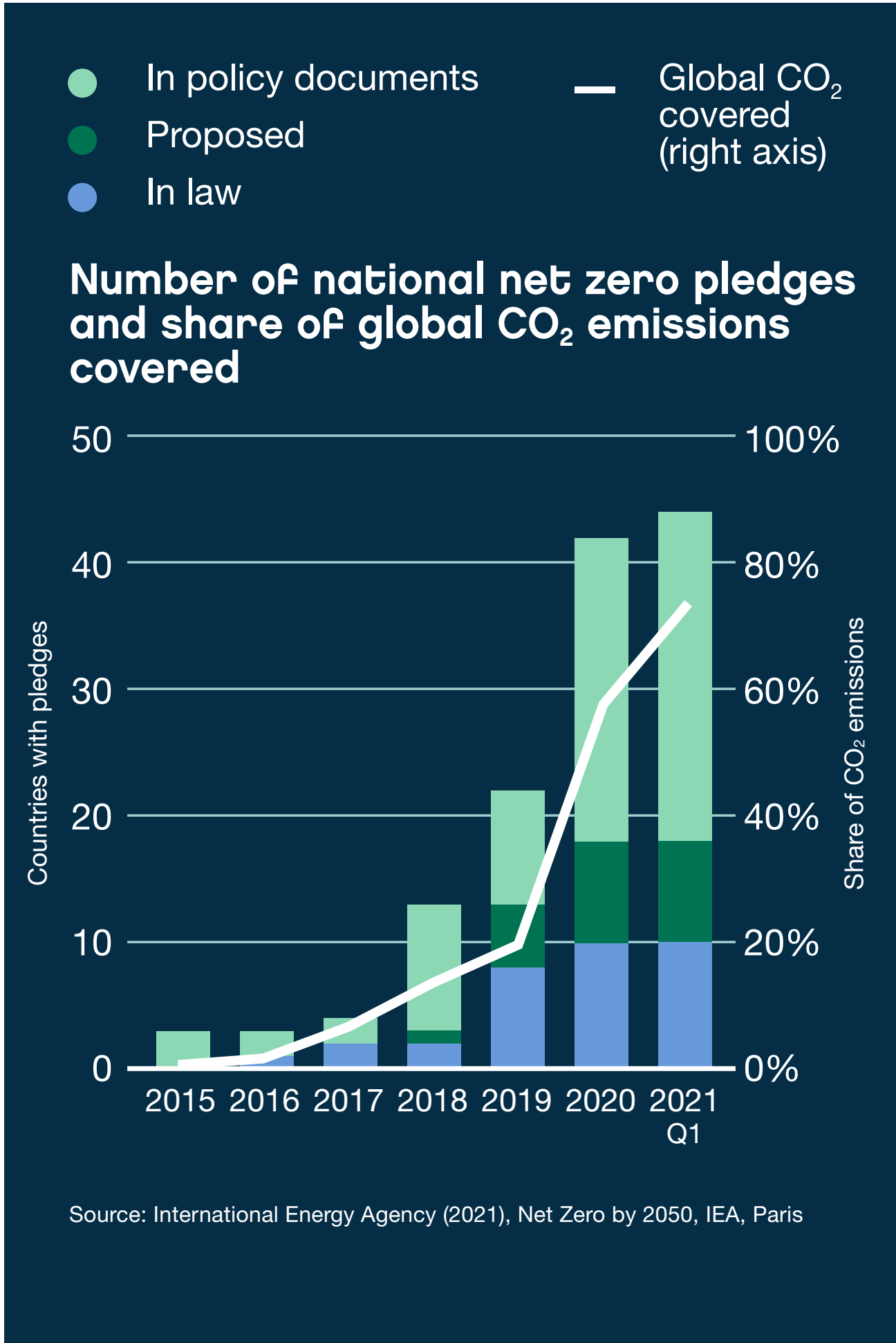
A systemic approach is needed to reach a balance between courageously innovating the future while also scaling all solutions for efficient use that are available already today. Neste will continue the transformation towards renewable and circular solutions and ensure that the entire value chain is aligned with the global ambition of limiting global warming to 1.5°C.

The transition to carbon neutrality requires change in mindsets and concrete actions from all of us. This change is team play. This change improves the old while creating the new.



Read more about how we combat climate change and accelerate a shift to a circular economy on **our website**.

# Aligning ambitions to tackle the climate crisis



Future-driven companies and investors endorse the urgent need to shift towards net-zero solutions in order to fight the climate crisis.

Thousands of commitments have been made, from private enterprises' race to carbon neutrality to investors' new sustainability standards for the companies they invest in. Already more than half of countries globally have raised their climate targets substantially. A growing number of those states, including the European Union, are committed to net-zero emission targets by 2050 or earlier. Achieving this goal will take a collaborative effort across a multitude of industries and interests.

Efforts to mitigate the impact of this immense and complex challenge are gaining momentum. It is essential that our ambitions today are transformed into the actions of tomorrow. Accelerating the use of existing solutions combined with rapid development of new ones is key.

Source: <https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=94>

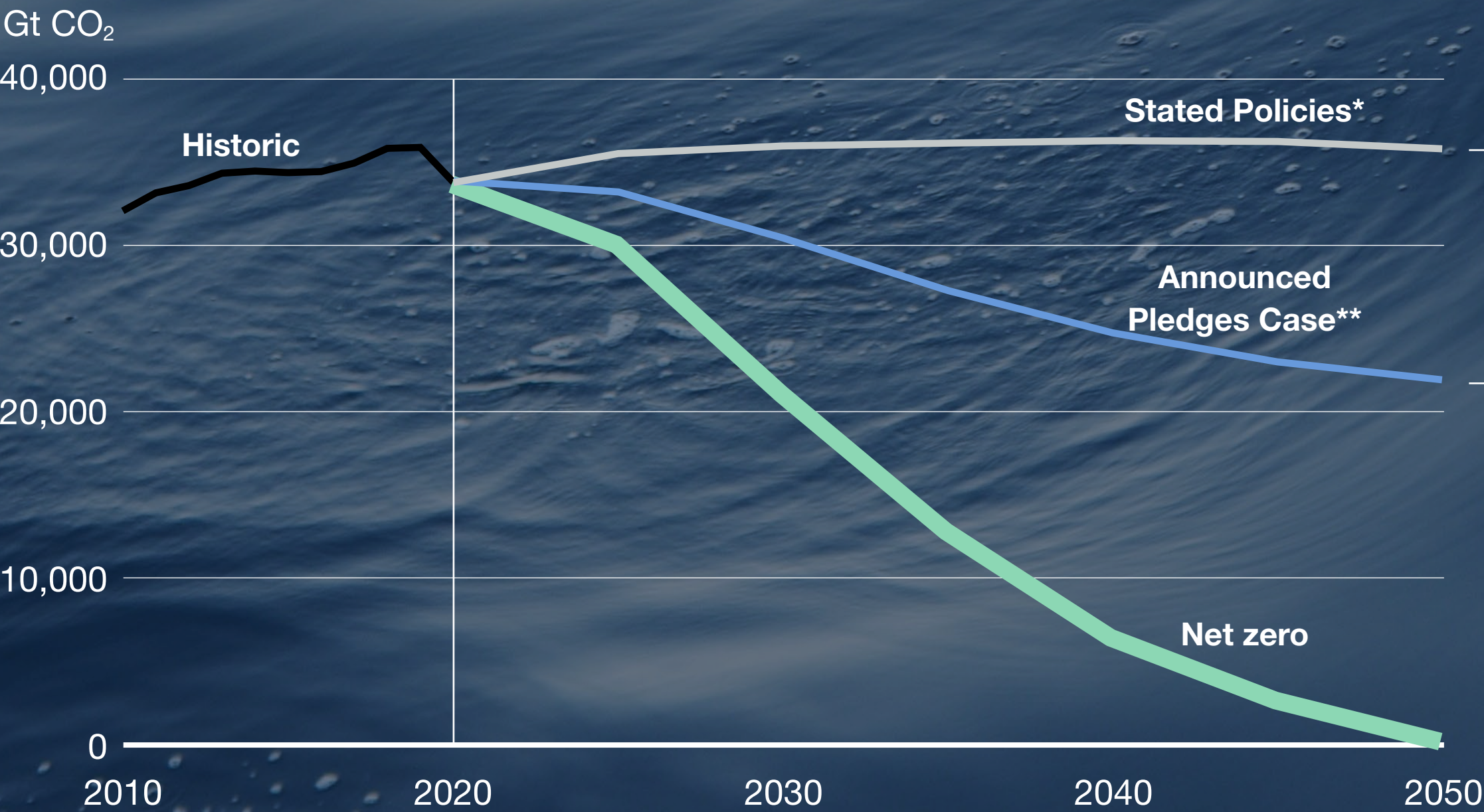
# Business as usual is no longer an option – higher ambitions and faster actions are needed

Swift and determined actions are needed to reduce the CO<sub>2</sub> emissions globally to limit the temperature from rising above 1.5°C by the end of the decade. A 50% reduction in global CO<sub>2</sub> emissions by 2030, and net-zero emissions by 2050 at the latest, are crucial milestones moving forward.

While pledges to combating climate change strive towards lower emissions, these goals fall short of reaching net-zero emissions by 2050. If we are to ensure a viable tomorrow, now is the time to make a low-emission economy a reality. While CO<sub>2</sub> emissions are at the center of the climate crisis, the transition to a fully sustainable economy requires a wider approach that encompasses a broad range of environmental, social, and economic aspects needed to ensure a just transition.

## Global energy-related and industrial process CO<sub>2</sub> emissions by scenario 2010–2050

### Global energy-related CO<sub>2</sub> emissions



Current policies are shifting the climate burden to future generations. Faster scale-up and implementation of existing technologies and solutions is necessary.

Announced net zero pledges provide a significant abatement compared to stated policies, but still fall significantly short of the level we need to reach.

Source: International Energy Agency (2021), Net Zero by 2050, IEA, Paris  
Please see the glossary section for the scenario description.

\*The Stated Policies Scenario (STEPS) takes account only of specific policies that are in place or have been announced by governments.

\*\*The Announced Pledges Case (APC) assumes that all announced national net-zero pledges are achieved in full and on time, whether or not they are currently underpinned by specific policies.

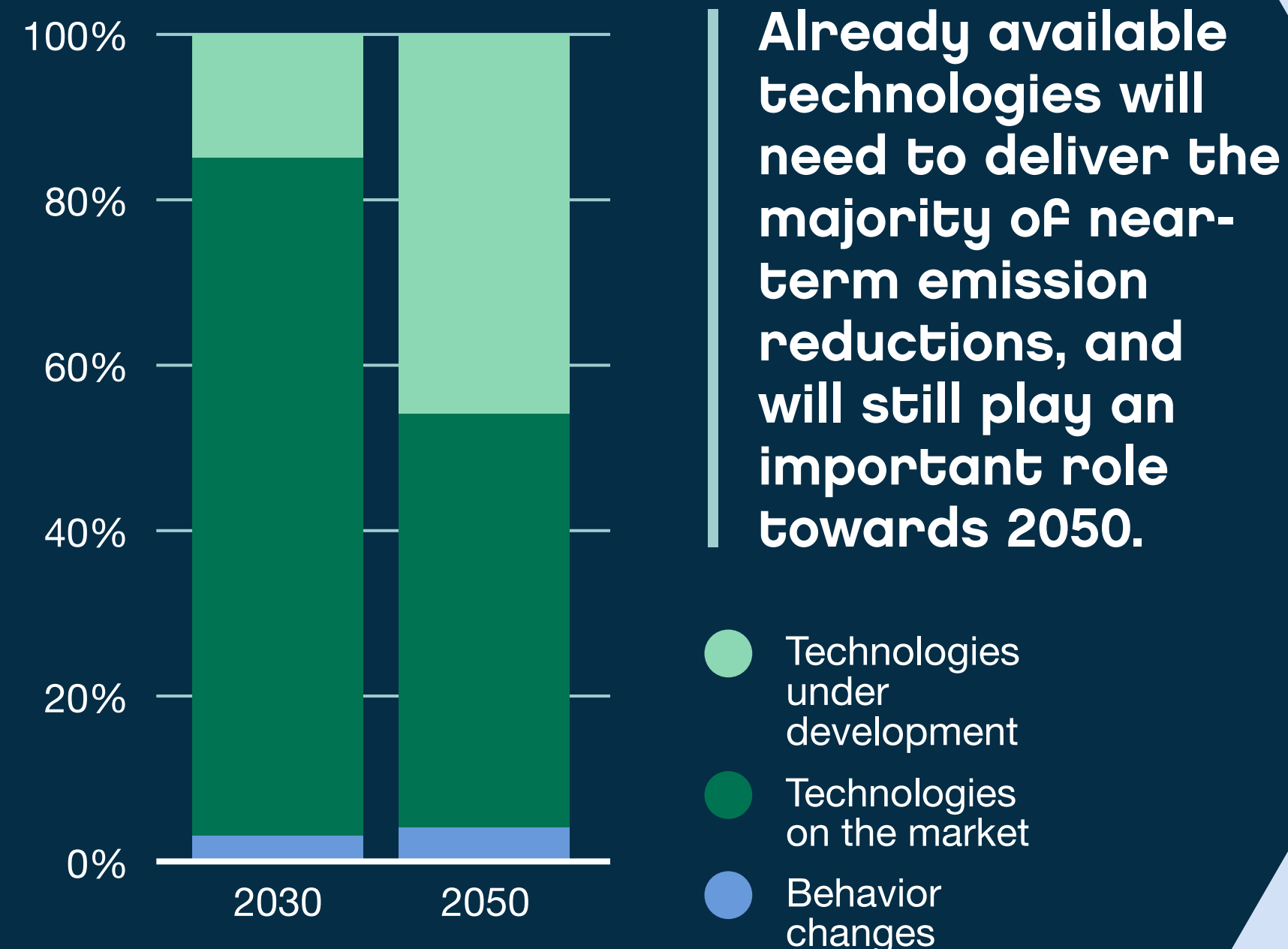
# Accelerating the use of existing solutions while developing new ones is key for reaching net-zero emissions

The Net Zero by 2050 Scenario by the International Energy Agency (IEA) highlights that by 2030 approximately 10 Gt emission savings compared to 2020 would come from technologies that are already mature today. In 2050, approximately 16 Gt CO<sub>2</sub>e, representing 46% of savings compared to 2020, are expected to come from technologies that are currently not commercially available.

It is crucial that regulators ensure a level playing field that allows companies and consumers to choose the most efficient technologies and solutions to drive the transition to net zero forward. Technologies present in the market today have a key role in contributing to CO<sub>2</sub> emission reductions both in the next decade and in the longer term with potential to contribute more than 50% of the total CO<sub>2</sub> emission reductions needed for net zero by 2050.

There is neither a technological silver bullet nor a single carbon price that would be effective in solving the challenge given the enormous variety of low-emissions technologies and their CO<sub>2</sub> abatement costs across different sectors. Sector-specific regulatory approaches are most effective in ensuring the emission reduction potential, if each sector is mobilized simultaneously to quickly get on a path towards net zero.

## Annual CO<sub>2</sub> emissions savings in the net zero pathway, 2030 and 2050, relative to 2020



Source: International Energy Agency (2021), Net Zero by 2050, IEA, Paris

## A level regulatory playing field ensures deployment and R&D

Waiting only for future solutions is not enough to combat the climate crisis. All available low carbon technologies need to be rolled out as fast as possible along with intensifying R&D and innovation to ensure scalable sustainable solutions for the future.

A stable regulatory landscape is needed to support the already available low-emissions technologies while encouraging further research and development on the next generation of innovation. Long-term emission reduction targets need to be a catalyst that enables bold actions in the near term.

1. Long-term ambitious policy frameworks are needed to drive investments in clean technology
2. Sector-specific regulation and incentives are key to driving emission reduction across all parts of the economy in parallel
3. Public support can play an important role in de-risking R&D investments that support new innovations needed to deliver the next generation of clean energy technologies.

# Companies are at the Forefront of developing solutions to meet rising sustainability expectations



## Mitigate climate change

The world needs a rapid transformation to limit global warming to 1.5°C. This translates to halving global GHG emissions by 2030 and redefining our economy to meet net zero by 2050.



## Reverse biodiversity loss

Biodiversity is declining globally at unprecedented rates due to human activities, such as land use changes, pollution, and climate change. Companies need to measure and mitigate their negative impacts and drive a positive impact on biodiversity across the value chain.



## Treat all people with dignity

The idea of human rights is as simple as it is powerful: all people have a right to be treated with dignity. Global companies' value chains impact thousands of people around the world, and businesses are responsible for doing their part in creating a more equitable and inclusive world.

