



# Pathway to net zero



PATHWAY TO NET ZERO 2021

# About the report

**This Pathway to net zero Report describes how En+ Group will meet the commitments it made in the announcement on its climate ambitions in January 2021. The Board has approved targets of at least a 35% in reduction in GHG emissions by 2030, and to be net zero by 2050 (Scope 1 and 2, as benchmarked against the Group's 2018 GHG emissions). This Report is part of our continued efforts to improve the transparency of our approach to climate change and more broadly sustainable business model.**

## Our ESG reporting

You can find more about EN+ ESG performance on the Company's website

### Annual report

[www.enplusgroup.com/upload/iblock/dcl/EN\\_AR20\\_ENG\\_Final-web-PDF.pdf](http://www.enplusgroup.com/upload/iblock/dcl/EN_AR20_ENG_Final-web-PDF.pdf)

### Sustainability report

[www.enplusgroup.com/upload/iblock/159/EN\\_Group\\_SR2020.pdf](http://www.enplusgroup.com/upload/iblock/159/EN_Group_SR2020.pdf)

### SDG report

[enplusgroup.com/upload/docs/En+%20SDG%20Report%20ENG.pdf](http://enplusgroup.com/upload/docs/En+%20SDG%20Report%20ENG.pdf)

### Investor presentations

[enplusgroup.com/en/investors/results-and-disclosure/ifrs/](http://enplusgroup.com/en/investors/results-and-disclosure/ifrs/)

### ESG databook

[www.enplusgroup.com/upload/iblock/5e1/En\\_Group\\_ESG\\_Databook.xlsx](http://www.enplusgroup.com/upload/iblock/5e1/En_Group_ESG_Databook.xlsx)



## Limitation of liability

This Report includes statements that are, or may be deemed to be, forward-looking statements. In this Report, information about the Company's strategy, plans, objectives, goals, future events, or intentions, as well as the terms "believes", "estimates", "plans", "projects", "anticipates", "expects", "intends", "may", "will" or "should" in various forms shall indicate forward-looking statements. Nevertheless, forward-looking statements may and often do vary from the Company's actual results. Any forward-looking statements are exposed to risks relating to future events and other risks, uncertainties and assumptions relating to the Group's business, results of operations, financial position, liquidity, prospects, growth, or strategies.

Data presented in this Report on industry, market and competitive position comes from official or third-party sources. It is generally stated that the data from third-party industry publications, studies and surveys has been obtained from sources believed to be reliable, but that there is no guarantee of the accuracy or completeness of such data. Although the Company reasonably believes that each of these publications, studies and surveys has been prepared by a reputable party, neither the Company nor any of its respective directors, officers, employees, agents, affiliates, advisors, or agents, have independently verified the data contained therein. Moreover, certain industry, market and competitive position data reflected in this Report comes from the Company's internal research and estimates based on the knowledge and experience of the Company's management.

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# Our Statement on Climate Change

**We support the Paris Agreement and endorse and align our activities with the global climate change goals outlined in the United Nations Framework Convention on Climate Change (UNFCCC).**

As the largest aluminium producer outside of China and leading independent hydropower producer globally:

- We are committed to becoming net zero by 2050 in alignment with the 1.5-degree future.
- We understand the tremendous challenge represented by climate change.
- We support the Paris Agreement and the initiatives of the implementing parties to fulfil its aims.
- We endorse and align our activities with the global climate change goals outlined in the United Nations Framework Convention on Climate Change (UNFCCC).
- We acknowledge the global climate change science assessed by the Intergovernmental Panel on Climate Change (IPCC).
- We recognise the importance of adaptation, resilience and restoration to a changing climate and our responsibility to contribute to the global effort.
- We support implementing effective measures to price carbon, thus facilitating the free flow of low-carbon goods, encouraging energy efficiency and energy transition, and stimulating sustainable economic growth.
- We adapt to the climate change risks, building on the resilience of our assets and investments, and contributing to community and ecosystem resilience.

En+ Group believes that collaboration is essential to addressing climate change and building a better future. In the belief that climate goals can only be met by mobilising businesses, governments and consumers as a team:

- We support development and deployment of low-carbon technologies throughout the supply chain, including policies, initiatives and technologies to promote growth in renewable energies supported by consistent methodologies to measure and disclose climate impacts.
- We join forces with other major players through organisations that aim to expand the courses of action available.
- We collaborate with national and regional governments and academia, as well as communities, to identify joint solutions.
- We work on sectoral decarbonisation with customers and suppliers.

# Message from our Executive Chairman

**In July 2020 En+ Group launched its vision for green aluminium, setting out nine principles to lead our industry into the low-carbon economy by developing a new asset class, green aluminium.**

We followed this with the most significant announcements we have ever made in relation to our sustainability performance.

These were our industry-leading targets for greenhouse gas emissions reduction, with a clear ambition of achieving net zero emissions by 2050 plus a stretching 35% reduction by 2030, and the success of our new-generation inert anode electrolyzers allowing us to produce the lowest carbon aluminium ever created.

We also said that in September 2021 we would publish our plan for our Pathway to net zero, and I am delighted to say after comprehensive consultation and stress testing with a whole range of global stakeholders, here it is! It has been a challenge – with well 98% of our aluminium is made using electricity already generated by hydropower (decarbonising power sources represents about 65% of the potential emission savings in our industry) we are not exactly replete with unpicked low hanging fruit, so this plan encompasses the entirety of our production chain, from extraction of bauxite, through the refining of alumina to the smelting of aluminium.

Smelting accounts for around one third of emissions in the process and so one of the main areas of focus in this report is the gradual transition to low-carbon and carbon-free aluminium reduction technologies, such as Eco-Soderberg, pre-baked anode technology and crucially in due course, further conversion to inert anode technology, where inert anodes replace the classic carbon anodes thereby significantly reducing emissions during the production process.

In the face of the climate emergency, En+ Group is embarking on an ambitious new cycle of investment with an unprecedented programme of capital expenditure right across the business.



“En+ Group is the world’s largest producer of low-carbon aluminium and independent hydropower. Our commitments and achievements are fundamental to the transformation of the wider industry. We are determined to continue to lead our industry to a greener and ultimately net zero future”.

**Rt Hon Lord Barker of Battle,**  
Executive Chairman

This will make us not just fit for the new sustainability standards of the 2020s but ultra-competitive in a future world which can’t afford to produce carbon at all. At our smelters, all of our new plant built or modernised as part of this new investment programme will be inert anode ready, so we can seamlessly begin to ramp up production of zero carbon aluminium as soon as technological developments allow.

A relentless focus on efficiency, particularly improving energy efficiency is always a very effective way to reduce greenhouse gas emissions. So, other consistent themes in this report include our continued commitment to our industry leading ‘New Energy Modernisation programme’ which aims to upgrade the hydro power plants of the Angara and Yenisei HPP cascade with a view to further increasing the energy output from the same volume of water passing through the hydropower turbines. We will also work to decrease electricity losses during transmission from generation facilities to consumption sites.

But this report also covers the whole gamut of our worldwide operations and key issues such as reuse and recycling, shipping, use of solar power and hydrogen, nature based solutions and carbon capture. We cannot possibly tackle all these issues on our own, so we are working in partnerships with best in class organisations across the globe to decarbonise our ‘hard to abate’ industry supply chain.

I believe that this report is actually an inspiring read, not least because it becomes increasingly clear that getting greener is also making us more efficient, opening the way for innovative low- carbon products to become lower cost and more competitively priced for the end consumer, so more and more people can afford to buy them.

As we all play our part in the race against climate change by striving to find new short cuts to a low carbon economy, Governments everywhere can also do more by promoting ‘Green Free Trade’ i.e. the permanent unilateral suspension of import tariffs on all products with low-carbon content – such as low-carbon aluminium.

Sustainable businesses the world over need access to this vital green metal. We simply can’t build a low carbon economy without low carbon aluminium. Now more than ever, it is the material of net zero future. This report maps out in detail how we can take it there.

**Rt Hon Lord Barker of Battle,**  
Executive Chairman

**En+ Group**  
Our partner @BallCorpHQ is making sustainable packaging with ultra-low carbon #inertanode metal, which has a #carbonfootprint of less than 0.01 tonnes of CO2e 🌱 Together En+ Group's @UC\_RUSAL and Ball Corp. are working to ensure a greener future for the next generation 🌍



Просмотров: 49

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**En+ Group**  
What we're reading 📖 @ArchDigest "Aluminum Furniture Is About to Be Everywhere"

✅ Lightweight, durable, noncorrosive, and infinitely recyclable, a new wave of aluminum designs is thinking indoors first. #aluminium #lowcarbon #design #CircularEconomy



architecturaldigest.com  
Aluminum Furniture Is About to Be Everywhere

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**En+ Group**  
“Between Forests and Skies” is made from aluminium with the lowest carbon footprint in the world, using En+ Group's Metals segment's #inertanode technology.



United Company RUSAL и 2 других

# Message from the management team

To manage our journey to net zero, we have created the EN+ Climate Change Taskforce.



February

## 2021

Taskforce setup to develop our detailed pathway to net zero

Every

## 2 weeks

Taskforce met to assess available options

“I am pleased to share with you our climate change strategy which involves actions throughout the entire value chain of En+ Group in line with the 1.5°C pathway.”

**Vyacheslav Solomin,**  
Deputy CEO - Chief Operating Officer of En+ Group,  
Head of the Taskforce

Following the announcement of our ambitious targets, we created the En+ Climate Change Taskforce to drive our transformation.

Over the past few months, the Taskforce has been working on a wide range of initiatives and measures, along with a timeline for their implementation that would allow the Group to achieve our climate change ambitions.

Each stream of work was led by a senior executive from our management teams in both Metals and Power segments. The team worked toward a common vision collaborating across multiple lines of business and held extensive consultations with all relevant external stakeholders, including suppliers, customers, investors, local communities and experts from across the world.

As a result, I am pleased to share with you our climate change strategy which involves actions throughout the entire value chain of En+ Group in line with the 1.5°C pathway. On the following pages, you will find out about the

initiatives that comprise our pathway to net zero which includes emissions abatement, avoided emissions solutions, and compensation. It also covers recycling, shipping, use of solar power and hydrogen, nature-based solutions and carbon capture. The report outlines En+ Group's approach to working in partnership with organisations across the globe to decarbonise its 'hard-to-abate' industry supply chain. The Group's targets include the production facilities of both our Metals and Power segments, so the report covers all material sources of GHG emissions under operational control for Scope 1 and 2, plus considerations for Scope 3.

This presentation of the Pathway to net zero is the beginning of our journey. The En+ Climate Change Taskforce will continue to deliver on our ambitions to achieve net zero by 2050 through implementing innovative solutions, supporting sustainable development, and being transparent on our progress.

**Vyacheslav Solomin**

# Climate Change Taskforce



**Vladimir Kiriukhin**  
CEO of En+ Group,  
Project management overview



**Roman Andryushin**  
Deputy General Manager  
for Sales in Russia, CIS and  
China of RUSAL



**Anton Butmanov**  
Director for Sustainable  
Development of En+ Group,  
Deputy Head of Taskforce



**Yulia Chekunaeva**  
Director for Capital Markets  
and Strategic Initiatives of  
En+ Group, Deputy Head  
of Taskforce



**Aleksey Gordymov**  
Business Support Director  
of RUSAL



**Steve Hodgson**  
Sales and Marketing Director  
of RUSAL



**Yakov Itskov**  
Head of Alumina Division  
of RUSAL



**Mikhail Khardikov**  
Deputy CEO – Chief Financial  
Officer of En+ Group



**Andrey Lymarev**  
Chief Technical Officer  
of En+ Group



**Viktor Mann**  
Technical Director of RUSAL



**Oleg Mukhamedshin**  
Deputy CEO-Director for  
Strategy and Capital Markets  
of En+ Group



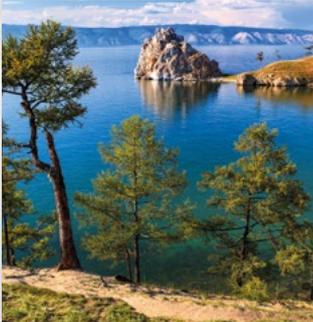
**Evgenii Nikitin**  
Chief Executive Officer  
of RUSAL



**Vyacheslav Solomin**  
Deputy CEO – Chief Operating  
Officer of En+ Group,  
Head of Taskforce

# Climate actions at a glance

En+ Group is striving to become a leader in the fight against climate change. We take actions to reduce GHG emissions across the whole value chain.



## SBTi

In September 2019, En+ Group joined the SBTi and committed to setting science-based emissions reduction targets in line with the recommendations described in the Assessment Reports of the IPCC and aligned with the 1.5°C trajectory. The Group developed and will submit its proposed decarbonisation pathway to the SBTi in 2021.



For more information, please refer to p.53



## The world leading low-carbon refinery in Ireland

After 20 years of continuous focus on decarbonisation Aughinish Alumina in Ireland now is the world's leading low-carbon high temperature refinery at 0.516 t CO<sub>2</sub>e/t Al<sup>1</sup> and with RUSAL's ALLOW aluminium made from renewable hydropower, it has one of the lowest carbon footprints in the industry.

Aughinish alumina is actively implementing various decarbonisation projects which also include installation of a renewable energy electric boiler (25 MW). This will further reduce Aughinish's carbon footprint. The EU recognised this project by giving preliminary approval for grant funding from the EU Innovation Fund.

For more information, please refer to p.35



## Climate initiatives in Jamaica

Winalco, the alumina refinery in Jamaica, is developing projects to reduce GHG emissions and cost per tonne for smelting operations, as well as converting plant site lighting to solar power.

Winalco has already implemented measures at ancillary facilities to reduce its GHG footprint - for example, the lighting of the pier at Port Esquivel is powered by solar energy.

For more information, please refer to p.35

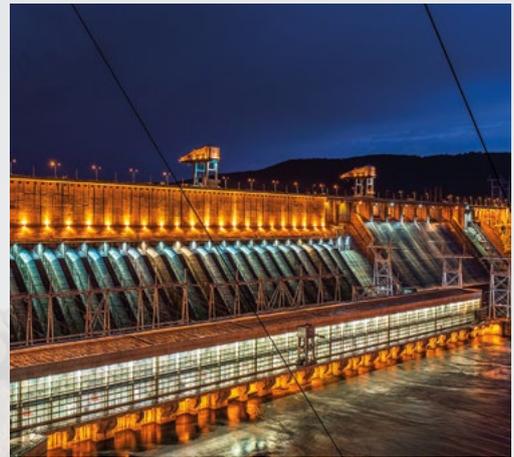
<sup>1</sup> In consistence with the European Union Emissions Trading System (EU ETS).

## New energy

En+ Group's large-scale modernisation project, 'New Energy', implemented at the Angara-Yenisei cascade HPPs is a key investment project for En+ Group's Power segment. Investments in the New Energy programme will total USD 284<sup>2</sup> million by 2026. Comprehensive replacement of main equipment, like hydraulic units and impellers, and auxiliary equipment, will be carried out under the programme.

The New Energy programme is one of the Group's most ambitious ongoing production asset upgrade programmes. It will bring the Group's HPP efficiency to world class standard, providing better reliability and quality of power supplied to Siberian consumers. Additionally, it will have a positive impact on the environment in the Siberian regions and help to mitigate negative impacts on water resources.

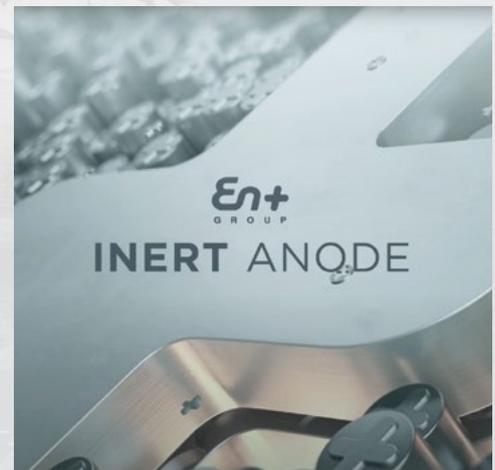
 For more information, please refer to p.29



## CDP

In 2020, RUSAL received an 'A-' rating for the first time in the aluminium industry following its annual assessment by the Carbon Disclosure Project (CDP) and became one of the 160 leading CDP companies out of more than 4,800 participants committed to reducing climate risks along the entire supply chain.

 For more information, please refer to p.52



## Business ambition 1.5C

In May 2020, En+ Group signed the UNGC and Business Ambition for 1.5°C's call to action. Together with a broad coalition of businesses, civil society, and UN leaders, we called on governments and policymakers to match the ambitions of companies already aligned with reaching net zero emissions well before 2050.

 For more information, please refer to p.53

## Inert anode

In 2020, RUSAL began testing operations in innovative technology for a pilot industrial electrolytic cell with inert anodes. Using it in the reduction process is considered a revolutionary solution in metallurgy, because it completely eliminates emissions of greenhouse gases (PFCs and CO<sub>2</sub>), polyaromatic hydrocarbons, benzo(a) pyrene, and sulphur from the reduction process, while significantly reducing the cost of production by saving anodes.

 For more information, please refer to p.28

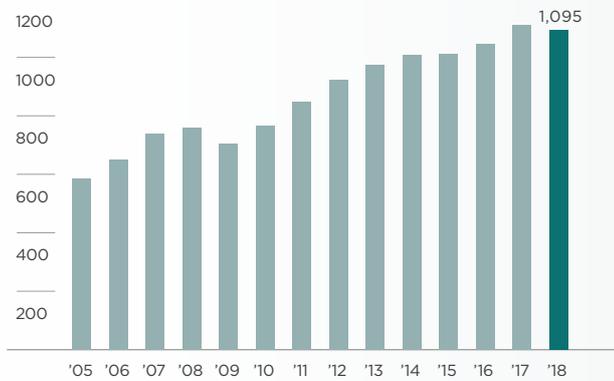
<sup>2</sup> For the purpose of this report RUB-denominated CAPEX of Power segment is translated to USD by the rate of 74 RUB/USD.