## Sustainable raw materials and supply chain

A traceable and transparent supply chain is a prerequisite for a sustainable business. This also includes a safe and healthy workplace, fair labor practices, and shared sustainability commitment across the supply chain.

## Responsible operations

Forerunner companies need to set ambitious climate targets for their own operations and, increasingly, their whole value chain. Biodiversity is an evolving topic where methodologies to measure impact are emerging. Companies need to promote and embrace an inclusive and diverse workplace culture where employees feel valued and respected.

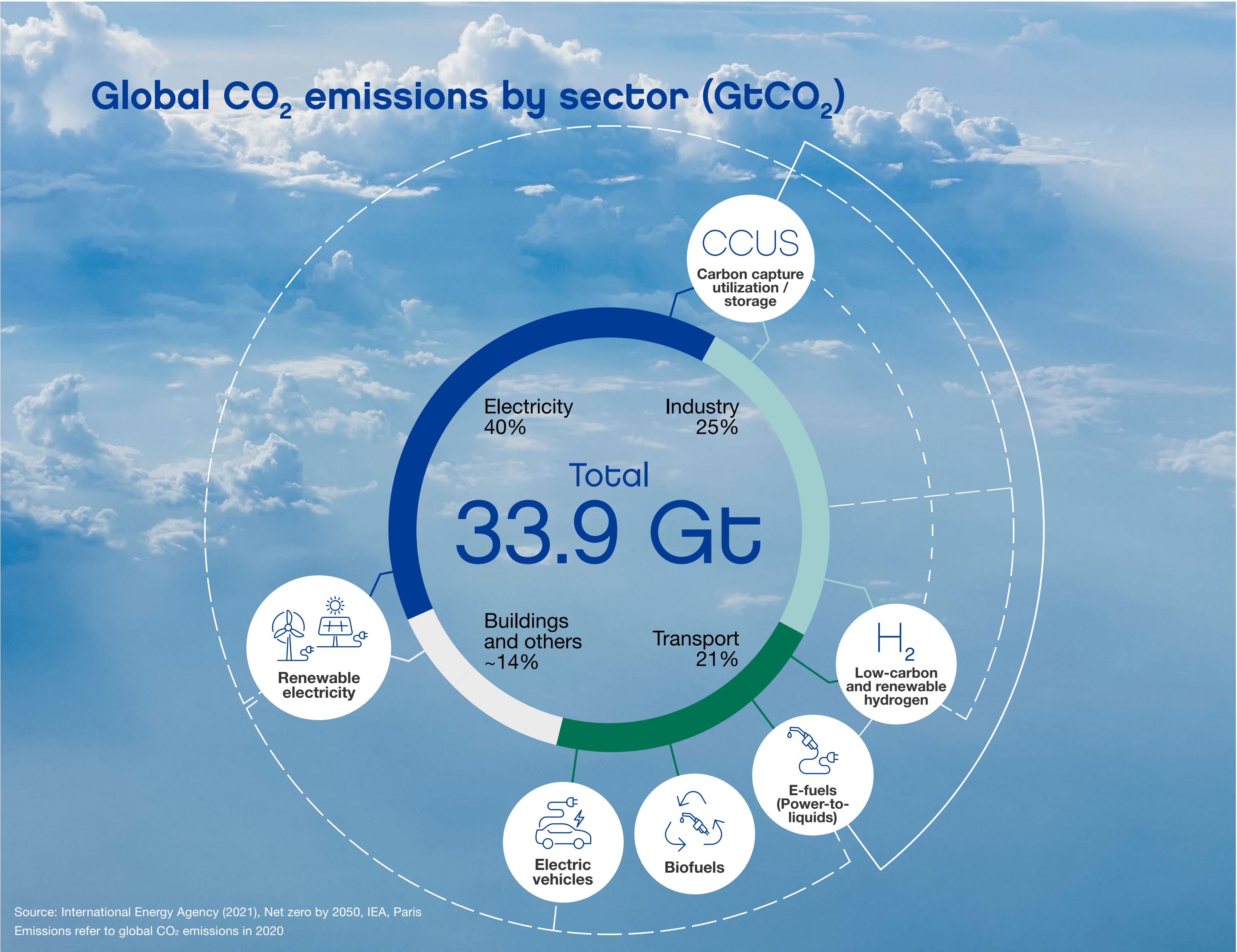
## Sustainable products and services

Products and services that effectively reduce emissions, advance positive biodiversity impacts, and promote human rights offer business opportunities and concrete ways for societies to move to a more sustainable direction.

# Low-emission technologies are scaling up – we just need more speed

Fortunately, there is no need to wait for new technologies to be developed to maturity. A wealth of technologies are readily available to significantly reduce emissions in the coming decades. We only have to create the right framework for deploying them faster.

Despite its complexities, the pursuit of carbon neutrality is filled with opportunities, from deploying current solutions to developing new and effective low-emission solutions. The transformation will occur faster if all viable and sustainable solutions are launched and implemented together, as opposed to launching innovations separately.



# Unlocking new raw material pools with innovation to accelerate emission reductions in transportation

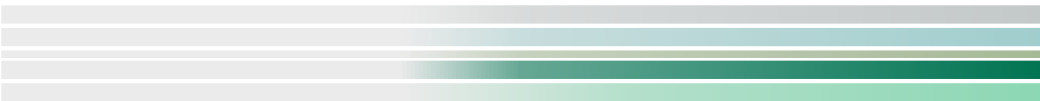
Renewable raw materials hold significant potential to accelerate the reduction of CO<sub>2</sub> emissions, particularly in the transportation sector. Existing low-carbon fuel technologies (e.g., renewable diesel) can still be scaled up significantly from current level. Renewable waste and residue fats and oils will be indispensable in delivering emission reductions in the near future and over the longer term. Novel vegetable oils (such as cover crops cultivated on existing agricultural land during off-season) will be an increasingly important source of raw material for further scaling up solutions such as renewable diesel as well as sustainable aviation fuel production.

In addition, new conversion technologies will enable the use of currently untapped raw material pools such as municipal solid waste and lignocellulosic biomass. In the long term, fuel produced from electricity and waste CO<sub>2</sub>, so-called e-fuels (or power-to-liquids), will also increasingly play a role. The potential of these technologies could be substantial if innovation activities successfully enhance technology maturity and bring down costs.

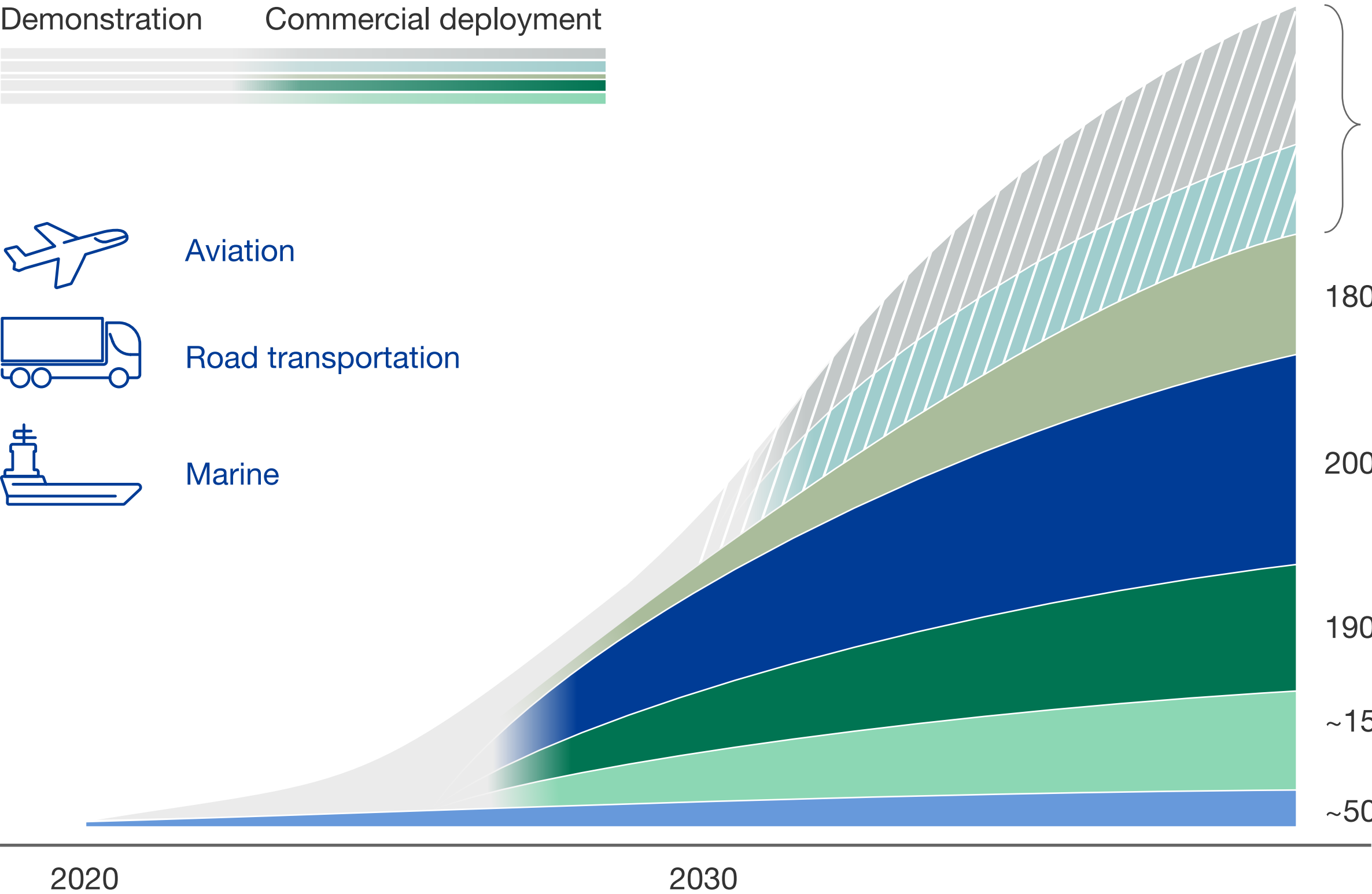
Regulators hold the key to ensuring the eligibility of a broad raw material pool to enable the full emission reduction potential of these renewable raw materials in transport and beyond.

Global raw material potential for renewable fuels (Mtoe)

Demonstration      Commercial deployment



- Aviation
- Road transportation
- Marine



Long-term Fuel potential (Mtoe)

- Significant potential for fuel production in the long term
- Power-to-liquids
- Algae
- 180–275 ● Cellulosic energy crops
- 200–400 ● Lignocellulosic residues (agriculture; forestry)
- 190–250 ● Municipal solid waste\*
- ~150 ● Novel vegetable oils (cover crops; degraded land)
- ~50 ● Waste and residue fats and oils

Source: Neste analysis based on WEF Clean Skies for Tomorrow and other sources  
Biomass potential converted to fuel potential, using around 85% conversion efficiency (weight-based) for fats and oils and novel vegetable oils; around 25% efficiency for lignocellulosic biomass and municipal solid waste.  
\*80% organic waste, with 20% non-reusable, non-separable plastic waste

DEEP DIVE

# Neste's innovation platfORMs aim at commercial operations by 2030

Neste's Innovation Business Platforms were established in 2020 and they focus on commercializing scalable and sustainable raw materials and technologies required for their use. Dedicated teams are driving technology and business development towards concrete projects and commercialization.

Neste is systematically strengthening its partnerships and networks across technological and commercial value chains. We also have a co-innovation program with partners to drive R&D collaboration that aims for large-scale commercialization.

Raw materials and technologies

End-use segments



**Renewable hydrogen**

Pilot project ongoing at Neste's Rotterdam refinery with partners. Green H<sub>2</sub> and CCS project at Neste's Porvoo refinery in feasibility phase, selected for EU Innovation Fund grant.



**Power-to-X**

Technology end-to-end mapping ongoing.



**Algae**

Technology platform build-up ongoing.



**Lignocellulose**

Conversion technology alternatives evaluated. Project development ongoing.



**Municipal solid waste**

Initial assessment of scalable technologies ongoing.



**Renewable  
aviation**

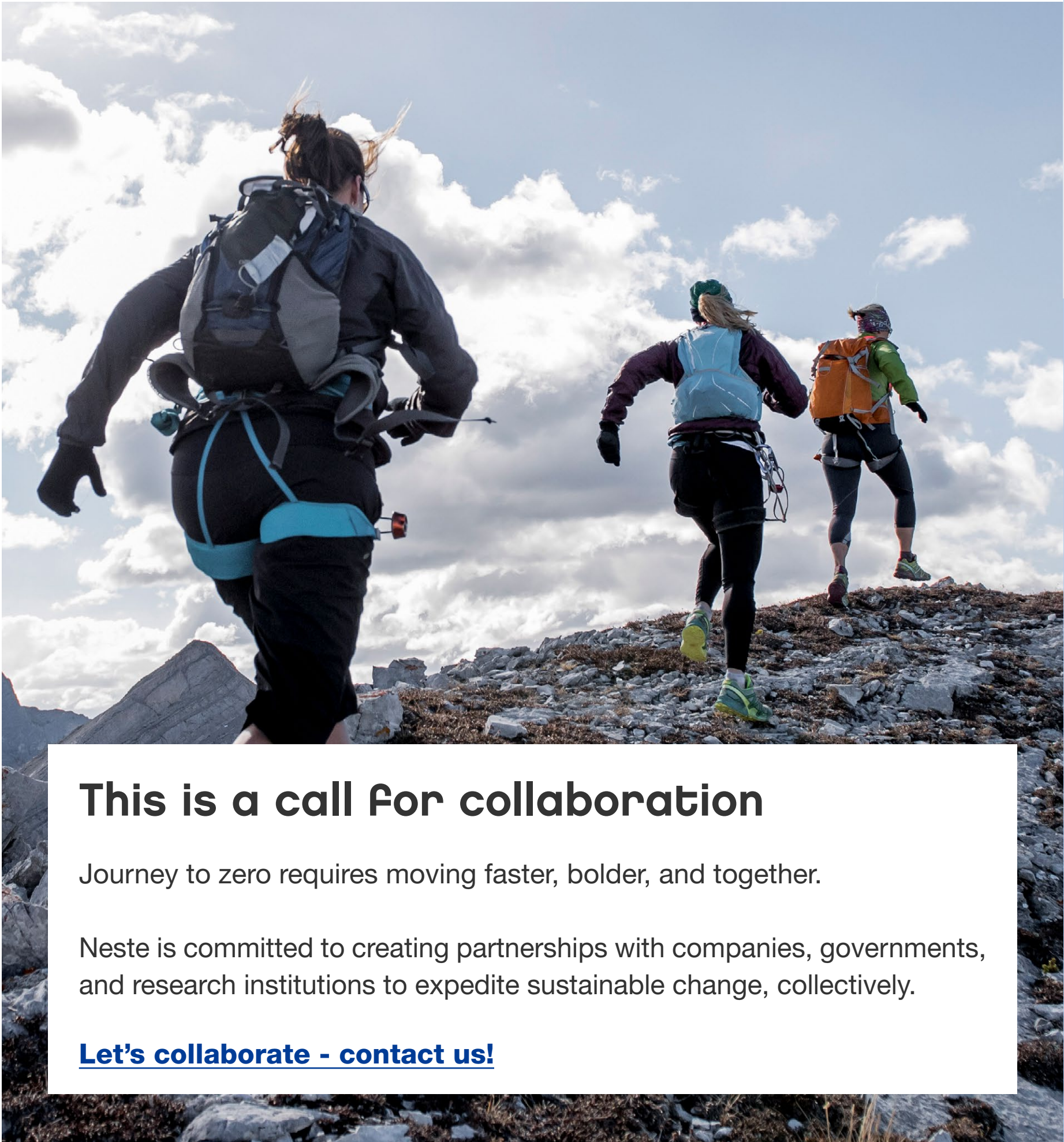


**Renewable  
polymers and  
chemicals**



**Renewable  
road  
transportation**

# Joining Forces to reach net zero



## This is a call for collaboration

Journey to zero requires moving faster, bolder, and together.

Neste is committed to creating partnerships with companies, governments, and research institutions to expedite sustainable change, collectively.

[Let's collaborate - contact us!](#)

## On a personal note



If we are to secure a full palette of emission-reducing technologies and further breakthrough innovations, it is vital to address the role of legislation. How do we enable a political and regulatory mindset that has GHG emissions in focus? This means embracing all solutions to reduce emissions and enabling the use of a full toolbox of raw material options rather than trying to guess and pick technological silver bullets. To meet high emission reduction targets, the potential of sustainable raw materials should not be restricted by regulation.

It is obvious that we need to make renewable solutions cost-efficient and financially sustainable. I'm honored to be a part of this journey with Neste, where we are pushing the boundaries for solutions to create a healthier planet for our children.

**Lars Peter Lindfors**  
Senior Vice President, Innovation

We need companies that can make the bold moves necessary to scale up these new innovations and bring the new solutions to businesses and consumers globally. At Neste, we are relentlessly striving to find new ways to reduce the amount of carbon released into the atmosphere and circular solutions to reuse the carbon again and again. There is no doubt in my mind that we will see more real change in the next ten years than we have seen in the last ten. This will keep Neste on track to fulfill our purpose, as well as the world on track to combat climate change.

**Minna Aila**  
Senior Vice President, Sustainability and Corporate Affairs



# We should talk



What are the most effective policy measures to drive emission reductions simultaneously in all sectors (power, transport, industry a.o.)?



How do we balance the need to maximize the contribution of available low-carbon technologies today, while encouraging the innovation of new solutions required for the longer run?



What are the most effective frameworks to speed up innovation and the use of existing low-carbon solutions?

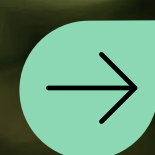


How do we foster resilience and create contingency plans to shield society and low-income households from unintended consequences as we undergo major transitions?

# Connecting consumers and the circular economy

Consumers increasingly demand more sustainable products and services with transparency to value chains. Such transparency is required for the material and energy flows over the life cycle, as well as for human rights and biodiversity impacts.

In this chapter, we weigh in on rising consumer expectations and explore prospective solutions for growing waste volumes through increased capabilities in both mechanical and chemical recycling and energy recovery.



Read more about Neste's renewable and circular solutions on **our website**.



# On a personal note

What we need is a circular economy – rethinking how we use our resources again and optimizing the value chains to make the most of the materials. We are at the beginning of our journey towards a truly circular society, and different industries must work together to create circular value chains.

Polymers are necessary in many applications and, hence, very valuable products. That is why it is crucial to ensure that none of the polymers are wasted, but are circulated, recycled, and used again. Producing essential and hard-to-replace products with polymers for the food and pharmaceutical industry uses, as well as for the automotive industry and construction, the petrochemical industry plays a key role in creating a circular lower-emission society.

I’m proud to work on this very matter, developing renewable and circular feedstocks which can be used by our partners to produce circular polymers and materials.

**Isabella Tonaco**  
Vice President, Value Proposition Development,  
Renewable Polymers and Chemicals



# A growing middle class and urbanization are driving consumption and energy use

The global population is estimated to increase by 1.4 billion by 2040. By then, the middle class will have grown 30% larger than it is today, and nearly 70% of this group will be living in the Asia Pacific region. As nations become wealthier, their citizens are willing to spend more on an assortment of services and products. This also means the global demand for primary energy will rise by 20% and waste generation will increase by 40%.

Increasing energy consumption and waste generation will put pressure on the climate crisis the world is facing. However, this challenge will also create opportunities for societies and businesses.

## Megatrends



## Primary impacts



Sources: 1 & 2: UN; 3. The Brookings institution; 4: IEA Stated Policies Scenario; 5: World bank

# Voices and choices – consumers' growing demand For sustainable products

Growing wealth drives consumption but also increases access to education, which strengthens environmental awareness. Consumer surveys reveal that plastic waste and climate change are viewed as the biggest environmental concerns globally. This applies also to emerging economies including China, Mexico, and Brazil. According to these surveys, consumers are willing to choose products and services from companies that demonstrate strong environmental values.

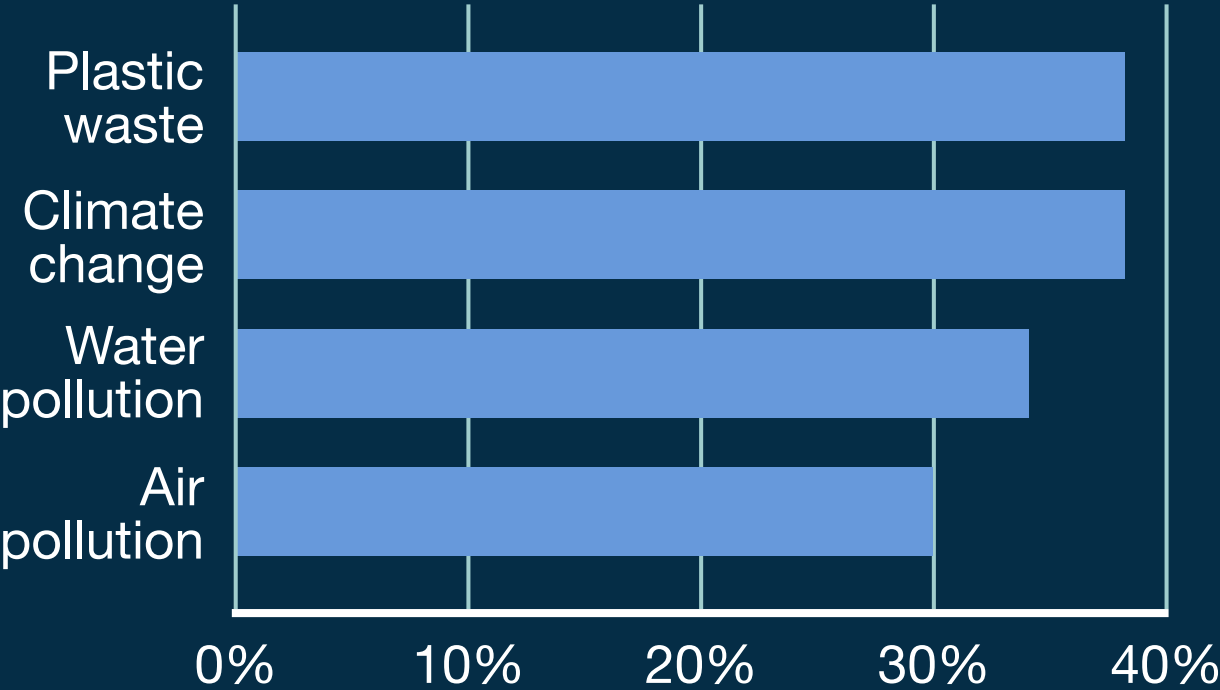
Progressive companies see business opportunities in offering environmentally friendlier and more sustainable products and services with lower emissions. This helps consumers make responsible choices while providing opportunities for growing the business.



Middle class population  
**+30%**  
increase in  
2020–2030

**+\$29  
trillion**  
in spending by  
2030 (increase  
in middle class  
spending vs.  
2017)

## Consumers' top 4 environmental concerns<sup>1</sup>



**60% of global consumers prefer  
to buy from companies that  
show genuine concern for the  
environment<sup>2</sup>**

<sup>1</sup> Only top 4 answers shown here. Source: Kantar: Who Cares, Who Does 2020  
<sup>2</sup> I try to buy from companies that show genuine concern for the environment  
(% fully agree/agree), Source: Kantar: Who Cares, Who Does 2020

Source: The Brookings Institute (2017): The unprecedented expansion of the global middle class

# Tackling growing waste volumes through increased recycling and energy recovery

The world has a growing waste problem, with global waste generation forecasted to increase by 50% by 2050, driven by the growing population and rapid urbanization.

Currently, 70% of the global waste volume is either discarded in landfills or leaking into ecosystems. Regardless of the origin, raw materials are disappearing from value chains. A rapid step change to increase recycling and higher-value energy use for difficult-to-recycle, primarily organic waste streams, is needed to reduce the waste of valuable resources.



## Key actions to tackle this global issue include:

- Reducing waste generation through smart use of packaging as well as elimination of unnecessary single-use plastic items.
- Increasing the sorting and recycling of valuable materials, e.g. glass, metals, paper, and plastics. These methods also include both mechanical and chemical recycling of plastics, based on the waste quality.
- Promoting the use of municipal solid waste (MSW), in particular the organic fraction, in lower-emission fuel production for road transportation and aviation to reduce crude oil reliance.

## Did you know:

**70%**

of global municipal waste streams are going to landfill or leaking into ecosystems. Only 14% are currently recycled.

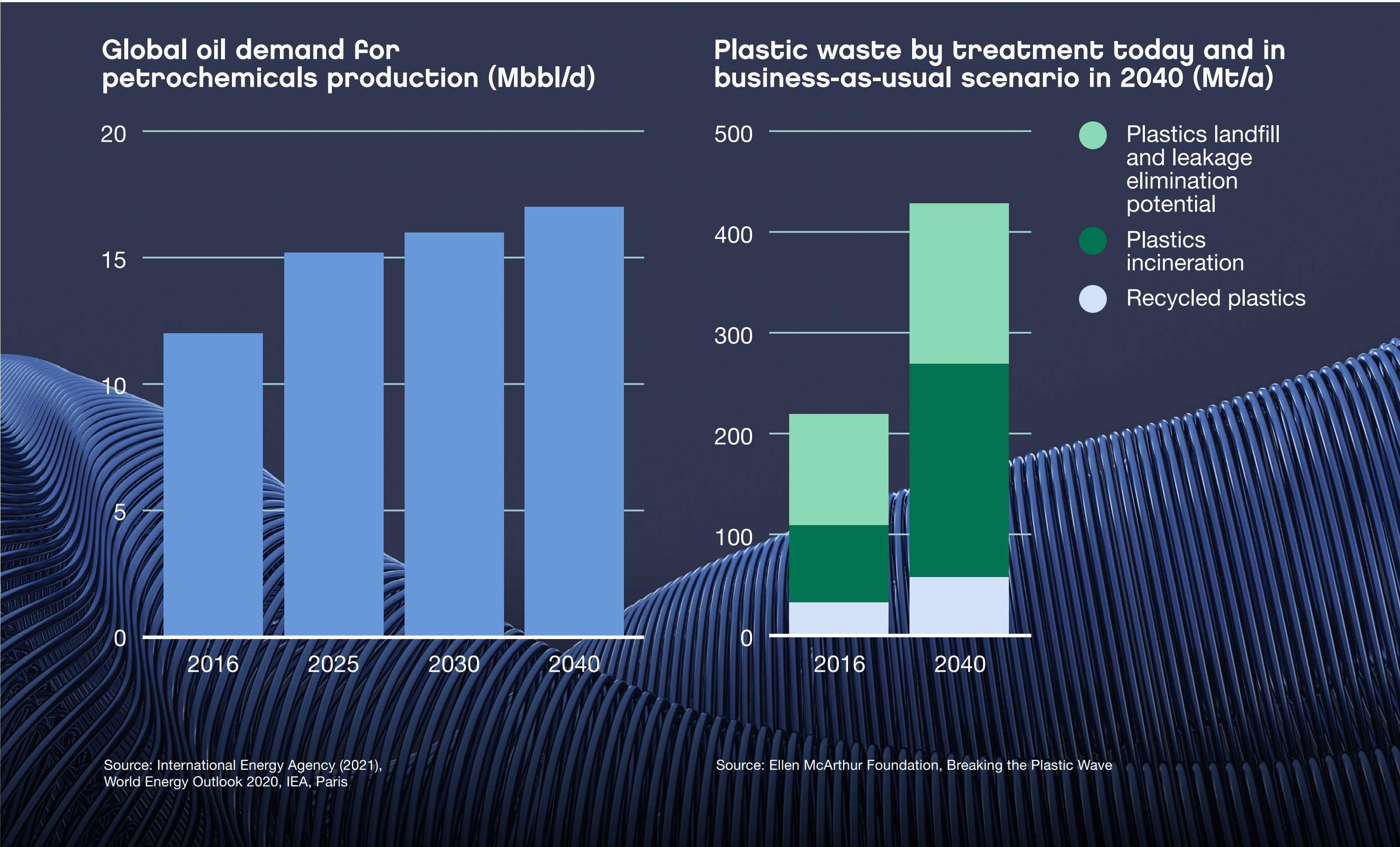
Source: World Bank: What a waste 2.0

# The chemical industry is in a pivotal position to create a circular economy

The petrochemical industry consumes 13% of the world’s crude oil today and could account for a half of global oil demand growth until 2040. The growing demand for polymers, e.g. in plastics production, is one growth driver. This results in growing global volumes of plastic waste, which disappear from the value chains either through incineration or leakages into the environment.

In order to reduce the GHG emissions, the world needs to significantly limit the increasing consumption of fossil crude oil driven by the petrochemical industry.

Among other actions, this challenge requires utilizing plastic waste as a raw material for new materials as well as using renewable raw materials to produce chemicals.



DEEP DIVE

# Ramping up the potential of chemical recycling

Neste is aiming to process more than 1 million tons of plastic waste annually from 2030 onwards. This valuable resource will be used to produce feedstock for new materials and products in a sustainable and value-adding manner. Test runs to process liquefied waste plastic have been conducted at Neste's refinery in Finland.

Neste collaborates with waste management and recycling experts Ravago and Remondis to accelerate the development of chemical recycling for currently hard-to-recycle plastics. Neste has made an equity investment in Recycling Technologies (RT), a company focused on developing technical solutions in chemical recycling. Neste joined Unilever in establishing a circular value chain with RT. Neste has also acquired a minority stake in Alterra Energy, with the ultimate goal of commercializing Alterra's waste plastic liquefaction technology in Europe. Neste and Ravago aim to establish a joint venture to build a commercial scale chemical recycling plant in the Netherlands. The plant will process approximately 55,000 tons of mixed plastic waste per year.



# We should talk



What are the requirements to enable a Full shift to a circular economy?



How can we leverage urbanization and the increasing wealth of consumers to reduce material loss rather than add to it?



How can the chemical industry best serve the growing demand for more sustainable products in a way that builds trust and transparency among consumers?



How do we decide what constitutes an efficient recycling technology?

# Leading an industrial emissions revolution

The industrial sector provides goods that are indispensable in our economies, from steel and cement, to transport fuels, polymers, and chemicals. The challenge is that the production of these materials is very energy intensive and thus emitting large amounts of CO<sub>2</sub>. How can these industries be transformed towards net-zero emission production?

Neste is committed to reducing our own production emissions (Scope 1 & 2) by 50% by 2030 and reaching carbon-neutral production by 2035. By 2040, we want to reduce the use phase emission intensity of sold products (Scope 3) by 50% compared to 2020 levels. In this chapter, we discuss the complex nature of the challenge, analyzing key solutions and their usage from hydrogen to carbon capture and co-processing.



Read more about sustainability  
at Neste on [our website](#).

# On a personal note

In my role, I come across strong debates over how to best advance sustainability and carbon neutrality, and how products should be produced in order to qualify as renewables. I believe in starting with the challenges closest to you and progressing stepwise, while keeping the long-term goals clear in sight. Every step counts. Sometimes the actions with immediate impacts may not be optimal from a long-term perspective. But can the planet wait until we reach perfection?



**Outi Ervasti**  
Vice President, Renewable Hydrogen



Everything related to the refining industry is about to transform. Neste aims to make its Porvoo refinery the most sustainable in Europe by 2030. We have set industry leading carbon handprint and footprint targets. I'm excited to invite our partners to join this journey, where we continue to set the bar high in our Oil Products business to help customers transform towards lower-emission solutions.