# Climate change challenges

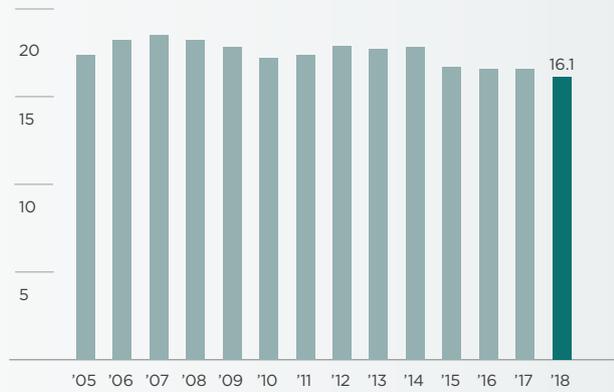
**En+ Group has long enjoyed a reputation for low-carbon production, powered by clean renewable energy from our hydropower plants. We will be leading the transformation of aluminium production, currently one of the world’s most energy-intensive industries, and driving change throughout our sector.**

## Aluminium industry

Global carbon footprint by aluminium sector, mn t CO<sub>2</sub>e<sup>2</sup>



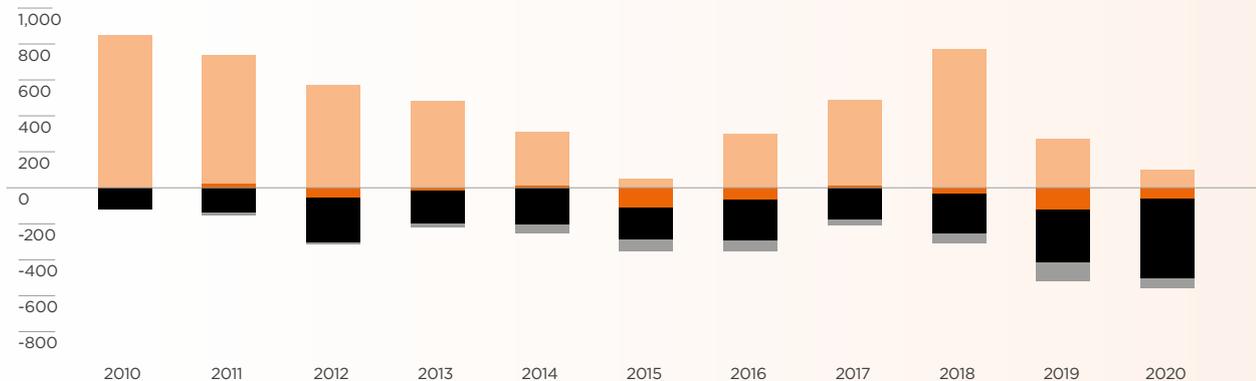
Global average carbon footprint by primary aluminium sector, t CO<sub>2</sub>e per t primary aluminium<sup>3</sup>



## Power sector

Structure of power sector’s emissions by source, Mt CO<sub>2</sub><sup>4</sup>

Electricity demand Coal-to-gas Renewables Nuclear



1 Level 1 in accordance with International Aluminium Institute (2018), Aluminium Carbon Footprint Technical Support Document, [www.international-aluminium.org/wp-content/uploads/2021/08/AL31DA1-1.pdf](http://www.international-aluminium.org/wp-content/uploads/2021/08/AL31DA1-1.pdf).  
 2 International Aluminium Institute (June 2021), Greenhouse gas emissions aluminium sector, [www.international-aluminium.org/wp-content/uploads/2020/09/ghg\\_emissions\\_aluminium\\_sector\\_1\\_June\\_2021\\_read\\_only.xlsx](http://www.international-aluminium.org/wp-content/uploads/2020/09/ghg_emissions_aluminium_sector_1_June_2021_read_only.xlsx).  
 3 Ibid.  
 4 International Energy Agency (March 2021), Global Energy Review: CO<sub>2</sub> Emissions in 2020, [www.iea.org/articles/global-energy-review-co2-emissions-in-2020](http://www.iea.org/articles/global-energy-review-co2-emissions-in-2020).

## From challenges

- Carbon intensive
- Hard-to-abate sector

## To opportunities

Aluminium as a critical element of sustainability/transition

- Low-carbon
- Recyclability
- Durability and impermeability
- Low Weight
- Corrosion Resistance

# 2.4 CO<sub>2</sub>e/t Al t<sup>1</sup>

We produce our ALLOW brand with 2.4 tonnes of CO<sub>2</sub>e emissions per tonne of aluminium (Scope 1&2 smelters only) - 5 times lower than the global industry average of 12.5 CO<sub>2</sub>e/t Al<sup>5</sup> (smelter emissions, scope1&2, IAI Level 1).

## From challenges

- Energy mix is dominated by fossil fuels

## To opportunities

- Increase in demand on renewables
- Hydropower-clean power

# >15 GW

of the Power segment's portfolio comes from hydroelectric power plants ("HPPs")

5 IAI data, 2018. Level 1 in accordance with Aluminium Carbon Footprint Technical Support Document (2018), [www.international-aluminium.org/wp-content/uploads/2021/08/AL31DA1-1.pdf](http://www.international-aluminium.org/wp-content/uploads/2021/08/AL31DA1-1.pdf).

# The power of our integrated business

## How we generate power



### Water

Water with its potential energy accumulates in HPP reservoirs.



### HPP generation

Potential energy of water converts to rotational kinetic energy by hydropower turbines. Rotational kinetic energy converts to electricity.



### Coal supply

Coal is extracted and transported by rail vehicles from the open pit to CHP storage facilities.



### CHP generation

Large coal chunks are crushed, then milled into dust and fed to steam generators. Air-coal mixture is burned in steam generators; water is heated to superheated vapour.

Superheated high-pressure vapour is transported to turbines, where it affects a blade apparatus and potential energy converts to kinetic energy. Mechanical work of turbines shaft converts to electricity and is transmitted to the network. Low-potential vapour heats network water or is used for production.



### Transmission and distribution

Electricity is fed through transformers to electrical grids, then supplied to end consumers through transmission and distribution grids.