**Sami Oja**  
Vice President, Strategy, Oil Products

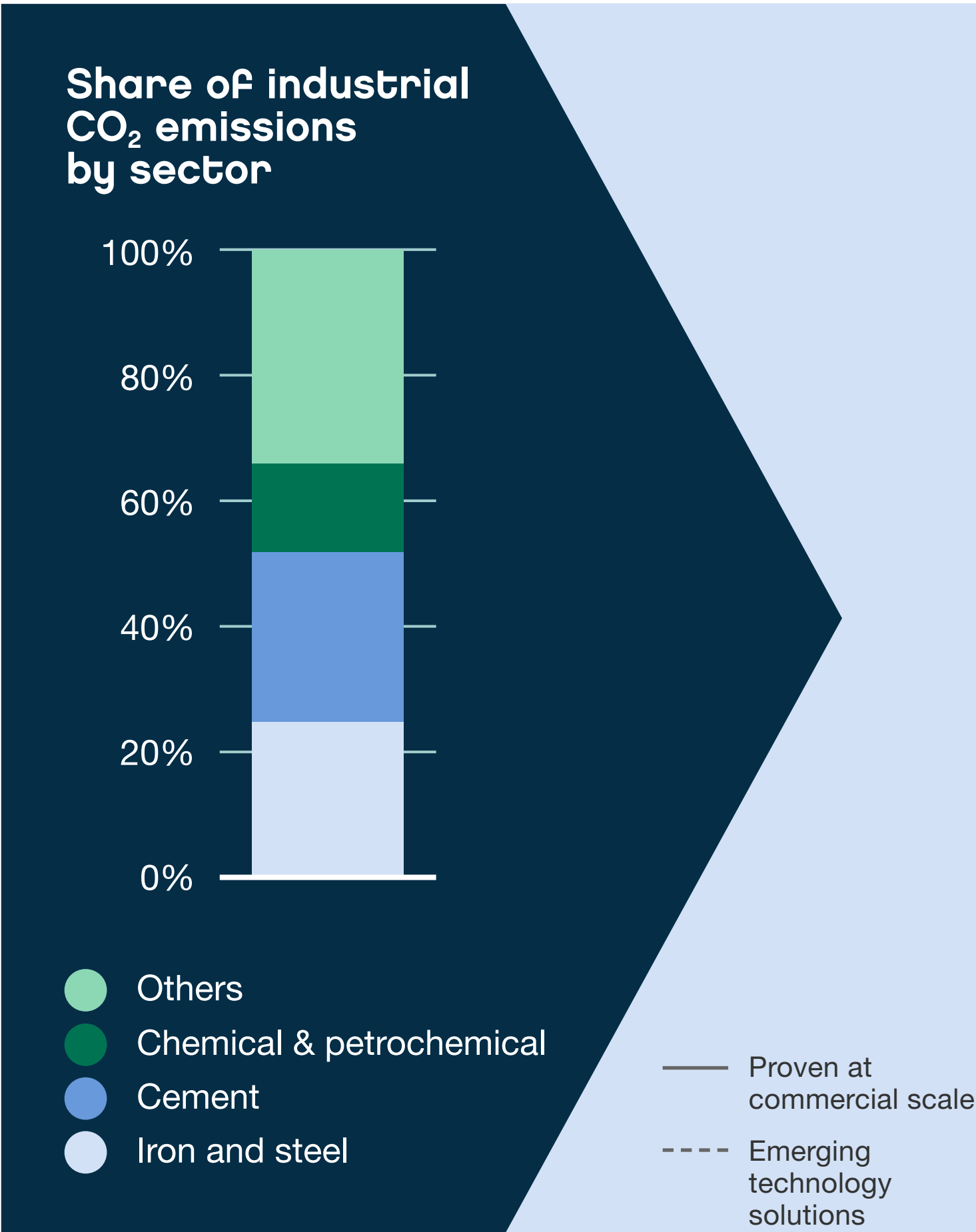


# Exploring various paths to reaching net-zero emissions in the industrial sector

The challenge of reducing emissions in the heavy industry sector arises from the complex nature of electrifying industrial processes. A large portion of emissions are discharged from refining raw materials and high-temperature heat generation. As a result, industrial emission reduction is forecasted to be one of the slowest to progress towards net zero over the approaching decade when compared to other sectors.

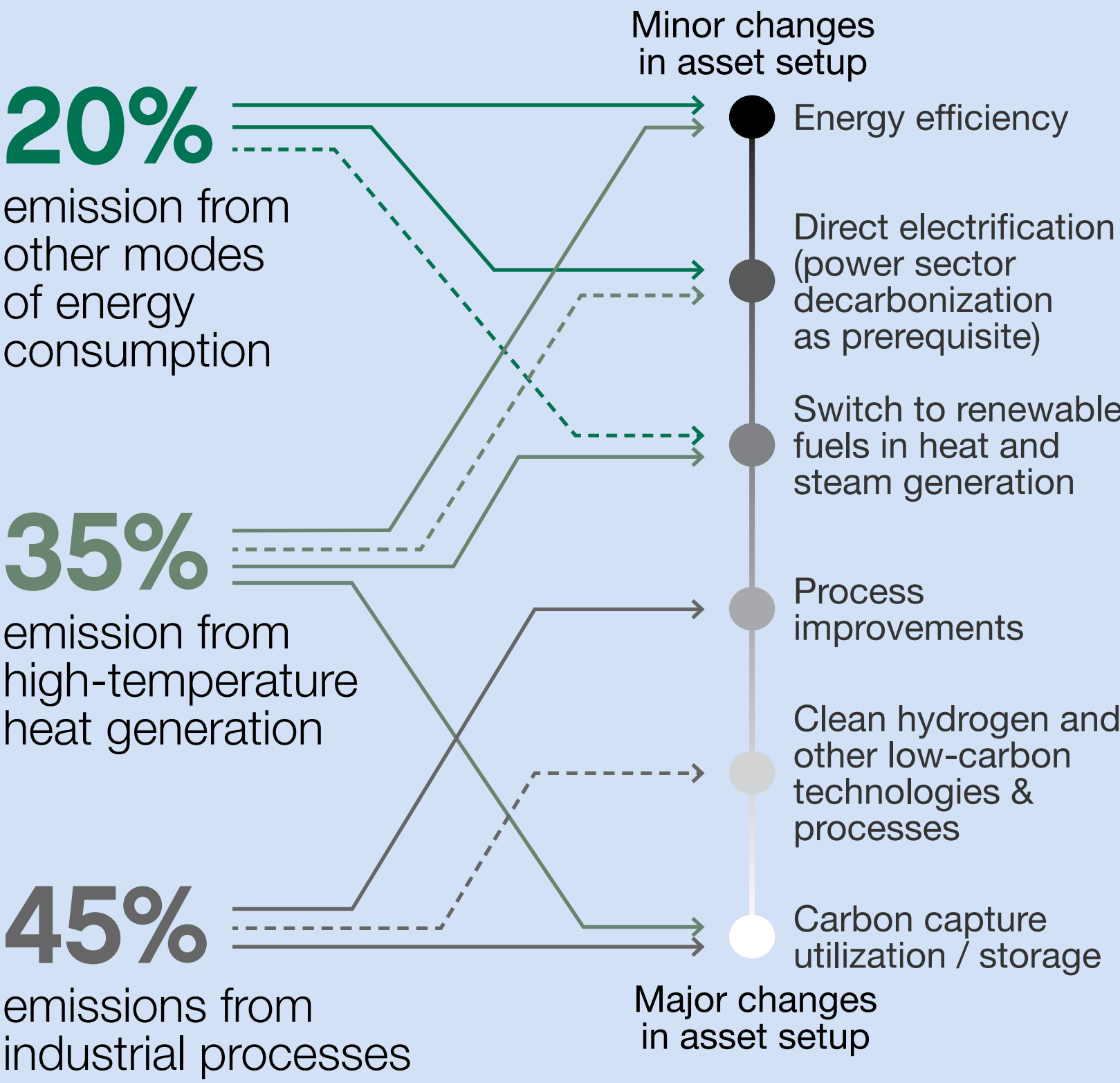
At the same time, new solutions are evolving, including clean hydrogen technology and CCUS which are set to accelerate progress in the carbon neutrality ambitions of major industries. This is vital, as industrial processes are highly structured with long operational lifetimes (more than 50 years). Redesigning existing assets and considering cleaner technologies are essential tools for reducing emissions in these sectors.

Some changes to currently used technologies and configurations can be implemented with limited investments and revisions to asset setup, such as energy-efficiency measures and the use of renewable electricity instead of fossil-based electricity. Reductions in raw material processing emissions are attained by transforming the process, namely through investments in green hydrogen production, carbon capture, utilization, and storage. Through deploying a full range of innovative solutions, achieving net zero can become a reality.



Source: International Energy Agency (2020), Tracking Industry 2020. Based on 2018 emissions data.

## Share of industrial CO<sub>2</sub> emissions by process and ways to reduce emissions



McKinsey (2018), Decarbonization of industrial sectors: the next frontier

# Unlocking the potential of co-processing and retrofitting to produce lower-emission products

Major industrial assets, such as refineries, typically have long operational lifetimes with large socioeconomic impact. Combined with complex operations, implementing larger changes to these assets (e.g., due to climate considerations) requires longer time and can often only be done during large maintenance breaks. Transforming these assets to accommodate renewable and circular raw materials, via co-processing and retrofitting is a way to accelerate the change, benefiting from readily available refining experience and know-how.

Co-processing of renewable and circular raw materials reduces dependency on fossil raw materials and increases the renewables capacity, enabling lower-emission products. Retrofitting selected units, or even major parts of refineries to produce renewable fuels and materials is another potential approach to utilize the existing asset.

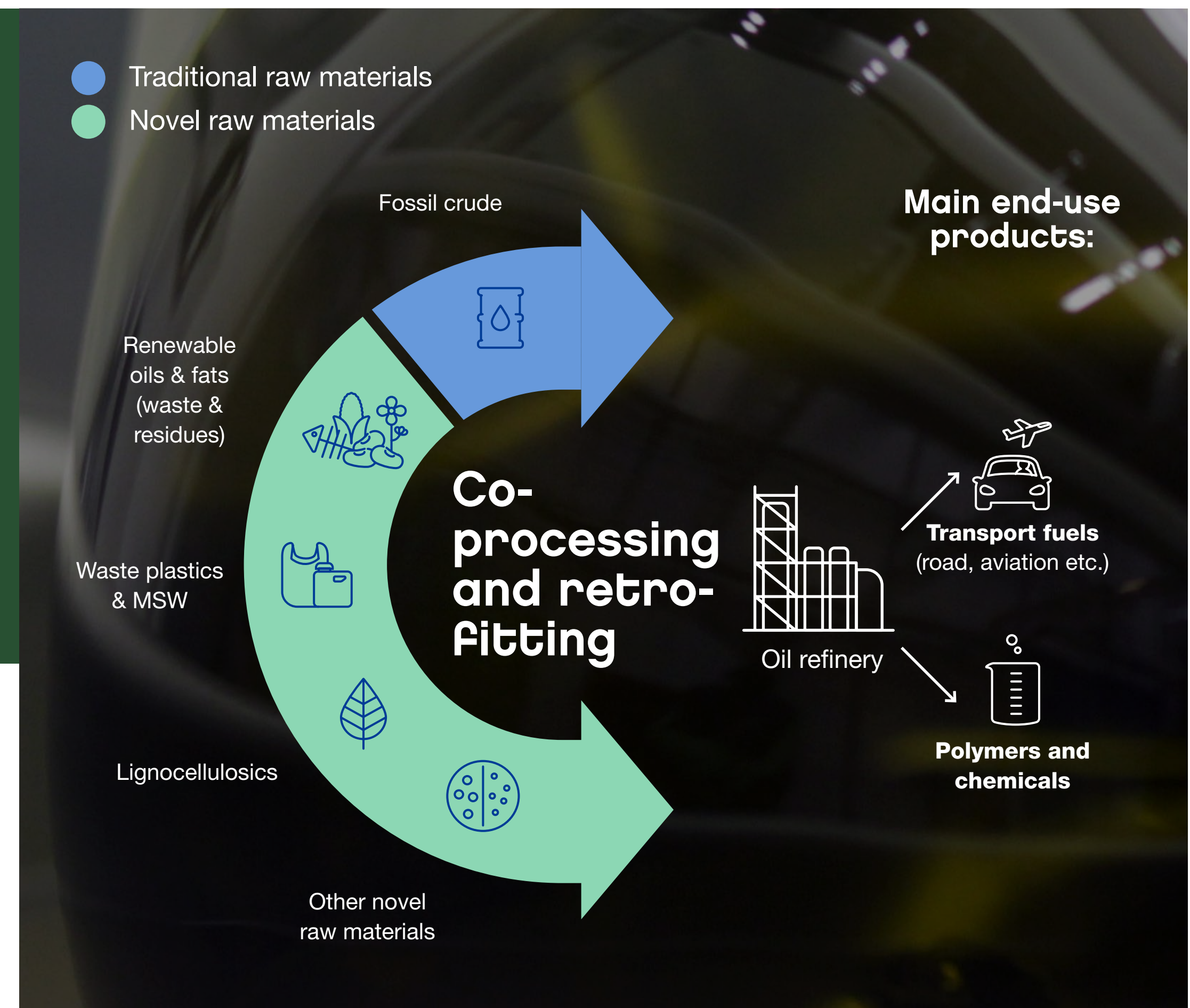
As part of the ambition to make our Porvoo refinery the most sustainable refinery in Europe by 2030, we are introducing alternative raw materials for co-processing, and are exploring options to retrofit certain units. This starts from renewable raw materials already used by Neste and is expanded to new and novel raw materials such as waste plastics, municipal waste, lignocellulosics and more. Co-processing and retrofitting can contribute to Neste achieving its target to reduce the use phase emission intensity of sold products by 50% by the year 2040.

## Key opportunities for processing renewable and circular raw materials in a refinery:

- Fast implementation: limited adjustments needed for co-processing or fully retrofitting selected units
- Logistic synergies due to existing infrastructure
- Long-term synergies from emission reduction investments (green hydrogen, CCS) enabling lower-emission, renewable fuels and circular and renewable materials

## Did you know:

Neste targets to co-process  
**>10%**  
renewable and recycled  
raw materials at its crude oil  
refinery by 2030



DEEP DIVE

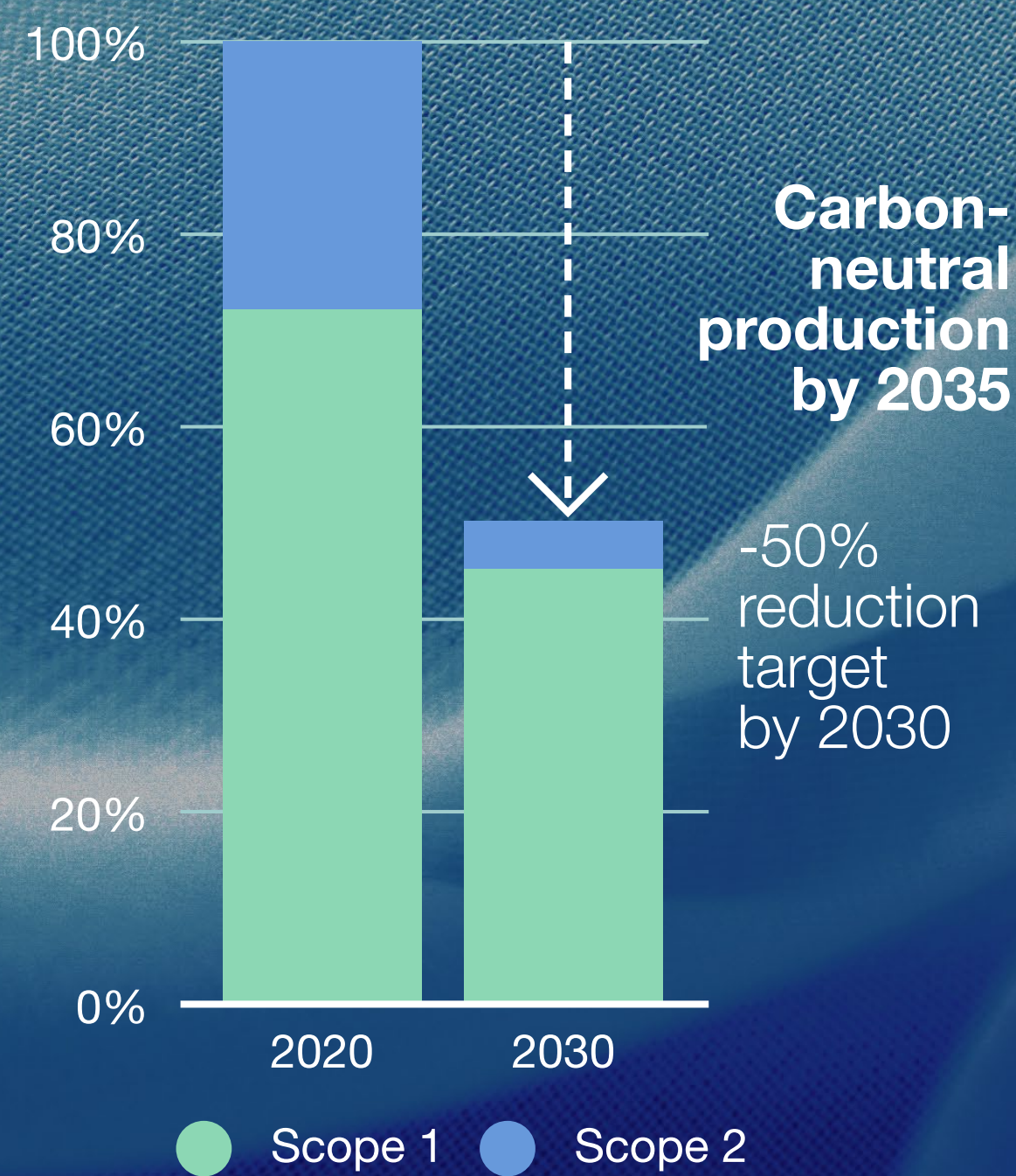
# Leading the way to carbon-neutral production by 2035

Neste has set an ambitious target to achieve carbon-neutral production (Scope 1 & 2) by 2035, with an intermediate target of 50% reduction by 2030. In addition, we have a target to reduce the use phase emission intensity\* of sold products (Scope 3) by 50% by 2040 compared to 2020 levels. Reducing production-related emissions requires both leveraging existing solutions, while continuously assessing and making breakthroughs in maturing new technologies and innovative solutions.