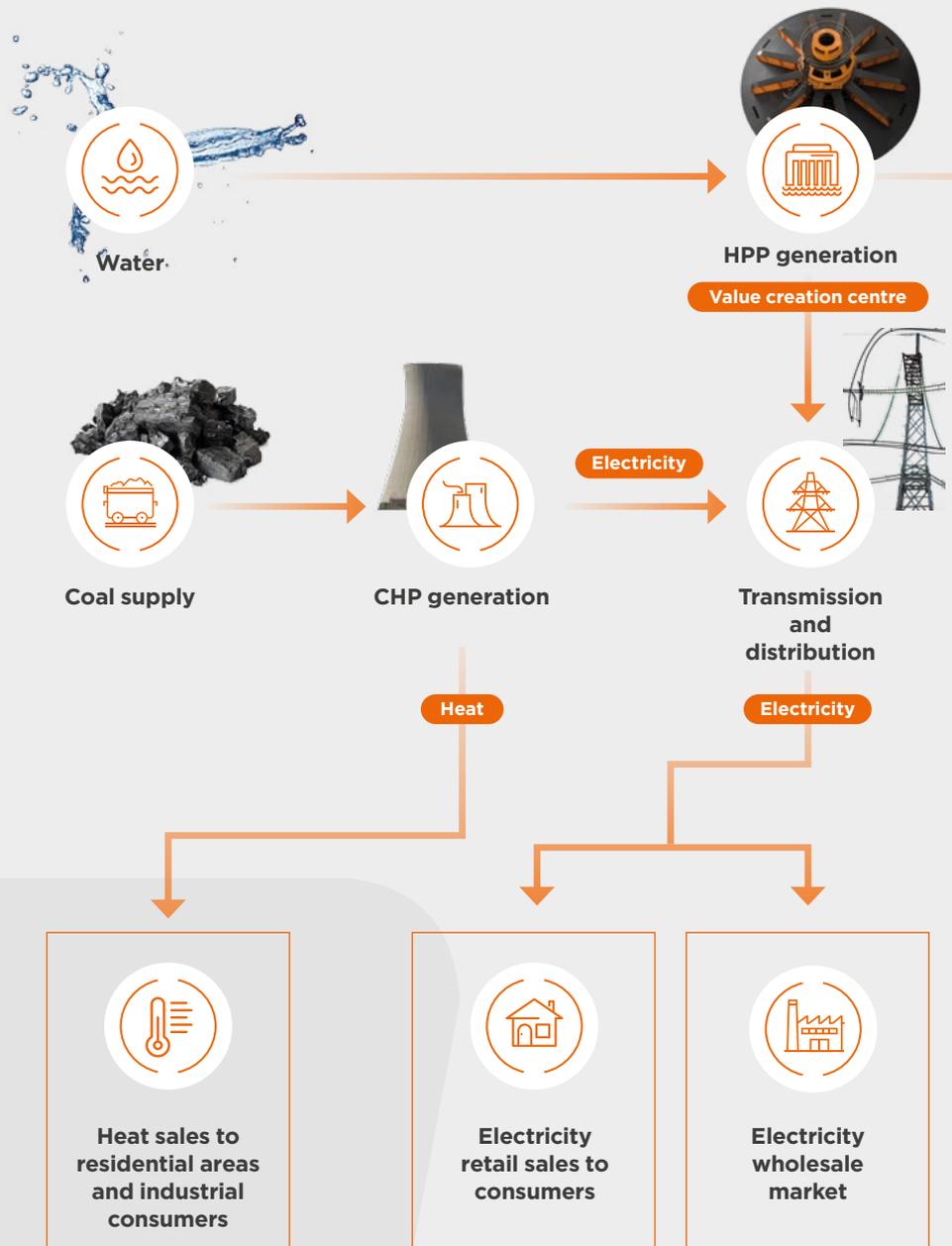


### Heat supply from CHPs

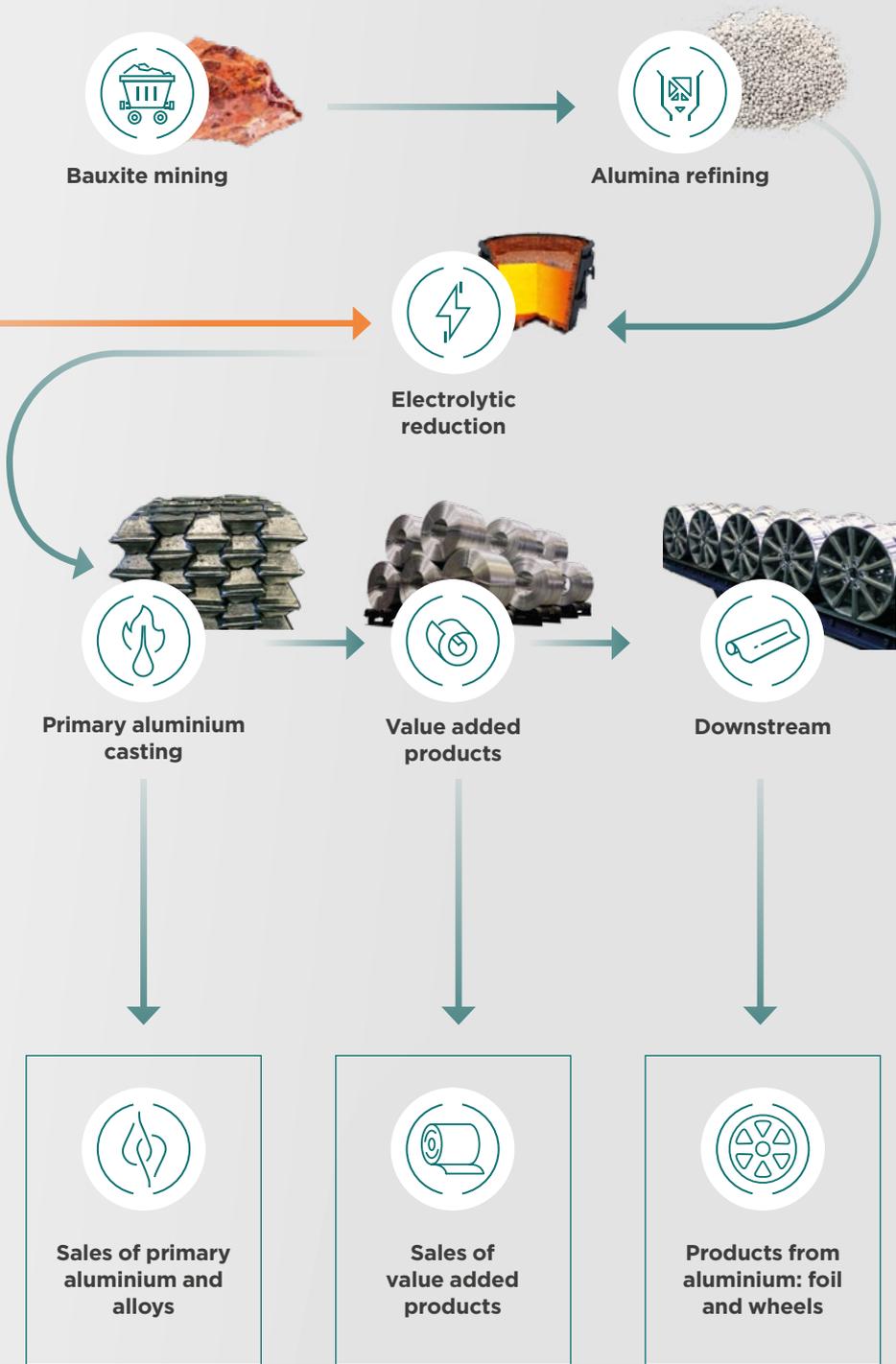
Low-temperature steam from turbines is used for heating water to supply heat to consumers.

Water heated at CHPs is then fed through main pipelines to residential areas and end consumers through distribution pipelines.

En+ Group benefits from its unique base of tightly-integrated assets that results in a fully integrated and highly self-sufficient business. Hydropower is used to refine raw materials and produce aluminium in Siberia. More than 98% of aluminium production energy needs are met by carbon-free power sources.



# How we produce aluminium



## Key stages in the aluminium production process



### Bauxite mining

At the start of the production process is the mining of bauxite, an aluminium rich mineral.



### Alumina refinery

Bauxite is crushed and mixed with water to create a thick paste which is heated to remove silicon.



### Reduction process

At an aluminium smelter, alumina is poured into special reduction cells where electric currents break the bonds between aluminium and oxygen atoms. This results in liquid aluminium settling at the bottom of the cell.



### Primary aluminium casting

Primary aluminium is cast into ingots and shipped to customers or used to produce alloys.



### Downstream products

The process where the aluminium is shaped to its required form. This process is used for making the vast majority of aluminium products from spectacle frames, telephone bodies, aeroplane fuselages or spaceship bodies.

# ALLOW product portfolio

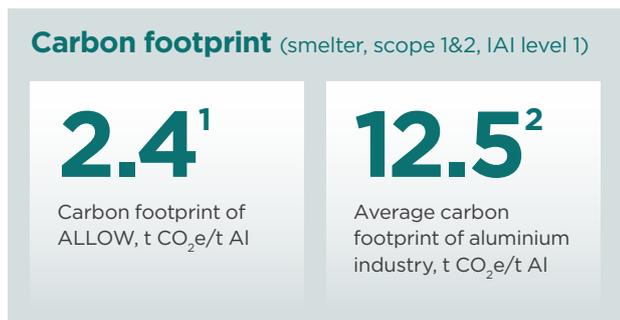
**En+ Group's Metals segment, RUSAL, is the world leader for the production of low-carbon aluminium, recognised in the market through its leading brand ALLOW.**

### Competitive advantage of ALLOW

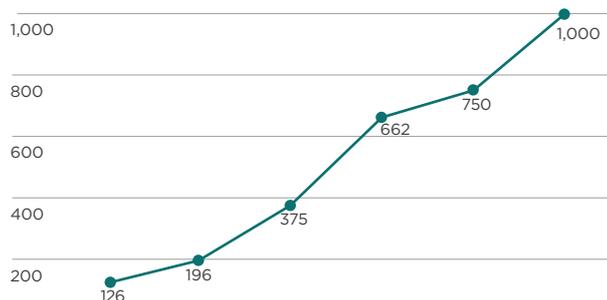
It is only the starting point of a journey which will progressively drive down the carbon footprint of our products to achieve net zero carbon by 2050.

RUSAL has been offering its customers ALLOW low-carbon aluminium, produced with renewable hydropower, since 2017.

In 2021, more than 100 customers of En+ Group opted for ALLOW-branded aluminium, with sales expected to surpass 750 kt. By the end of 2022, we expect to sell more than 1 million tonnes of ALLOW, reflecting growing market demand for low-carbon aluminium.



ALLOW sales, Mt



ALLOW enables our customers to progress their decarbonisation journey, and to reduce the carbon footprint of their products across all major aluminium-consuming segments.

The ALLOW value proposition includes:

1. A guaranteed low-carbon footprint TODAY of 2.4 t CO<sub>2</sub>e/t Al, more than 5 times below the global industry average of around 12 t CO<sub>2</sub>e/t Al (smelter emissions, Scope1&2, IAI Level 1).
2. A commitment to eventually reduce the carbon footprint to near zero by 2050.
  - Combined with renewable hydropower, inert anode technology will provide unprecedented near-zero emissions operation at the smelter (see below).
3. Other services which help our customers to decarbonise their supply chain, beyond the physical delivery of metal.
  - We foster improved carbon footprint transparency, enabling a reliable climate impact assessment of the end product. ALLOW comes with statements of carbon footprint prepared in line with the IAI guidelines and verified externally by independent auditors.
  - We promote enhanced product traceability. The ALLOW digital passport will provide our customers with easy access to a full set of environmental, social, and governance (ESG) information. It will also be available on LME's platform to enable buyer decisions based on carbon footprint, ASI (Aluminium Stewardship Initiative) certification, and sources of energy used in its production.

### Alignment of products to segments

The ALLOW product portfolio is being positioned in all key market segments with a focus on addressing the end user push to meet their own Scope 3 requirements. ALLOW is positioned as a low-carbon solution competing against other low-carbon aluminium (LCA) alternatives including primary aluminium alloys containing recycled content, and secondary aluminium.

1 Level 1 in accordance with Aluminium Carbon Footprint Technical Support Document (2018) [www.international-aluminium.org/wp-content/uploads/2021/08/AL31DA1-1.pdf](http://www.international-aluminium.org/wp-content/uploads/2021/08/AL31DA1-1.pdf).

2 IAI data, 2018. Level 1 in accordance with Aluminium Carbon Footprint Technical Support Document (2018) [www.international-aluminium.org/wp-content/uploads/2021/08/AL31DA1-1.pdf](http://www.international-aluminium.org/wp-content/uploads/2021/08/AL31DA1-1.pdf).

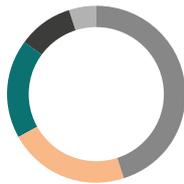
ALLOW products will be positioned across all key segments with a focus on decarbonising supply chains.

**Product sales breakdown by end-use**

■ Automotive ■ Aerospace ■ Packaging ■ B&C ■ Energy T&D ■ Consumer goods ■ Machinery & equipment ■ Steel industry ■ Other

**Packaging (Sheet Ingots)**

- 45% Packaging
- 22% Consumer goods
- 18% Automotive
- 10% B&C
- 5% Machinery & equipment



The largest share of ALLOW slab sales go to the Packaging sector, where can stock dominates demand. Beverage can producers will strive for 100% circularity by 2030 from the current 70%, therefore the primary metal share will continue to shrink. Machinery & equipment is another industry with a high share of secondary metal but exposure to it is below 10%. In Automotive, with high-quality requirements associated with aluminium body sheet, primary metal input is well established and growing, and will continue to be a target commercial segment.

**Building & construction (Billets)**

- 70% B&C
- 10% Automotive
- 10% Machinery & equipment
- 10% Other



Building & construction (B&C) is the largest consuming industry for extrusion billets, but also represents the largest input opportunity for recycled metal (estimated at 40%-50%). In Automotive, the primary share is estimated to be 90%. While recycled share is going to further expand in B&C, primary billet demand will be led by the growth in EV, and the associated demand for battery trays and strapping. ALLOW extrusion billet demand is set to continue growing in this application.

**Automotive (Primary Foundry alloys)**

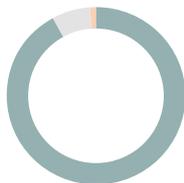
- 89% Automotive
- 11% Steel industry



The bulk majority of ALLOW PFA sales are shipped to the Automotive segment, with the balance going to Steel industry coating applications (share of secondary ~10%). The share of primary aluminium input will increase in line with the expected rapid increase in EV penetration. However, wheel manufacturers plan to use up to 20%-30% of recycled aluminium in the next decade, which is set to hold back and cap the growth of PFA in the wheel segment.

**Energy transmission and distribution (Wire Rod)**

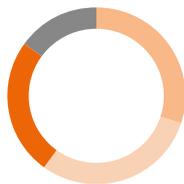
- 92% Energy T&D
- 7% Steel industry
- 1% Other



In energy transmission and distribution requiring ALLOW wire rod, secondary metal penetration is negligible which is explained by the requirement for excellent conductivity. There is a minor share (25%-30%) of primary wire rod consumed by the steel industry for deoxidation.

**Electronics (High Purity Aluminium)**

- 30% Consumer goods
- 30% Other
- 25% Aerospace
- 15% Packaging



The main customer for ALLOW HPA is the Electronics segment. All other consuming industries use it as a 'sweetener' for re-melting / recycling to achieve a required chemical composition.

**Role of inert anode in creating alternative applications**

Inert anode technology represents a major step forward on our decarbonisation journey. The Group has been working on the development of this technology for more than 10 years. The metal is currently produced at a pilot sites, located in Krasnoyarsk.

It is produced with nearly zero process emissions, (less than 0.01 tonnes of CO<sub>2</sub> equivalent per tonne of metal). This is for Scope 1 and Scope 2 direct and indirect energy related emissions. This is one hundred times lower than the industry average.

ALLOW, with a current full-scope (cradle-to-gate) carbon footprint 5 times less than the industry average is set to reduce over time, and inert anode technology will be an accelerator to achieve a near zero carbon footprint in 2050.

🔗 For more information, please refer to **Our Actions. Production cycle on p.26**

# Our strategic approach

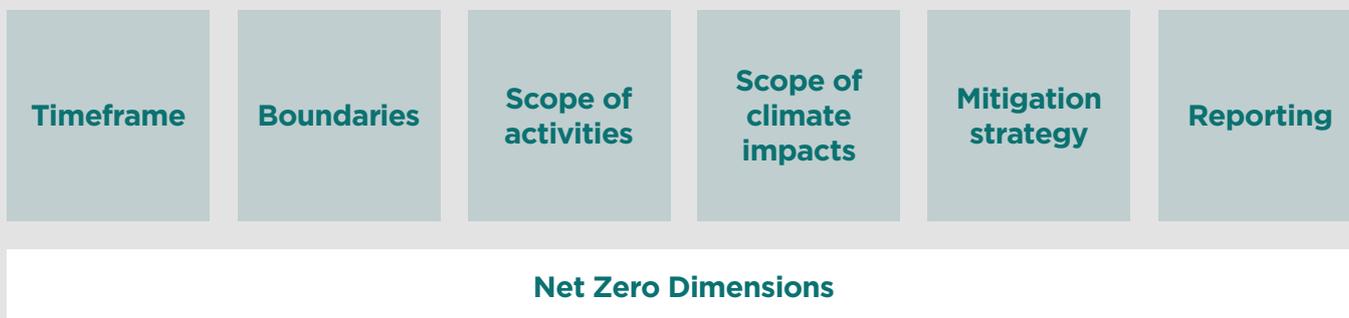
**Our climate ambition is to reach net zero by reducing value chain GHG emissions across the whole value chain, in line with 1.5°C pathways, and by balancing the impact of any remaining hard-to-decarbonise greenhouse gas emissions with an appropriate amount of certified carbon removals.<sup>1</sup>**

**By 2050, the activities within the Group's value chain will result in no net impact on the climate from greenhouse gas emissions.**

## Science-based approach

Adoption of science-based targets (SBT) is an important component for any corporate decarbonisation strategy that aligns with the Paris Agreement 1.5°C goals. In 2021, the Intergovernmental Panel on Climate Change (IPCC) confirmed<sup>2</sup> that in order to limit global warming to 1.5°C, the world needs to reach net zero CO<sub>2</sub> emissions by mid-century. In addition, the IPCC stresses the need for deep reductions in non-CO<sub>2</sub> emissions across the economy to achieve this limit. Our climate ambitions are in line with global net zero goals. The Metals segment will introduce SBTs for Scope 1 & 2 in line with the Aluminium Sector GHG Pathways to 2050 report developed by the International Aluminium Institute.

## Key net zero dimensions



<sup>1</sup> In line with the definition proposed by Science-Based Targets initiative. Science Based Targets (September 2020), Foundations for science-based net-zero target setting in the corporate sector, Version 1.0, [www.sciencebasedtargets.org/resources/files/foundations-for-net-zero-full-paper.pdf](http://www.sciencebasedtargets.org/resources/files/foundations-for-net-zero-full-paper.pdf).

<sup>2</sup> IPCC (August 2021), Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, [www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC\\_AR6\\_WGI\\_Full\\_Report.pdf](http://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf).

## Timeframe

In 2015 RUSAL developed five strategic climate goals for the period to 2025. The strategic goals were revised in 2016 and two additional goals were established:

- To purchase at least 95% of the electricity requirements from hydropower plants and other types of carbon-free power generation for aluminium smelters. The Company achieved the goal ahead of schedule.
- To reduce direct specific GHG emissions by 15% in existing aluminium smelters vs. the 2014 level.
- To reduce direct specific GHG emissions by 10% vs. the 2014 level in existing alumina refineries.
- To reduce average specific electric power consumption by aluminium smelters by 7% vs. the 2011 level.
- To achieve an average of specific direct and indirect GHG emissions by a reduction of no more than 2.7 tonnes of CO<sub>2</sub> equivalent per tonne of aluminium.
- To use an internal carbon price when making strategic and investment decisions, starting in 2017.
- To support Russian and international initiatives and associations advocating actions to prevent climate change and which back carbon pricing, provided they are aligned with the Company's strategic goals.

The Group's plan has annual short-term targets that are maintained and periodically updated where necessary. The Group's mid-term target is to cut GHG emissions by at least 35% by 2030 (compared to 2018). Our long-term target is to reach net zero emissions by 2050.