Currently, Neste is evaluating and implementing over 80 measures to reduce our Scope 1 & 2 emissions. By setting concrete and ambitious emission reduction targets we want to demonstrate Neste's commitment to limit global warming to 1.5°C.

\*Use phase emission intensity is calculated by dividing the emissions from the use of products sold by Neste with the total amount of sold energy (gCO<sub>2</sub>e/MJ)

Neste's journey to carbon-neutral production 2035 (Scope 1 & 2 emissions)



| Focus areas           | Identified measures                                                                                                                                                                                                                                                            |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Purchased energy      | <ul style="list-style-type: none"><li>Aiming for 100% renewable electricity by 2023</li><li>Steam from renewable energy sources</li></ul>                                                                                                                                      |
| Process emissions     | <ul style="list-style-type: none"><li>Continuous process improvements including energy efficiency investments</li><li>Asset optimizations</li></ul>                                                                                                                            |
| Hydrogen production   | <ul style="list-style-type: none"><li>Ongoing evaluation of various clean hydrogen technology including:<ul style="list-style-type: none"><li>Electrolysis</li><li>Carbon capture and utilization / storage</li><li>Biogas for steam methane refining unit</li></ul></li></ul> |
| Credible compensation | <ul style="list-style-type: none"><li>Utilizing verified and reliable methods for compensating for the remaining emissions after emission reduction measures have been deployed.</li></ul>                                                                                     |

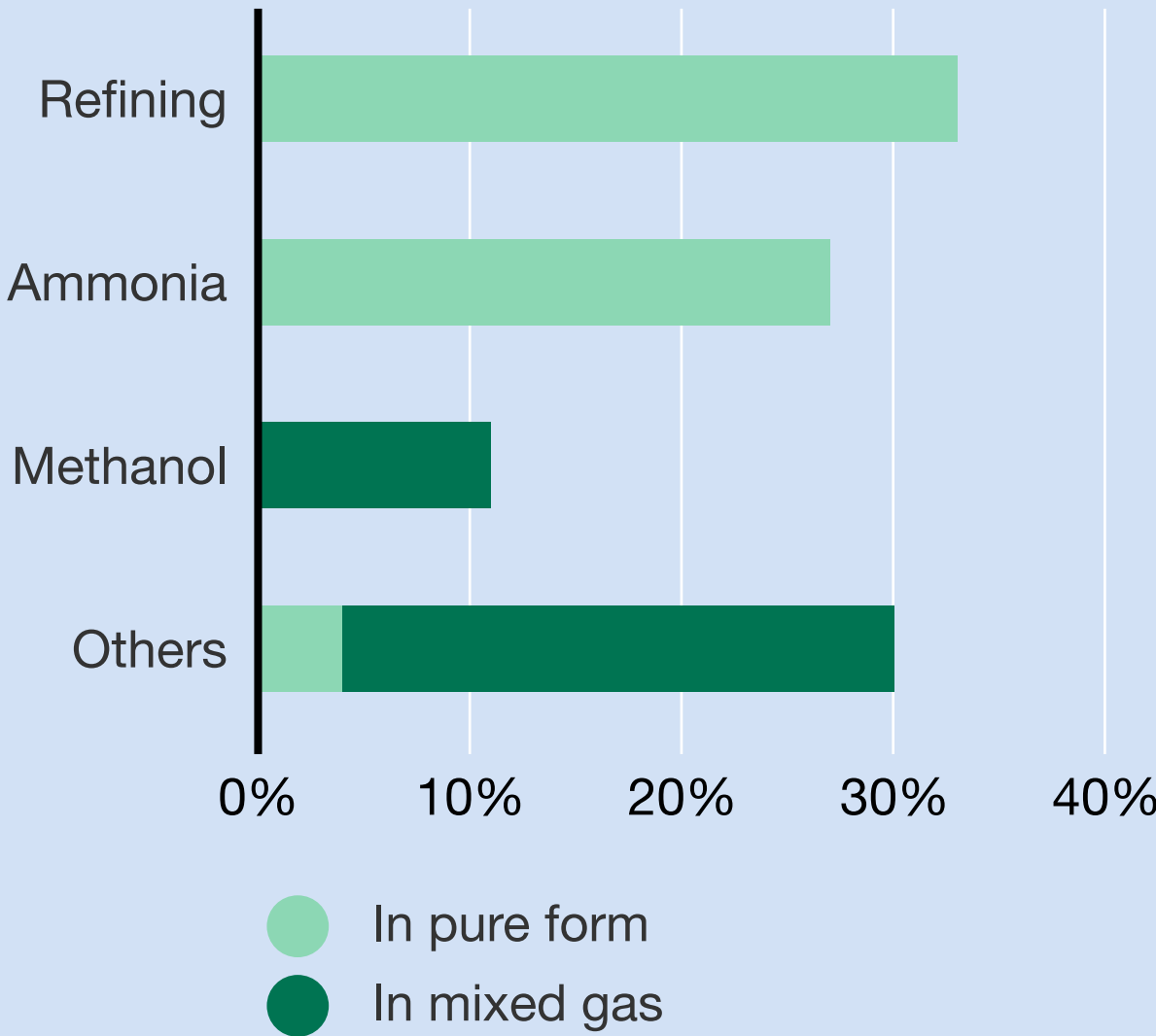
# The lightest element can decarbonize the heaviest industries

Clean hydrogen is set to enable significant emission reductions in heavy industry, refinery operations included. Largely driven by improved availability, maturing technologies, and the declining price of renewable electricity – combined with definitive regulations in a growing number of countries – are driving the production of clean hydrogen. Considering emission allowance costs, clean hydrogen will be competitive against fossil-based hydrogen in some regions as early as 2030.

Clean hydrogen – including green and low-emissions blue hydrogen – has the greatest near-term potential in existing applications in refining and other industrial processes. Changing the source of the hydrogen provides significant emission reduction, while continuing to use existing processes and infrastructure.

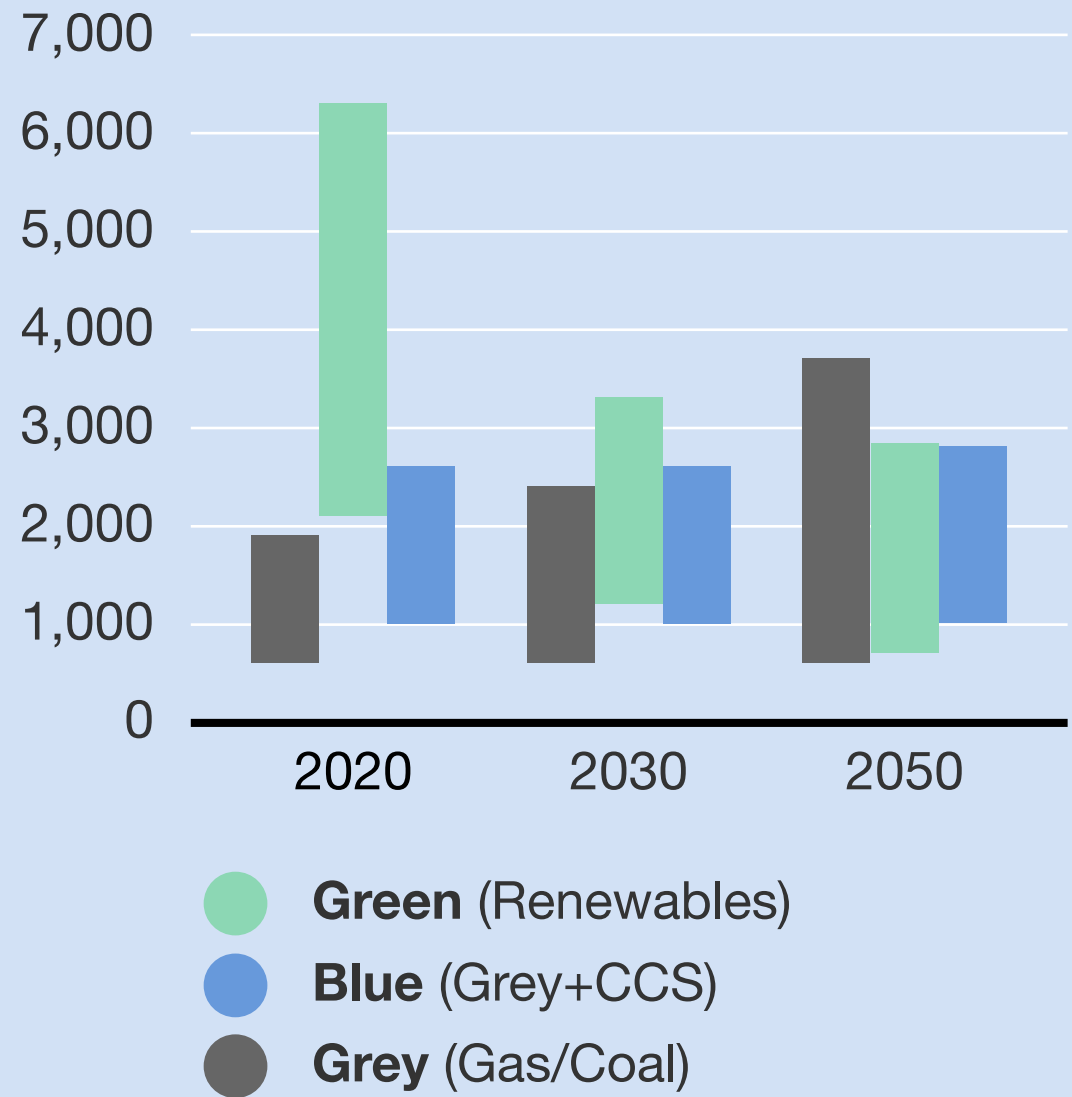
Green hydrogen provides opportunities to reduce also transport sector emissions, in the form of direct use of H<sub>2</sub> in fuel-cell vehicles or as Power-to-Liquids (PtL) fuel, the latter being able to utilize captured CO<sub>2</sub> emissions. Hard-to-abate transportation segments such as aviation (primarily PtL), shipping (PtL, Methanol), and some heavy-duty road transport (PtL, hydrogen) are the primary focus, as well as segments in which direct electrification is challenging, e.g. due to operational modes.

Global hydrogen demand by sector



Source: International Energy Agency (2019), The Future of Hydrogen. Based on 2018 data.

Global production cost ranges\* for hydrogen by production method (EUR/tH<sub>2</sub>)



Source: Neste analysis from various sources including IEA, IRENA, and others  
\*Assumed CO<sub>2</sub> Prices (EUR/tCO<sub>2</sub>) = 2020: 0, 2030: 50, 2050: 100–200

**~10%**  
of global industrial  
CO<sub>2</sub> emissions are caused  
by hydrogen production

**<1%**  
of globally used H<sub>2</sub>  
currently comes from  
renewable sources

**6%**  
share of hydrogen  
production in global  
natural gas consumption

DEEP DIVE

# Building a platform for renewable H<sub>2</sub> and power-to-X solutions

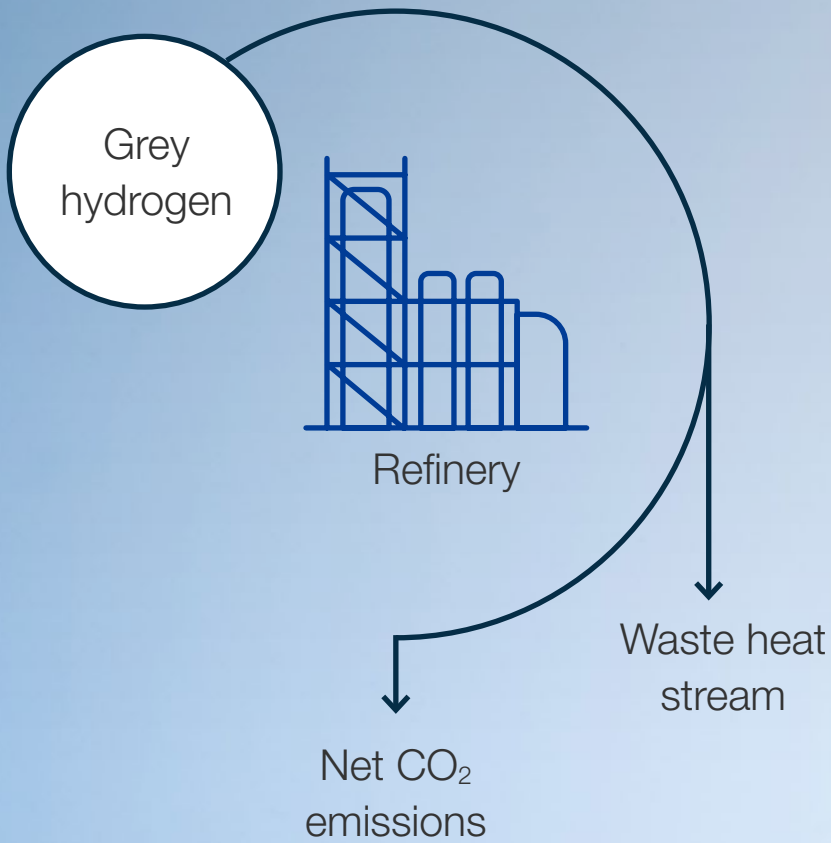
Neste's Renewable H<sub>2</sub> and PtX Business Platform was established to evaluate, pilot, and build commercial readiness for Neste in the fields of clean hydrogen, carbon capture, utilization & storage, and other power-to-X concepts.

The platform explores various utilization pathways and markets of clean hydrogen. These include using it in existing refinery assets (e.g., to produce oil and renewable products) and in emerging end uses such as using H<sub>2</sub> in the transport sector, power-to-X, and by-products that arise from the process.

**Did you know about hydrogen?**

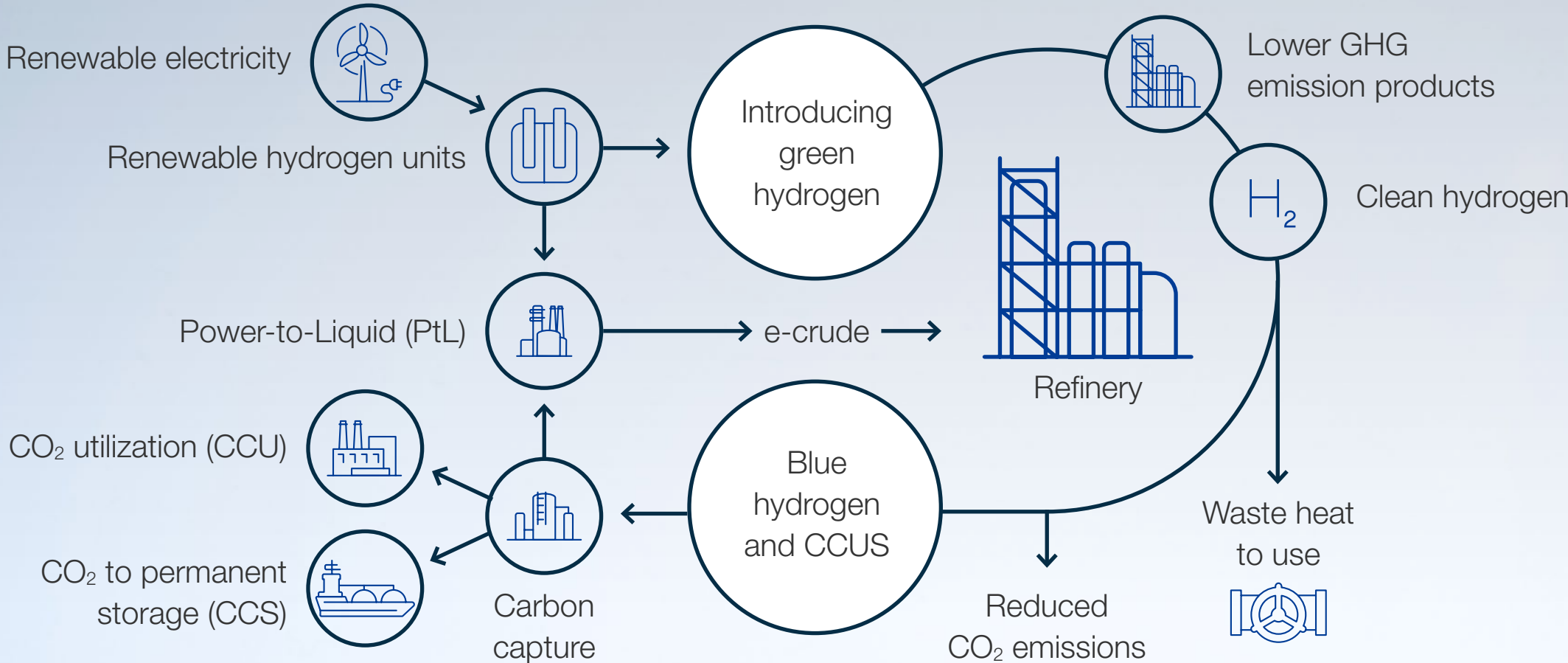
- Green: produced via electrolysis using renewable electricity
- Blue: produced from natural gas via steam methane reforming combined with carbon capture
- Clean: green and blue hydrogen
- Grey: produced from natural gas via steam methane reforming

TODAY



- Hydrogen plays a crucial role in refinery operations
- Hydrogen production represents a significant share of total refinery emissions
- Successes in transforming hydrogen production will lead to lower GHG emissions in refining and consequently in the end-products.