**“A green business is an efficient business and so the Group is embarking on an ambitious new cycle of investment.”**

**Lord Barker of Battle**, Executive Chairman

## The path of EN+ Group's climate agenda

2015

- RUSAL set five GHG reduction goals for the period until 2025

2017

- Launch of ALLOW, low-carbon aluminium brand
- Verification of GHG emissions of RUSAL and ALLOW carbon footprint by TUV Austria

2019

- Group's Sustainability report 2018
- First SDG report

2020

- Group's Sustainability report 2019 verified by the independent auditor

2021

- The Group committed to
  - 35% GHG emissions (Scope 1&2 against a 2018 baseline) by 2030
  - Net zero by 2050
- Submission of the climate targets for approval to the SBTi

## Boundaries and scope of activities

Our target boundaries include the production facilities<sup>3</sup> of both the Metals and Power segments, and cover all material sources of GHG emissions under operational control.

## Scope of climate impacts

We set targets covering GHG emissions that are under our direct control (Scope 1) and indirect GHG emissions related to energy generation (Scope 2) in accordance with the GHG Protocol Corporate Standard<sup>4</sup>, as well as Scope 3 emissions, including purchased goods and services, and fuel and energy related activities.

For Scope 3, our focus will be on the reduction of the carbon footprint of purchased alumina, bauxite, and carbon-containing materials. Transportation-related GHG emissions are expected to be reduced by attracting low-carbon climate-oriented transport companies.

The first step is the involvement of suppliers in calculating the reduction of Scope 3 emissions by requesting cradle-to-gate carbon footprint data and providing training. The second step is creating a system of supplier selection based on carbon footprint level criteria. Activities to ensure that suppliers are permanently involved in GHG reduction will be carried out in parallel. It is expected that by 2030, the main producers of purchased alumina will achieve a 25% reduction in their carbon footprint in comparison with a 2018 baseline, and by 2050, they will have reduced their own carbon footprint by at least two thirds.

## Mitigation strategy

To achieve our climate targets, En+ Group relies on the following:

### Emissions abatement

Abatement measures are a core element of our pathway to net zero. We intend to implement technologies to prevent the release of GHGs into the atmosphere by reducing or eliminating sources of emissions associated with all of the Group's operations, products and value chain:

- Shifting to pre-baked anode and inert anode technologies for smelters.
- Shifting from fossil fuels to liquefied natural gas (LNG), natural gas, and green hydrogen, or using renewable power for heating processes.

 For more information, please refer to p.26

### Avoided emissions

The Group runs the New Energy programme, which is designed to increase hydropower generation up to 2.5 TWh per year, with the same amount of water passed through the hydro turbines of the HPP, and significantly reduce the impact on the environment, in particular, by reducing reliance on and hence preventing greenhouse gas emissions from the low efficiency fossil fuel powerplants.

 For more information, please refer to p.29

### Compensation and neutralisation

The Group is considering carbon capture, utilisation and storage (CCUS) technology for removal and sequestration of GHG emissions in the value chain that cannot be eliminated by abatement measures. The Group has a strategy to use nature-based solutions for the sequestration of GHG from the atmosphere.

 For more information, please refer to Nature-Based Solutions p.40

<sup>3</sup> For more information about production facilities please refer to our Annual Report 2020.

<sup>4</sup> World Resources Institute and World Business Council for Sustainable Development (March 2004), A Corporate Accounting and Reporting Standard, Revised edition, [www.ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf](http://www.ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf).

For primary aluminium production more than 98% of the Group's electricity is produced at carbon-free or low-carbon sources of power generation, mostly from large scale hydropower stations.

En+ Group understands that electricity consumption from renewable sources and especially from hydropower stations for primary aluminium production is an important part of the low-carbon pathway to achieve net zero emissions by 2050.

It is clear, however, that no one renewable technology will achieve zero carbon emissions. To provide transparency of carbon footprint the Group has decided to measure real anthropogenic GHG emissions from HPP reservoirs in accordance with the principles of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

This work is being carried out in with cooperation with the second largest Russian hydropower producer, RusHydro, with the Institute of Global Ecology and Climate (which is responsible for the preparation and submission to UNFCCC of national official record of GHG emissions of the Russian Federation), and with methodological support from SINTEF.

The aim of this work is to define and calculate Tier 3 emissions coefficients for six HPP reservoirs in Russia that fully or partly belong to the Group: Irkutsk, Bratsk, Ust-Ilimsk, Krasnoyarsk, Ondskaya, and Boguchany HPPs, and, together with RusHydro, to define Tier 2 national Russian average emissions coefficients for Russian HPPs.

The first autumn, spring and summer campaigns have been carried out at the Bratsk and Ust-Ilimsk HPPs reservoirs. Next year we plan to extend the measuring campaign to include Irkutsk HPP.

## Transparency/Reporting

Our commitment to transparency and data-led disclosure is supported by reporting on the sources of emissions included and excluded from the target boundary, the timeframe for achieving net zero emissions, the amount of abatement and neutralisation planned in reaching net zero emissions, and any interim targets or milestones.

In 2020, En+ Group urged the London Metal Exchange (LME) to show greater green ambition with its sustainability proposals. We called for mandatory carbon content and sustainability-related disclosures by metal producers, and for these to be fully integrated with the existing trading system. This would enable better-informed decisions by buyers seeking to source responsibly and minimise the climate impacts of their procurement.

### Carbon Disclosure Project

In 2020, RUSAL received an 'A-' rating for the first time in the aluminium industry following its annual assessment by the Carbon Disclosure Project (CDP), and became one of the 160 leading CDP companies out of more than 4,800 participants committed to reducing climate risks along the entire supply chain. Based on the results of the assessment in 2020, RUSAL:

- topped the CDP climate ranking among the world's aluminium companies with an 'A-' rating
- was top rated by CDP for 'Supplier Engagement', i.e. the company's efforts to reduce CO<sub>2</sub> emissions throughout the supply chain.

Since RUSAL first committed to disclosing information on its GHG emissions by joining the CDP in 2015, the Company has submitted reports on GHG emissions on an annual basis. The CDP "A -" rating is the culmination of the consistent efforts to support transparency and tackle climate change. By improving our rating, we are increasing the competitiveness of our products as the CDP report is highly regarded by the world's most prominent customer companies and investors when purchasing products and making investment decisions.

# Roadmap to net zero

To perform net zero commitment, the Group will need to upgrade all its production facilities, as well as introduce innovative technologies throughout the production chain.

## En+ decarbonisation pathway

Power segment Metals segment Compensation Balance



2050  
Net zero

**2020 - 2030**

Modernisation. Switching half of the capacity at four of our facilities to pre-baked technology

**2020 - 2030**

**Inert Anode** Inert anode: intensive R&D

**2030 - 2050**

Confirmation Tests and switching to the Inert Anode technology

**2030 - 2050**

Electrification of Bauxite mining

**2030 - 2040**

Gasification (Alumina refineries)

**2020 - 2050**

Energy Efficiency projects at Alumina refineries

**2020 - 2030**

**Hydrogen** Options Research

**2030 - 2040**

Construction of the Infrastructure

**2040 - 2050**

Implementation on Alumina Segment

**2020 - 2050**

Compensation measures (Forestry projects and CCUS)

## Metals segment

### 1. Optimisation of raw materials supplying alumina and bauxite system

Optimisation of our materials supplying system will reduce the carbon footprint of alumina used for the production of ALLOW primary aluminium (cradle-to-gate). The optimisation process is planned to be completed by the end of 2022.

### 2. Eco-Söderberg implementation

Söderberg plants are expected to be modernised with more efficient and environmentally friendly technology – Eco-Söderberg. The main effect of Eco-Söderberg technology on GHG emissions is the significant reduction of PFC emissions due to reduction in anode effect frequency. Eco-Söderberg technology has automatic point feeders that facilitate this reduction through the regular supply of alumina and by maintaining a certain level of alumina concentration in electrolyte. The modernisation process is planned to be finished by 2025. The modernisation investment is expected to total USD 118 million in the period to 2026, including funds already invested in the modernisation process (-USD 83,8 million).

### 3. Conversion to the Pre-baked anode

This involves increasing the share of aluminium produced with modern pre-baked technology and the reduction of carbon intensity of primary aluminium production at smelters. Converting half of the capacity at Krasnoyarsk, Bratsk, Irkutsk, and Novokuznetsk smelters to pre-baked anode technology is planned for the period between 2025 and 2030. Once implemented, the programme will also help massively reduce the smelters' emissions of fluorides and resinous substances, including benzo(a) pyrene. This will also reduce energy consumption by 11-18%. The preliminary total CAPEX is estimated at USD 4.9 billion.<sup>1</sup>

 For more information about our production cycle, please refer to p.26

<sup>1</sup> Including the construction of a new modern facility, the Taishet Anode Plant, and VAT.

## Roadmap to net zero continued

### 4. Inert anode technology

Our innovative inert anode technology will allow the significant reduction of GHG emissions from primary aluminium production. Only a few Scope 3 emissions will remain related to indirect emissions from the production of raw materials used for the making of inert anodes.

At the moment the technology is being trialled and improved at several full scale pots. It is expected that the technology will be ready for industrial scale implementation by 2030. Our Krasnoyarsk aluminium smelter is producing two tonnes of ultra-low-carbon aluminium per day in its pilot plants. It is expected that the technology will be ready for industrial scale implementation by 2030. Full scale industrial implementation will then follow and from 2040-2050 we will convert all pre-baked cells to inert anode technology. Inert anode CAPEX is expected to be similar to the CAPEX of pre-baked technology, but OPEX is expected to be less than 5% compared with current pre-baked technology.