VISION



Milestones

|                                                                                                                                                       |                                                                                                           |                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Clean hydrogen</b><br>We aim at introducing clean hydrogen in our production processes as part of our target to achieve carbon-neutral production. | <b>Power-to-liquids (PtL)</b><br>We target to be among the first e-fuel suppliers to the evolving market. | <b>Carbon capture and storage (CCUS)</b><br>We work on CO <sub>2</sub> capture in our refineries and develop pathways for CO <sub>2</sub> storage and utilization (e.g., as raw material for PtL production). |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

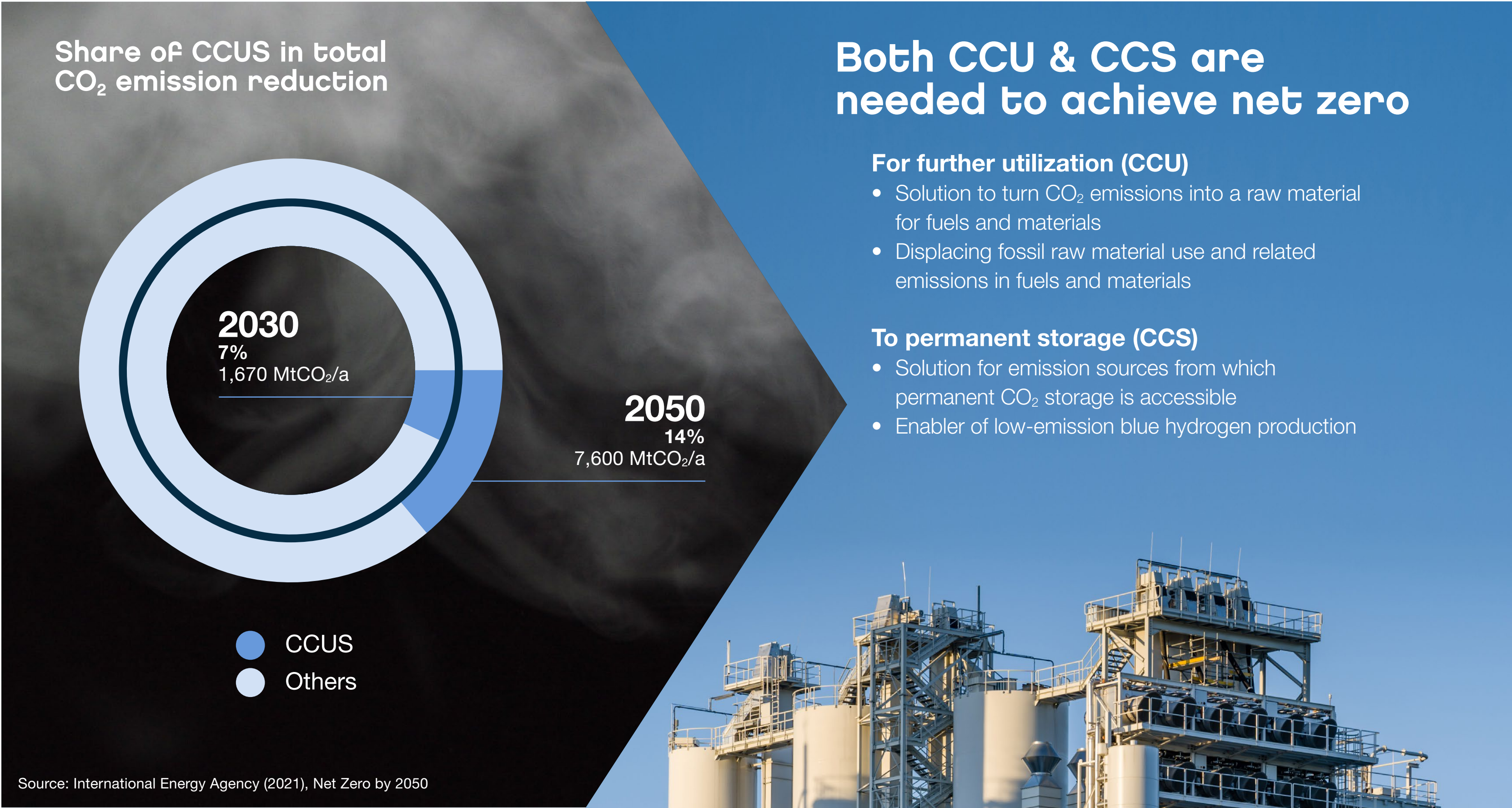
# Carbon capture, utilization, and storage will be required to achieve net zero targets

Carbon capture plays a growing and crucial role in the pathway to net zero as it tackles many of the dead ends of the emission reduction efforts. This includes capturing emissions from existing energy assets and reforming current hydrogen production. It is a promising and scalable solution in hard-to-abate applications where other emission reduction technologies are not suitable or are simply too costly.

There is no doubt that carbon capture and storage will need to increase substantially in the coming decades. However, the numbers of geological sites developed for CCS remain limited in the next decade, further establishing the need to accelerate deployment of CC+Utilization technologies.

## Why carbon capture?

- Tackling emissions from existing energy and industrial assets
- As a solution for processes, in which other emission reduction solutions are not available or not viable
- Removing carbon from the atmosphere to balance emissions that cannot be directly abated or avoided (e.g., through direct air capture and storage).



# We should talk



Do we as companies, societies, and regulators fully recognize the potential of existing industrial assets in the energy transition?



How do we ensure the best regulatory framework is enacted to enable investments into reducing emissions of the existing industrial assets and processes?



What role should blue hydrogen play in reducing industrial emissions near-term and in paving the way for large-scale deployment of green hydrogen in the longer run?

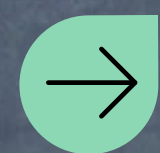


How can we avoid delaying emission reduction measures in energy-intensive industries while working towards global carbon neutrality by 2050?

# Creating sustainable global mobility

Reducing emissions in the transportation sector holds enormous potential. However, emissions are persistently rising. There are numerous ways to reduce greenhouse gas emissions and it is clear that all of them will be needed.

This chapter explores various paths to bringing down the emissions of transportation, proposes a voluntary crediting system to facilitate vehicle CO<sub>2</sub> targets, and delves into potential options to reduce emissions in the aviation sector.



Read more about sustainable mobility  
on **our website**.

# On a personal note

Neste’s sustainable aviation fuel is a solution for reducing the climate impact of flying. What truly inspires me is seeing how the aviation sector is rising to its emission challenge through innovation and collaboration. In September 2021, 60 leading global aviation stakeholders committed to reaching 10% share globally for sustainable aviation fuels by 2030, showing their ambition level for regulators creating the policy frameworks to accelerate the industry transformation.



**Sami Jauhiainen**  
Vice President, Business Development, Renewable Aviation



As the demand for sustainable aviation fuel is growing, so is the need for scalable raw materials. At Neste, we are exploring algae and municipal solid waste as potential future raw materials e.g. for SAF as they are scalable feedstock sources detached from the need for cultivation land. We are developing partnerships with the aim of establishing scalable business models covering the entire value chain, and we look for partners to join on this exciting journey.

**Jason Michael Blake**  
Vice President, Business Platform Aviation Feedstock



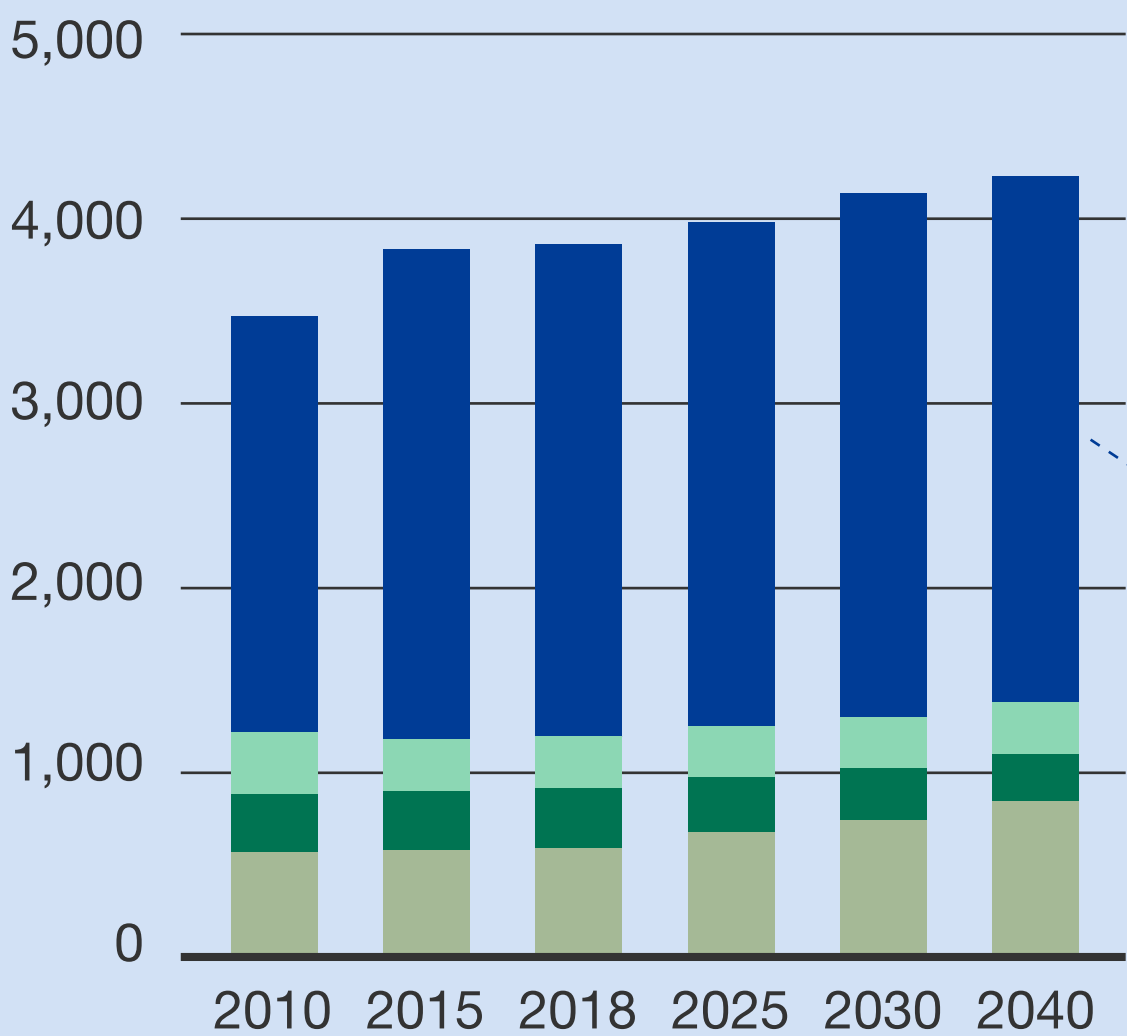
# The enormous potential in reducing transportation emissions

With the current energy and climate policies prevailing, the transport sector will continue to drive global oil demand far above the required level for the world to reach net-zero emissions by 2050. To achieve this target, additional actions need to be taken now. A rapid adoption of fuel efficiency measures will be needed, as well as the deployment of renewable lower-emission fuels and power-train technologies, and supportive infrastructures.

Liquid renewable fuels are the biggest source of renewable energy in transport today. They can be scaled up substantially thanks to vehicle and infrastructure compatibility across all transport modes. The number of electric vehicles is also growing rapidly around the world. Battery electric and fuel-cell electric vehicles hold significant potential for reducing emissions in road transport given the increasing share of renewable and low-emission electricity in the power mix.

There is no doubt that all available technologies will be needed to reap the full emission reduction potential in transport.

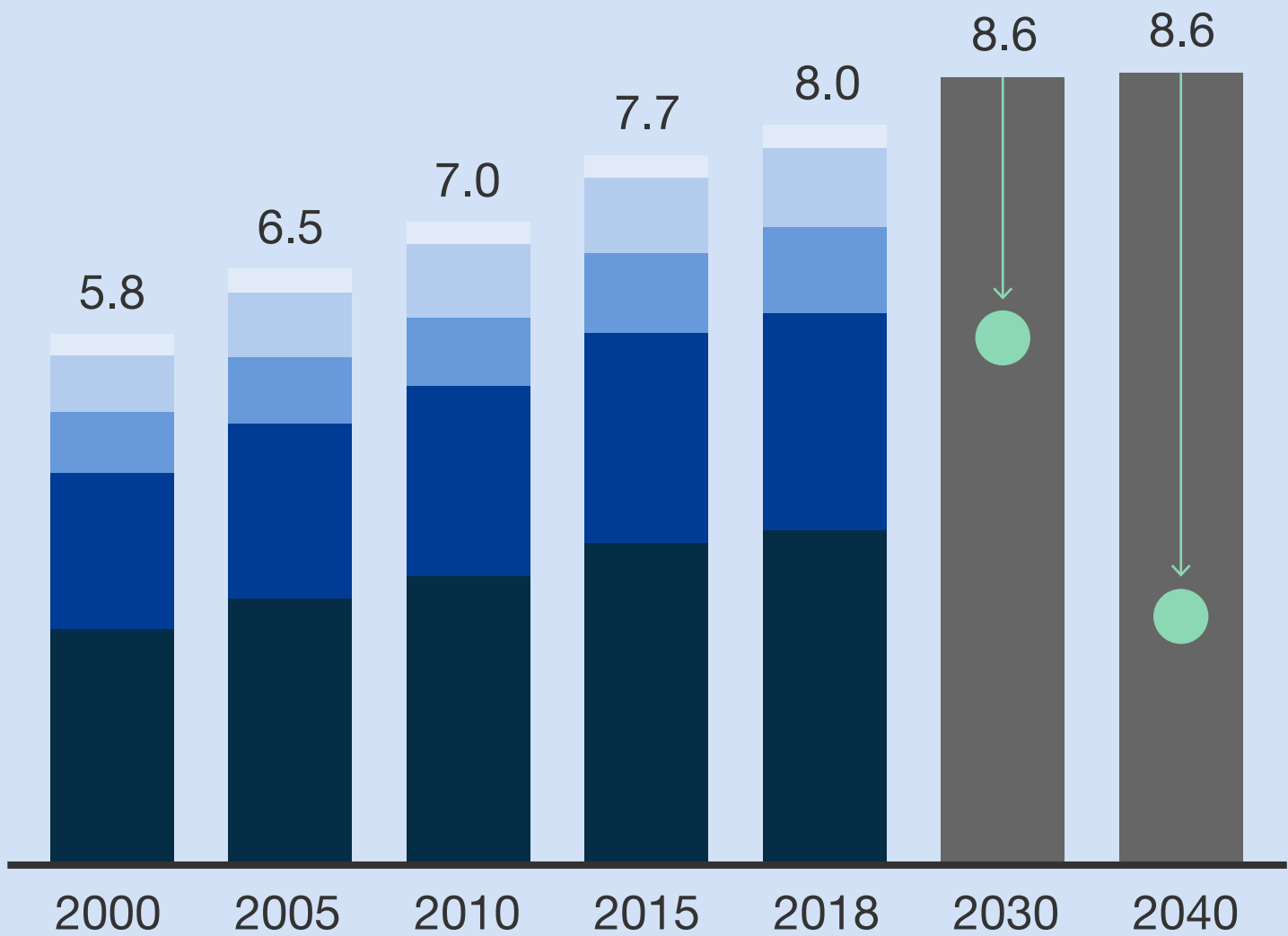
Global oil demand by sector (Mtoe/a)



● Transport ● Buildings  
● Industry ● Petrochemicals

Note: Figure shows final energy demand for oil

Global transport sector CO<sub>2</sub> emissions by mode (Gt CO<sub>2</sub>)



● Others ● Road freight ● Transport sector CO<sub>2</sub> projections (current policies)  
● Shipping ● Road passenger ● Required for net zero 2050  
● Aviation ●

Sources: IEA, IEA World Energy Outlook 2020, Stated Policies Scenario, and IEA Roadmap to Net Zero 2050

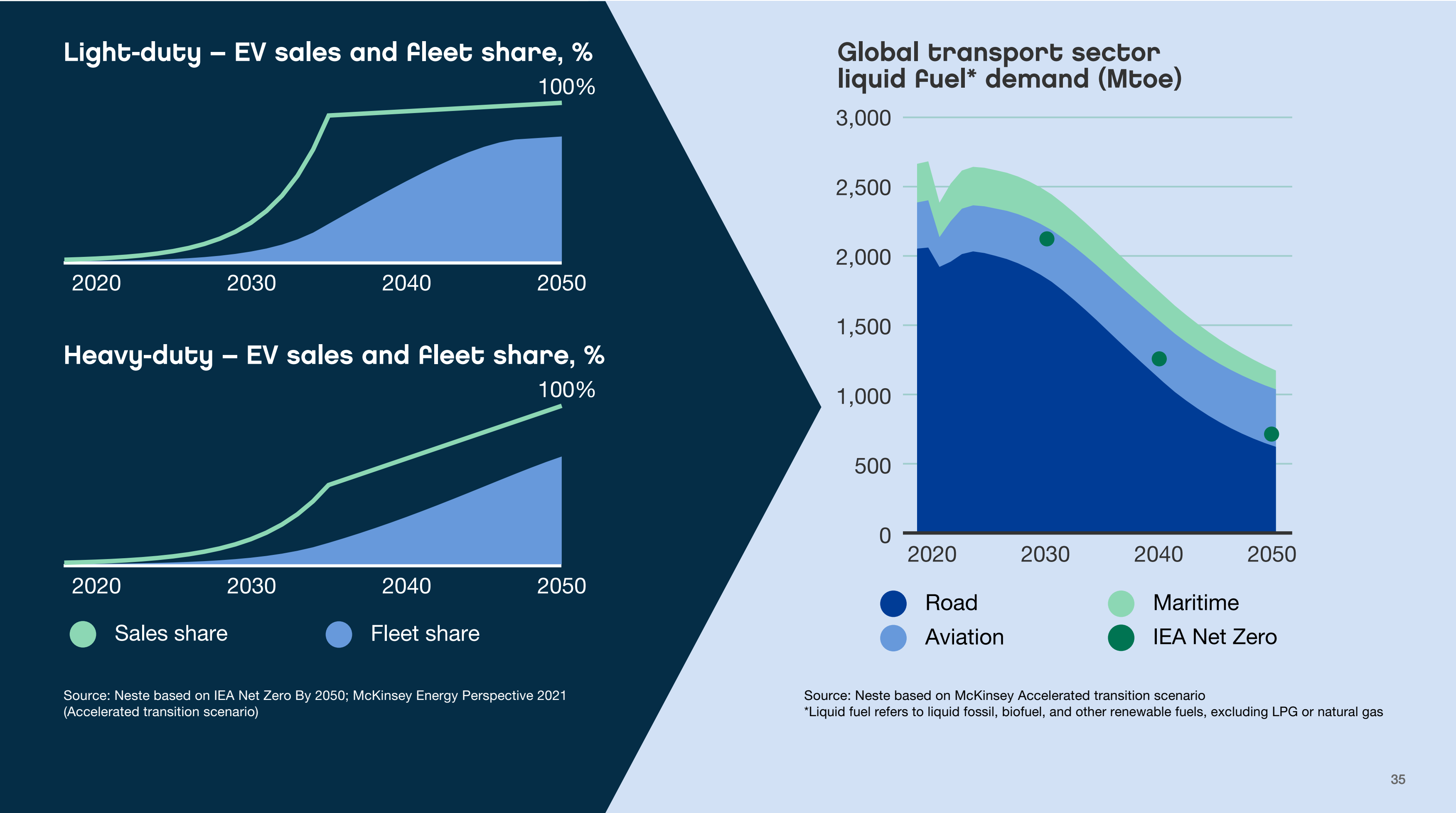
# Transforming mobility requires more solutions than only electrification

Electric vehicles undoubtedly hold enormous potential for displacing fossil fuel consumption in transport and can contribute to significant emission reductions. If electric and fuel-cell electric vehicle deployment is accelerated well beyond current projections, EVs could become the main powertrain choice for new passenger cars and heavy-duty vehicles in the next 10 to 15 years. However, long vehicle lifetimes (e.g., the EU passenger car fleet average is 11.5 years) mean that changes in the vehicle fleet will take time.

Even when taking an optimistic view on the electrification of transport, substantial volumes of liquid fuels will still be needed for decades. This is particularly true for long-distance transport in the aviation and marine sectors, where the potential of electrification is much more limited than in road transport.

Liquid renewable fuels and electric vehicles together can deliver the steep emission reduction needed in transport. Over time, renewable fuel demand will increasingly shift from road transport to the aviation and marine sectors.

## How far could accelerated electrification take us?



DEEP DIVE

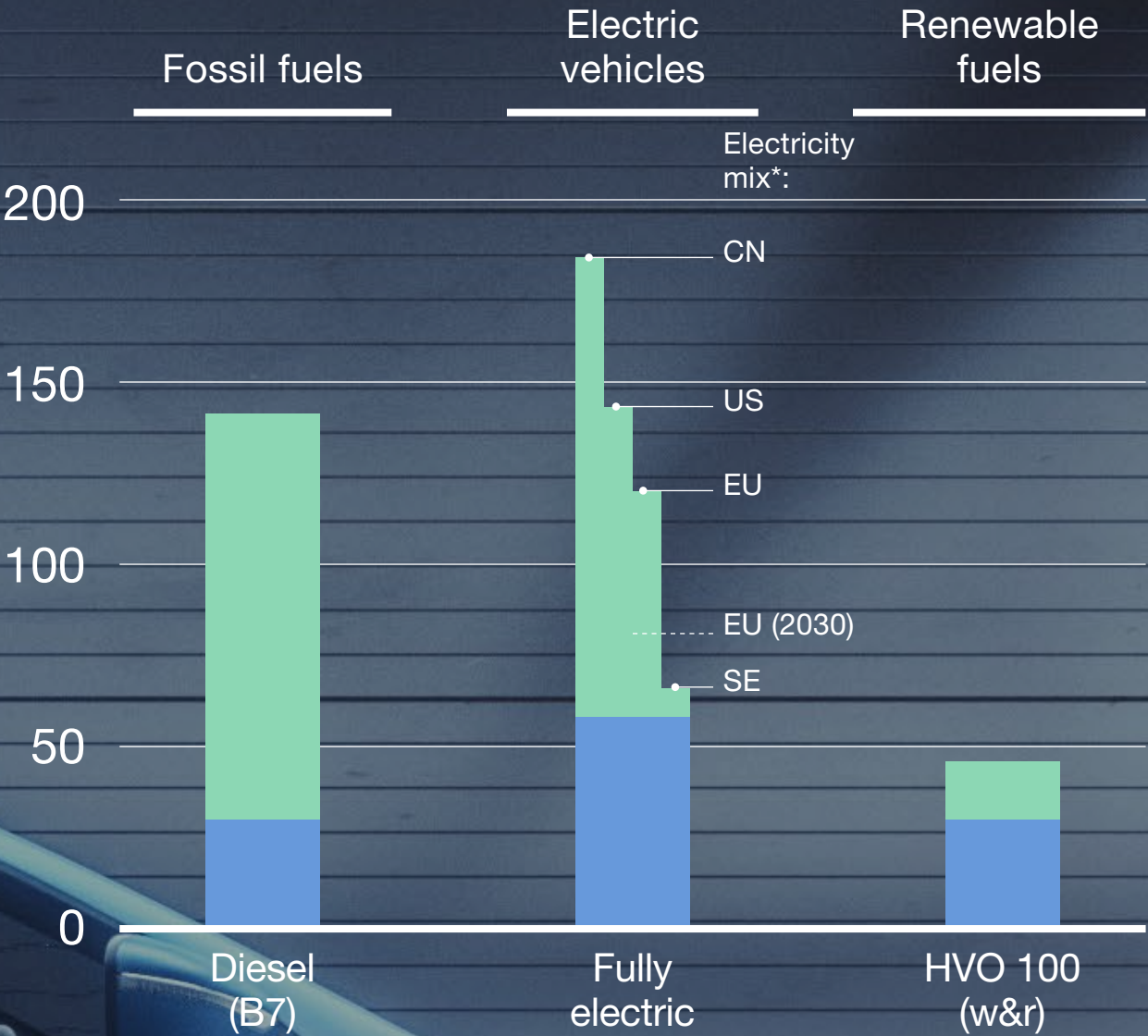
Exploring multiple routes to achieve low-emission vehicles

Looking at vehicle CO<sub>2</sub> emissions from a full life cycle perspective shows that zero-emission vehicles do not really exist. Electric vehicles certainly hold a great potential for enabling low-emission road transport when running on renewable electricity.

Renewable liquid fuels are also able to deliver substantial CO<sub>2</sub> emission reductions in road transport. The highest CO<sub>2</sub> reductions can be achieved with fuels produced from waste and residues (e.g., used cooking oil). In fact, a diesel car that runs with waste and residue based renewable diesel delivers similar CO<sub>2</sub> savings over its life cycle as an equivalent electric vehicle running on 100% renewable electricity.

Given the great variance in CO<sub>2</sub> emissions for different vehicle-fuel combinations, would it not make sense that regulation took a broader well-to-wheels emissions approach rather than focusing only on the tank-to-wheel emissions? See more thoughts on this in the Deep Dive on the next page.

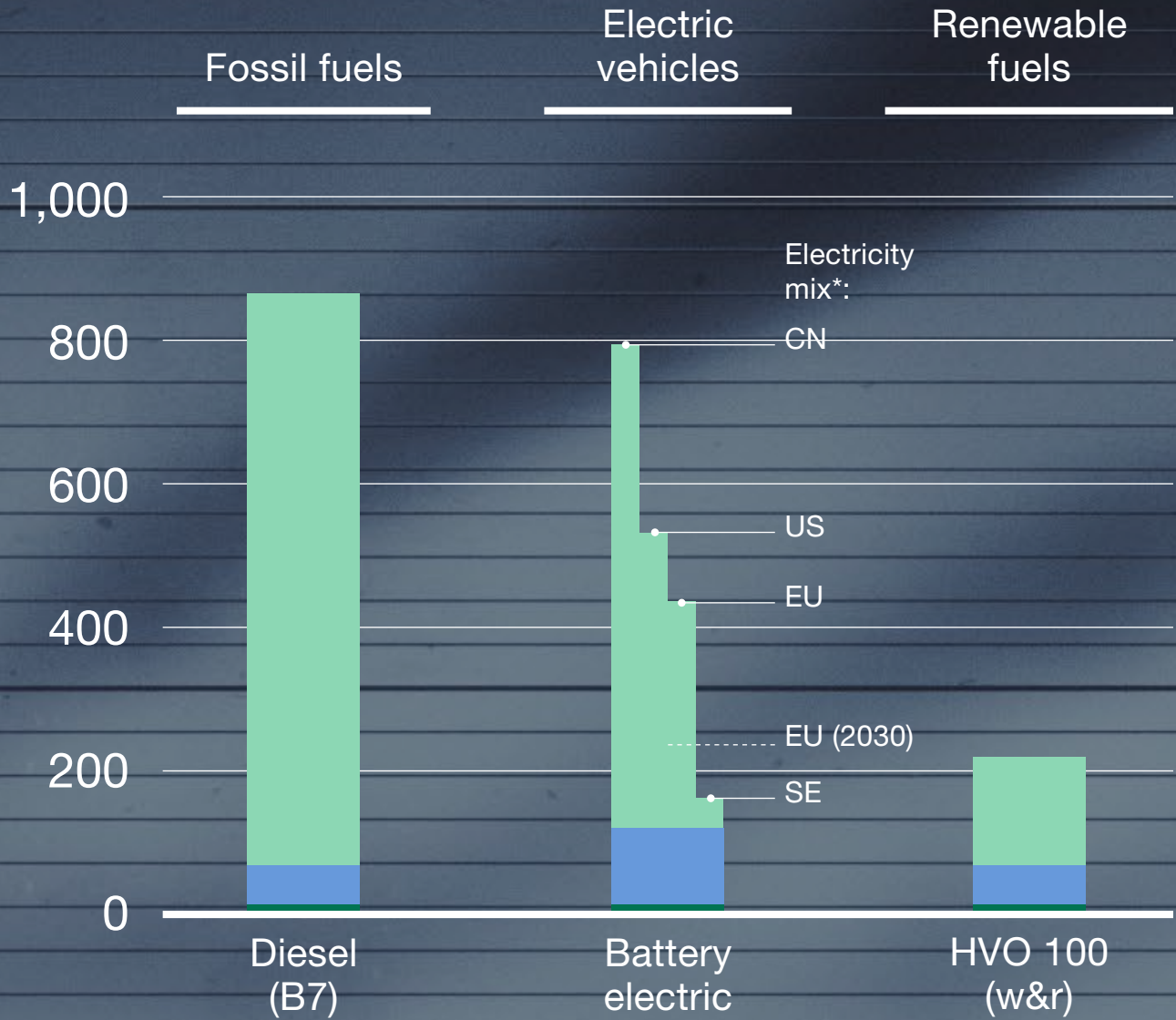
Passenger cars:  
life cycle CO<sub>2</sub> emissions (g CO<sub>2</sub>/km)



Note: w&r = waste and residues

\*Power sector CO<sub>2</sub> intensity varies across countries depending on their fuel mix. In 2018, Sweden's intensity was 43 t CO<sub>2</sub>/GWh, followed by EU's 320, US's 416, and China's 682, according to the IEA. With a greener power mix, the intensity is expected to decline to 132 t CO<sub>2</sub>/GWh for the EU, 257 for the US and 531 for China by 2030, according to IEA's stated policy scenario.

Heavy-duty trucks:  
life cycle CO<sub>2</sub> emissions (g CO<sub>2</sub>/km)

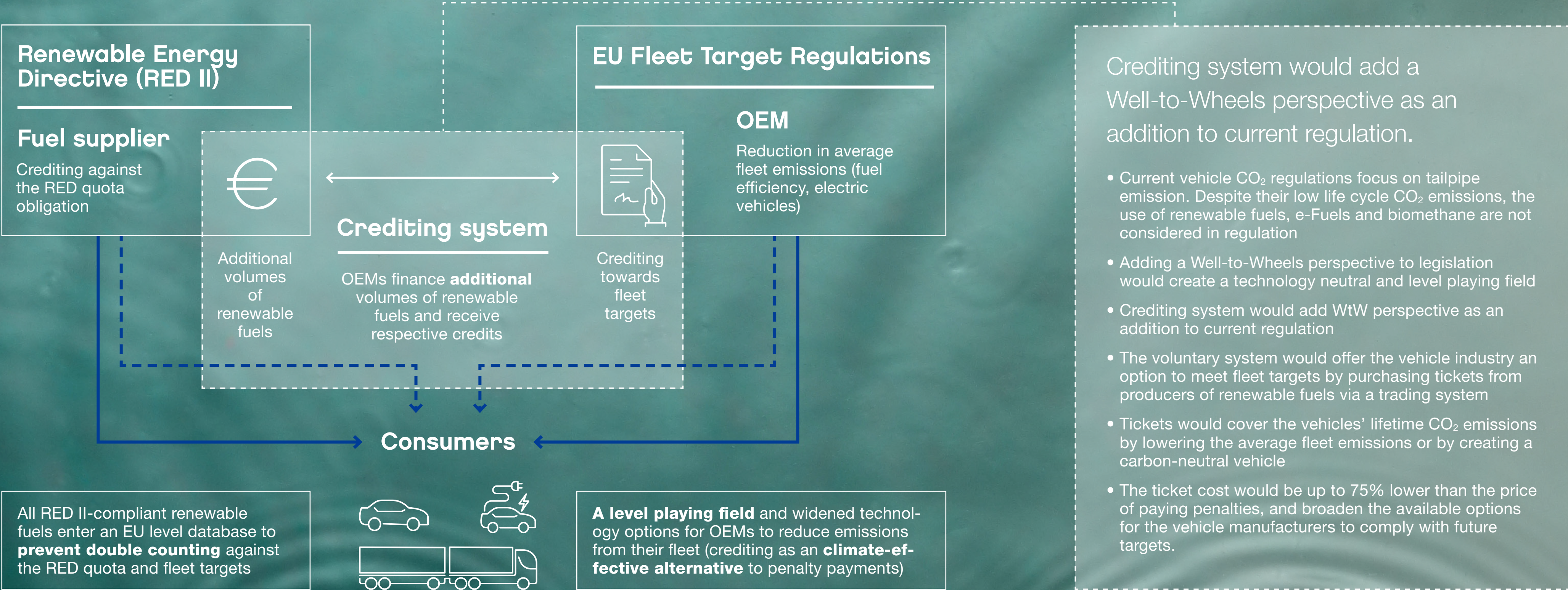


- Well-to-Wheels (LDV) / Fuel use (HDV)
- Production of vehicle
- Vehicle end-of-life

Source: Neste based on Volkswagen, IEA and Scania; 200,000 km life-cycle mileage assumed for passenger cars and 500,000 km for heavy-duty trucks (6.1 tons as an average payload).