### 5. Energy efficiency control on regular basis

Implementing more efficient equipment and improving operational control on alumina refineries is also helping to reduce emissions, based on regular analysis and upgrades.

### 6. CO<sub>2</sub> emissions absorption by caustic soda

Significant results are expected to be achieved by introducing the absorption of CO<sub>2</sub> emissions by caustic soda. CO<sub>2</sub> reacts with caustic soda and forms sodium carbonates that are absorbed by bauxite and nepheline residue and then stored at residue disposal storage. The introduction of this technology is planned during 2022-2040.

### 7. LNG and natural gas

Alumina refineries that currently use heavy fuel oil or coal are expected to switch to natural gas or LNG before 2030 again, significantly reducing GHG emissions.

### 8. Hydrogen

It is expected that green hydrogen will become cheaper and more readily available and, from 2040, used as a fuel. Another possibility is using renewable sources of power to produce the heat and steam necessary for the alumina production process. As a result, it is expected that the main source of GHG emission from the alumina refineries will be eliminated by 2050.

### 9. Transportation

Transport is the main source of GHG emissions from bauxite and nepheline ore mining. Switching transport from fossil fuel to electricity or biofuels will help the continual reduction of GHG emissions from transport by up to 80-90%. Power generation will also be converted to renewables.

### 10. I-RECs

The Company has a very small carbon footprint of purchased electricity because more than 98% of power for electrolysis comes from HPPs and other carbon-free generators. It is expected by 2040 that we will reach close to 100% of power consumption from the grid from renewable sources by using marketing mechanisms, such as Power Purchase Agreements and renewable certificates like I-RECs. This will also give us opportunities to motivate other power generators to become carbon neutral.

### 11. Recycling

Increasing the use of aluminium scrap is one priority of the strategy. However, the percentage of scrap depends on the development of the recycling system and infrastructure in Russia and CIS.



## Power segment

### 1. Optimisation of the power generation structure and the creation of two mainstream generation segments – fossil fuel generation and low-carbon/renewable power generation.

Fossil fuel generation – we consider switching from carbon intensive fossil fuels to natural gas by 2030 and after that it is anticipated to be converted to renewable power and heat generation if the appropriate technologies and sources of renewable energy are available then.

### 2. Increasing of renewable power generation by:

- a. Implementation of the New Energy programme that allows increased hydropower generation by up to 2.5 TWh at HPPs using the same amount of water.
- b. Development and construction of new renewable power and heat generation: hydropower, biofuels and hydrogen production.

## En+ Group

Taken together, these measures will allow the reduction of En+ Group's absolute GHG emissions Scope 1&2&3 by at least c.60% from current levels by 2050. Around 40% of emissions cannot be eliminated by applying the current level of technology and costs – these emissions need to be compensated for using technical and nature-based solutions:

1. Technical solutions comprise carbon capture, utilisation and storage (CCUS) technologies. These require an appropriate CO<sub>2</sub> gas compressing and transportation infrastructure to be created, that allows for the capture of concentrated CO<sub>2</sub> from the emissions and its transport to places where it is possible to use or store the carbon underground (or anywhere it cannot escape). We expect that we can capture and utilise or store around 7.5 million t CO<sub>2</sub>e per annum.
2. Nature-based solutions are solutions that allow the capture and storage of CO<sub>2</sub> using natural processes. Since 2019, the Group has implemented extensive forestry projects.

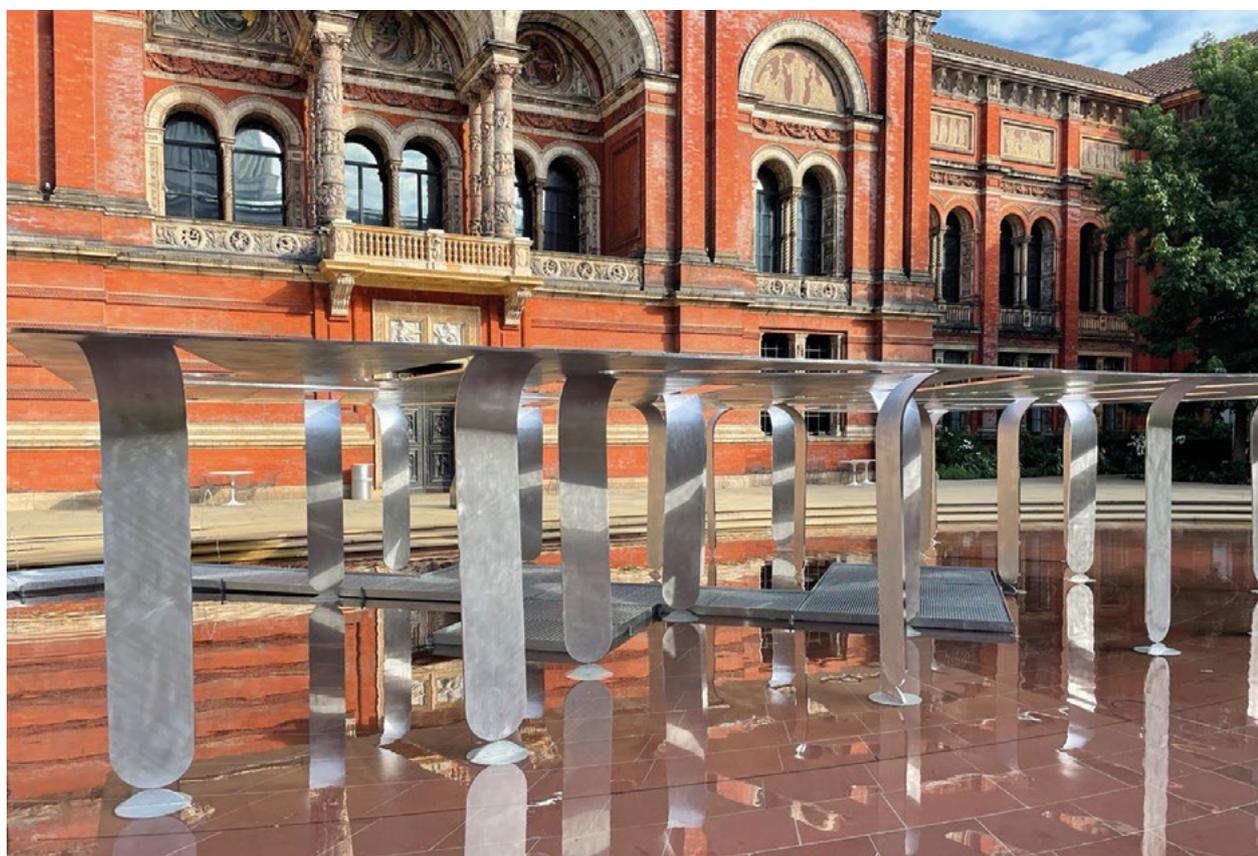
 For more information, please refer to p.26



# Business strategy

**We are committed to the Group's green development strategy – to use unique sources of low-carbon hydropower energy to achieve vertical integration and self-sufficiency across our value chain, to maintain and grow high-margin, low-risk aluminium production, which is one of the key materials allowing world's green transformation, and to maintain robust financial strength and grow total shareholder returns, including the payment of sustainable and attractive dividends.**

**As stated, the Group will achieve its ambitious targets by the implementation of strategies developed for both its Power and Metals segments.**



En+ Group and the V&A are partnering to produce an immersive pavilion "Between Forests and Skies" for the London Design Festival. The pavilion is made from aluminium with the world's lowest carbon footprint produced using En+ Group's unique inert anode technology.

## Metals segment

The Group noted the announcement from RUSAL, its holding company for aluminium assets, for a potential demerger of its higher carbon assets<sup>1</sup> and anticipates that RUSAL would have a differentiated strategy for the two sub-sets of fully vertically integrated value chains of aluminium production: higher- and low-carbon assets. Execution of this strategy if and when implemented, would drive value creation for all stakeholders:

<sup>1</sup> [www.enplusgroup.com/en/media/news/press/en-announces-intention-to-demerge-high-carbon-assets/](http://www.enplusgroup.com/en/media/news/press/en-announces-intention-to-demerge-high-carbon-assets/).