DEEP DIVE

# Proposing a voluntary crediting system that allows renewable fuels to contribute to vehicle CO<sub>2</sub> targets



# Aviation needs growing volumes of sustainable aviation fuels to cut emissions

The aviation sector needs a wide range of low-emission solutions in the race towards net zero. To accelerate near-term emission reductions, 60 companies under the World Economic Forum's Clean Skies for Tomorrow Coalition committed to working together to achieve a 10% Sustainable Aviation Fuel (SAF) use target globally by 2030.

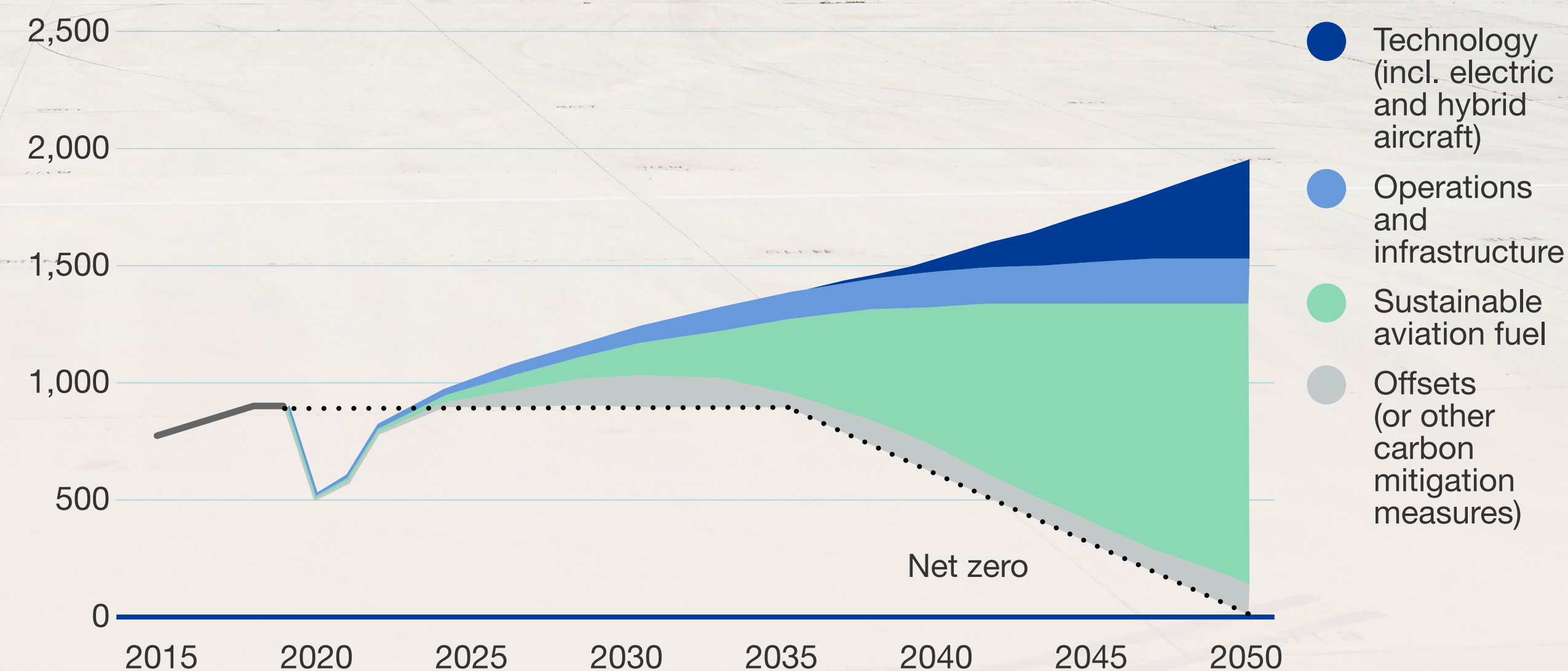
Although improvements in efficiency continue to reduce demand for jet fuel, these efforts are not enough to ensure that emissions from the aviation sector do not increase in the future. Systematic and structural changes to reducing flight activity will impact short-haul flights – with high-speed rail becoming an essential replacement in contributing to emission reductions.

The majority of jet fuel consumption (80% of global jet fuel demand, pre-COVID-19) is linked to flights that cover more than 1,500km in distance. Replacing those flights with other transport alternatives is more challenging. Alternative airplane propulsion technologies suited for longer distance flights are currently being explored and developed. This means jet engines powered by liquid fuels will be the prevailing aircraft propulsion for many decades to come. Therefore, the ATAG emphasizes the importance of SAF in decarbonizing the aviation sector.

Sustainable aviation fuel has an additional advantage of reducing the non-CO<sub>2</sub> related climate impact of aviation. In fact, the aviation sector's total climate impact is three times larger than that of CO<sub>2</sub> alone. An important contributor to this is contrail cirrus caused by soot particles. SAF can reduce soot particles by 50 to 70% and does not produce any SO<sub>x</sub> emissions.

**Did you know:** The IATA\* targets net-zero emissions for the airline sector by 2050, potentially requiring **65% of SAF globally**

## Aviation CO<sub>2</sub> emissions trajectory and reductions by measure (Mt CO<sub>2</sub>e)



Source: ATAG Waypoint 2050

\*The International Air Transport Association represents 290 airlines, or more than 80% of global air traffic.

# Sustainable transport requires all low-carbon solutions

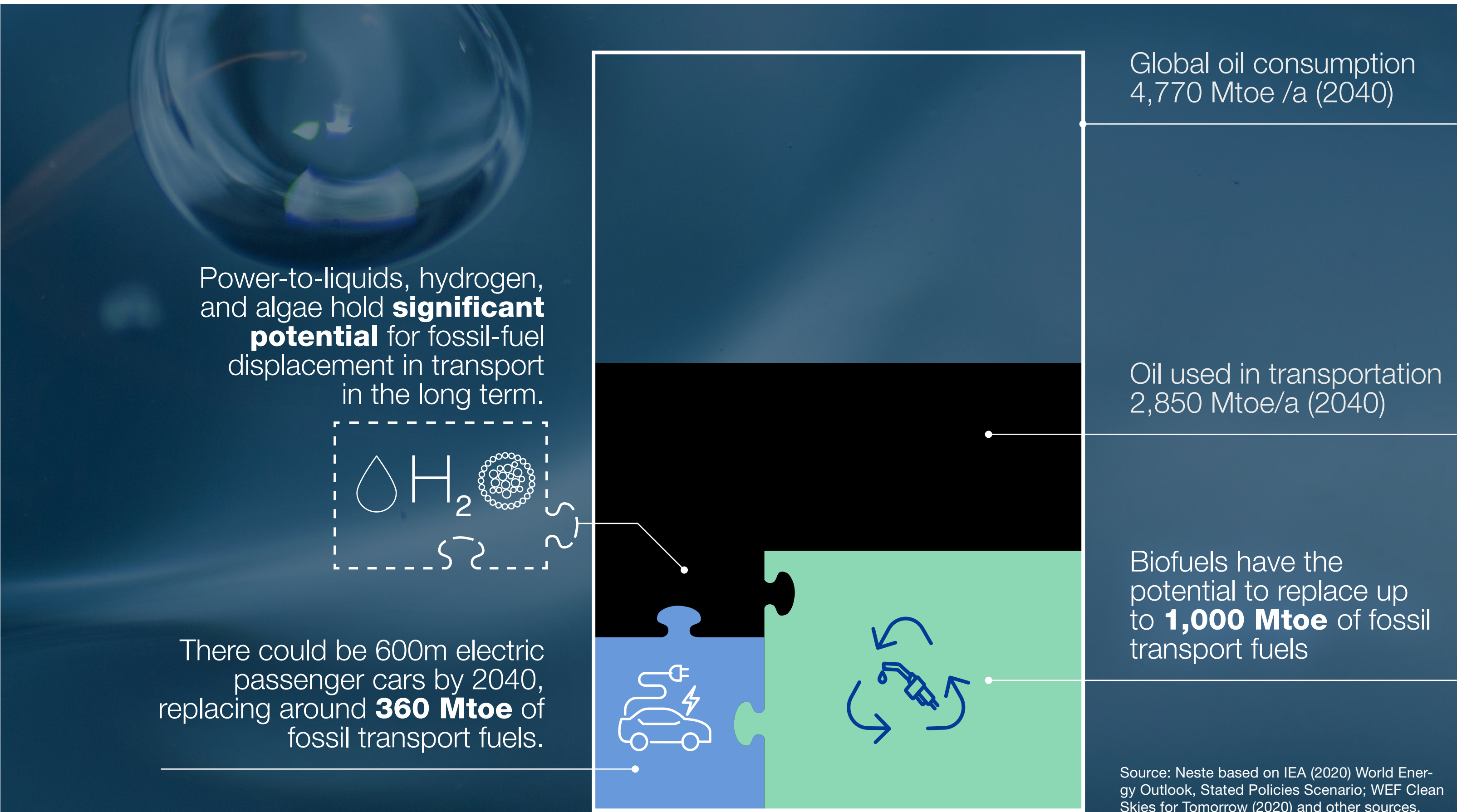
Assuming current climate policies, the global transport sector's liquid fuel demand will rise to above 2,800 Mtoe by 2040, from 2,668 Mtoe in 2019.

Even assuming 600 million EVs on the road by 2040, liquid fuels will still account for the majority of transport sector fuel demand.

The use of renewable raw materials in fuels production will displace more than 1,000 Mtoe of crude oil use. Even more can be reached by unlocking new raw material pools.

Emerging low-carbon solutions including renewable hydrogen, algae-based fuels and e-Fuels (power-to-liquids) hold significant potential to displace fossil fuel in the longer run.

Given the size of the challenge, we need all solutions to reach net-zero emissions in the transport sector.



# We should talk



What does the sustainable mobility system of the future look like?



How can sustainable mobility be designed to be socially equitable and available to everyone?



Are we Fully appreciating the emission reduction potential that lies in utilizing the existing combustion engine fleet in road transport, aviation, and shipping?

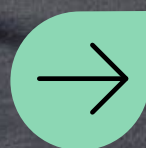


Given the seriousness of the climate challenge, how can we ensure that all sustainable low-emissions solutions are deployed, while Fully utilizing the raw material range available to produce liquid renewable Fuels?



# Faster, bolder, and Together

More than a decade ago, Neste embarked on its first wave of transformation – evolving from a regional oil refiner into a global leader in renewables. Today Neste is in the midst of its second wave of transformation, widening its role in aviation as well as polymers and chemicals, innovating to adopt new raw materials, and expanding the scope of its sustainability vision.



Read more about how we continue our transformation journey on **our website**.

# Change runs on renewables

We are strongly committed to our Faster, Bolder, and Together strategy, which is guided by our purpose to create a healthier planet for our children.

We continue to scale up in renewables, while innovating new solutions that drive growth and transformation in operations for combating climate change. We offer lower-emission renewable fuels to road transportation and aviation, and introduce new renewable and circular solutions for more sustainable plastics and chemicals.

To secure our future growth, we are expanding our global raw material and production platform for renewables. With our Singapore expansion, we are bringing the total global renewables production capacity to 4.5 million ton/a in 2023. We are strengthening our global waste and residues sourcing position via acquisitions, and increasing innovations to grow the raw materials base that serves the broadening of our end markets and future needs.

There is no time to lose when combatting the climate crisis. In order to succeed, we need to act, innovate, develop new solutions, and deliver them faster and bolder than ever before – together.



## Our strategy: We aim to be a global leader in renewable and circular solutions

### Grow renewable and circular solutions

- Serve existing and new customers
- Grow our production capacity
- Strengthen our raw material supply

### Get ready for the future

- Innovate and commercialize new solutions
- Deliver on our climate commitments
- Set high standards in sustainability and safety

### Boost competitiveness and transformation

- Enhance operational excellence
- Transform oil refining and distribution towards lower-emission feeds and carbon-neutral production

# Acronym key

| Acronym              | Meaning                                  | Description                                                                                                                      |
|----------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| APAC                 | Asia Pacific                             |                                                                                                                                  |
| ATAG                 | Air Transport Action Group               |                                                                                                                                  |
| CCS                  | Carbon capture and storage               |                                                                                                                                  |
| CCU                  | Carbon capture and utilisation           |                                                                                                                                  |
| CCUS                 | Carbon capture utilization & storage     |                                                                                                                                  |
| CO <sub>2</sub>      | Carbon dioxide                           |                                                                                                                                  |
| EUR/tH <sub>2</sub>  | Euro per ton of hydrogen                 |                                                                                                                                  |
| EV                   | Electric vehicle                         | Vehicle with electric powertrain and on-board source of electricity in form of a battery                                         |
| FCEV                 | Fuel Cell Electric Vehicle               | Vehicle running on hydrogen                                                                                                      |
| GHG                  | Greenhouse Gas                           | Gases that trap heat in the atmosphere; Typically refers to CO <sub>2</sub> , and also includes methane, ammonia and other gases |
| GtCO <sub>2</sub> eq | Giga tonnes of carbon dioxide equivalent |                                                                                                                                  |
| HDV                  | Heavy Duty Vehicle                       | Vehicles referring to buses and heavy trucks                                                                                     |
| ICE                  | Internal Combustion Engine               |                                                                                                                                  |
| IEA                  | International Energy Agency              |                                                                                                                                  |
| LDV                  | Light Duty Vehicle                       | Vehicles referring to passenger cars and light commercial vehicles                                                               |
| Mb/d                 | Millions Barrels per Day                 | Unit used to describe the crude oil production and consumption                                                                   |

| Acronym | Meaning                                    | Description                                                                                                  |
|---------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| MSW     | Municipal Solid Waste                      | Waste that households create through the consumption of various products                                     |
| Mt/a    | Million tons per annum                     |                                                                                                              |
| Mtoe    | Million tonnes of oil equivalent           | Unit used to describe energy contents                                                                        |
| Mtoe/a  | Million tonnes of oil equivalent per annum | Unit used to describe energy contents                                                                        |
| OEM     | Original equipment manufacturer            | Car manufacturers, such as Volvo or Volkswagen                                                               |
| PtL     | Power-to-Liquids                           | Synthetic fuels                                                                                              |
| PtX     | Power-to-X                                 | Conversion technologies which allow power for use in other sectors (e.g., fuels and chemicals)               |
| R&D     | Research & development                     |                                                                                                              |
| RED II  | Renewable Energy Directive II              | EU directive 2021-30, which sets specific targets for renewable energy use in the EU                         |
| SAF     | Sustainable Aviation Fuel                  | Sustainable alternatives of fossil-based jet fuels, derived from PtL or bio-feedstock                        |
| SMR     | Steam methane reforming                    | Technology for hydrogen production                                                                           |
| ton/a   | Tonnes per annum                           |                                                                                                              |
| WEF     | World Economic Forum                       |                                                                                                              |
| WTW     | Well-to-wheels                             | Transportation fuel analysis that takes into account the full lifecycle of all inputs to the fuel production |

# Disclaimer

The following information contains, or may be deemed to contain, “forward-looking statements”. These statements relate to future events or our future financial performance, including, but not limited to, strategic plans, potential growth, planned operational changes, expected capital expenditures, future cash sources and requirements, liquidity and cost savings that involve known and unknown risks, uncertainties and other factors that may cause Neste Corporation’s or its businesses’ actual results, levels of activity, performance or achievements to be materially different from those expressed or implied by any forward-looking statements. In some cases, such forward-looking statements can be identified by terminology such as “may”, “will”, “could”, “would”, “should”, “expect”, “plan”, “anticipate”, “intend”, “believe”, “estimate”, “predict”, “potential”, or “continue”, or the negative of those terms or other comparable terminology. By their nature, forward-looking statements involve risks and uncertainties because they relate to events and depend on circumstances that may or may not occur in the future. Future results may vary from the results expressed in, or implied by, the following forward-looking statements, possibly to a material degree. All forward-looking statements made in this presentation are based on information presently available to management and Neste Corporation assumes no obligation to update any forward-looking statements. Nothing in this presentation constitutes investment advice and this presentation shall not constitute an offer to sell or the solicitation of an offer to buy any securities or otherwise to engage in any investment activity.

# NESTE

Change runs on renewables