	<b>Lower carbon segment</b>	<b>Higher carbon segment</b>
<b>Key focus</b>	Reinforcing its position as a leading producer of low-carbon aluminium to achieve full potential as a sustainable business, and developing ground-breaking technology such as inert anode, which delivers carbon free aluminium production.	Development of the domestic market and its growth potential. A key pillar of the strategy for the new company would be to deliver a long-term environmental modernisation programme where the new company would replace most of its presently installed electrolysis lines with new ones using the most up-to-date pre-baked smelting technology.
<b>Key technical solutions</b>	<ul style="list-style-type: none"> <li>- Modernisation of Krasnoyarsk smelter to introduce RA-550 pre-baked anode technology (by 2030)</li> <li>- Alumina refineries Windalco and Friguia switched to LNG (by 2030)</li> <li>- Second stage of BoAZ production (BoAZ has the lowest carbon footprint in the Metals segment)</li> <li>- Increase in energy efficiency at alumina refineries during 2020-2050</li> <li>- Inert anode technology partially implemented by 2040</li> <li>- Inert anode technology fully implemented by 2050</li> <li>- Conversion of alumina production to hydrogen by 2050</li> <li>- Use of heat from electric boilers powered by renewables</li> </ul>	<ul style="list-style-type: none"> <li>- Introduction of Eco-Søderberg at Bratsk Aluminium Smelter (BrAZ), Irkutsk Aluminium Smelter (IrkAZ), Novokuznetsk Aluminium Smelter (NkAZ), and Volgograd Aluminium Smelter (VgAZ) by 2025</li> <li>- Modernisation of BrAZ, IrkAZ and NkAZ smelters to introduce pre-baked anode technology for half of the plants capacities (by 2030)</li> <li>- Achinsk Alumina Refinery (AGK) switched to natural gas (by 2030)</li> <li>- North-Urals Bauxite Mine (SUBR) transferred to 100% renewable power by 2030</li> <li>- Increase in energy efficiency at alumina refineries during 2020-2050</li> <li>- Inert anode technology partially implemented by 2040</li> <li>- Inert anode technology fully implemented by 2050</li> <li>- Conversion of alumina production to hydrogen by 2050</li> <li>- Use of heat from electric boilers powered by renewables</li> </ul>
<b>Key expected benefits</b>	<p>The proposed strategy will provide benefits in the short to medium term, mostly resulting from the additional margin for low-carbon aluminium which arises from the sale of higher value products. Market demand for ALLOW will continue to be driven by carbon cost avoidance as customers intensify their efforts to decarbonise their supply chains.</p> <p>In addition, the company will continue to benefit from its low-cost energy sources (hydropower generated in Siberia) supplying the most efficient operations.</p> <p><b>Reduction of GHG emissions</b></p> <ul style="list-style-type: none"> <li>- After 2030, related to fuel conversion to natural gas or LNG at alumina refineries</li> <li>- From 2040-2050, related to smelters adopting inert anode technology</li> </ul>	<p>In the short to medium term it is the company's intention to raise financing for the environmental modernisation programme and apply for support through relevant state programmes.</p> <p>In the long term, after completion of the proposed modernisation, the company will benefit from cost reduction because of implementation of the newest and efficient technologies.</p> <p><b>Reduction of GHG emissions</b></p> <ul style="list-style-type: none"> <li>- After 2030, related to fuel conversion to natural gas or LNG at alumina refineries</li> <li>- From 2040-2050, related to smelters adopting inert anode technology</li> </ul> <p><b>Reduction of other hazardous emissions, including fluorides and benzo(a)pyrene</b></p> <ul style="list-style-type: none"> <li>- After 2030, related to the modernisation of the BrAZ, IrkAZ and NkAZ smelters to introduce pre-baked anode technology</li> </ul>

## Business strategy continued

### Power segment

The Group's key priority in its Power segment is to provide a low-carbon hydropower supply to further reduce our overall carbon footprint and to achieve carbon neutrality by 2050. Based on aluminium growth estimates, by 2030 the Group's total hydrogeneration should increase to 70.0 TWh, including new projects with an additional 6.9 TWh of supply. New power stations will include Nizhneboguchany HPP, as well as the construction of the Telmamskaya HPP for third-party sales.

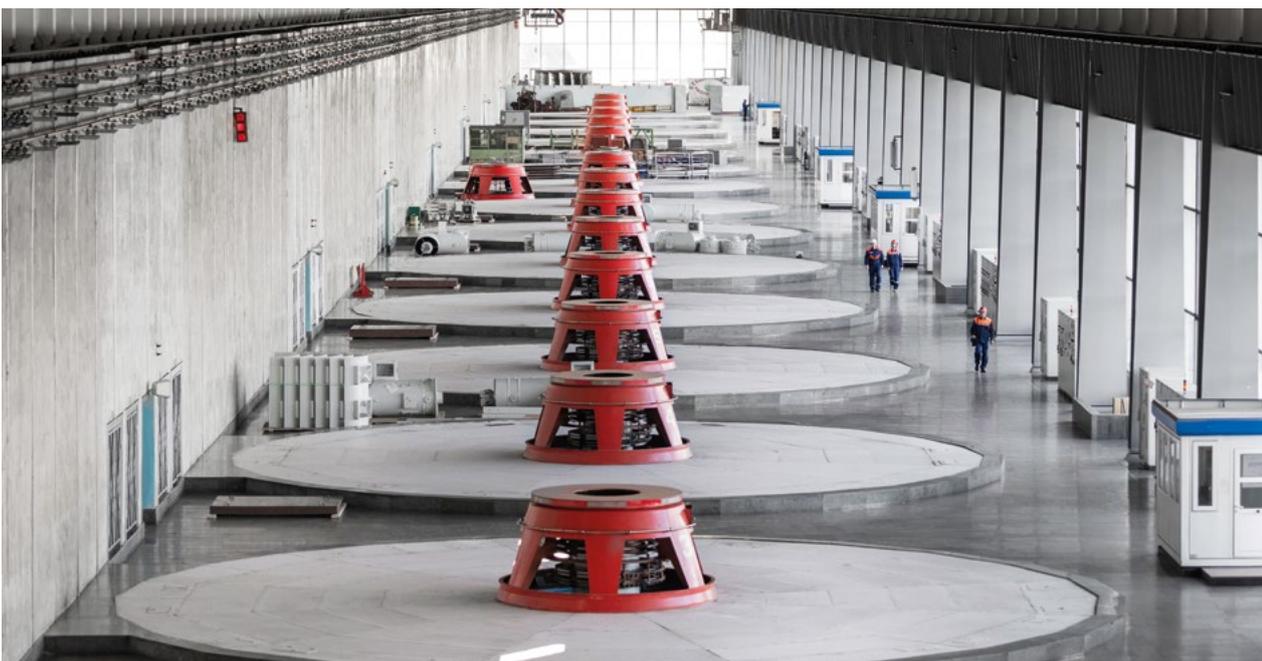
En+ will continue its existing HPP modernisation programme, as well as modelling the water level to optimise HPP generation and further reduce power costs. En+ Group has become Russia's first company to join the market for international renewable energy certificates (I-RECs) via an agreement made in 2020 with the Goal Number Seven association which acts as the Russian agent of the Netherlands-based I-REC market operator I-REC Services BV.

En+ Group has two power plants, i.e. Krasnoyarsk HPP and Abakan Solar Plant, included in the I-REC register. The first certificates were delivered in December 2020.

The Group also made another agreement with I-REC Services BV in the summer of 2021 to be able to offer I-REC buyers a wider range of services, including not only I-REC issuance, but also redemption. As of mid-August 2021, En+ Group has around a 60% share of the Russian market in terms of delivered I-RECs and is active in securing new contracts for future deliveries.

 For more information about Hydrogen, **please refer to p.33**

En+ recently outlined plans to start production of 13 ktpa of green hydrogen using additional power capacity in Siberia and Karelia for sales to EU and Asian markets. An R&D project is underway to develop our aluminium containers for transportation of hydrogen. The pilot project includes green hydrogen production up to 13 ktpa using additional electricity output from existing hydropower plants, as a result of the New Energy programme. Extra capacities are available at Irkutsk, Bratsk and Ust-Ilimsk HPPs, in the Irkutsk Region. The Company is also investigating the production of hydrogen using electricity from Ondskaya HPP, Karelia. The total capacity considered for hydrogen production is estimated to be up to 228 MW.



Another project is developing a concept for a hydrogen transport infrastructure for Krasnoyarsk. The project consists of the construction of small-scale green hydrogen electrolyzers using electricity from Krasnoyarsk HPP, which is planned as fuel for public transport. The project also includes storage, dispensers and hydrogen fuel cell buses. The Company plans to launch a feasibility study for the project in Q3 2021, to be completed by the end of 2021.

In parallel, En+ Group is also developing opportunities of giga-scale green hydrogen production using electricity from captive new-build renewable projects (hydro and wind) both in Siberia and in the Far East of Russia. For example, the construction of the 1 GW Motyginskaya HPP on the River Angara is planned solely for hydrogen production.

In addition, the Group will continue the development of small hydro HPPs. As part of the state programme backed by the Capacity Allocation Contracts mechanism for renewable projects, En+ Group is implementing the small-scale Segozerskaya HPP (8.1 MW) in Karelia (Russia). En+ has formed a portfolio of projects with a total installed capacity of about 200 MW. Depending on the results of the project feasibility study, a decision will be made on when these projects will be implemented.

En+ Group is also analysing opportunities for the extension of the Abakan Solar Power Plant by approximately 15 MW backed by the Capacity Allocation Contracts.



En+ has also launched the development of a gasification programme for the Krasnoyarsk and Irkutsk regions based on LNG. The pilot project in Krasnoyarsk involves the gasification of 200 households, schools and boiler houses. In Irkutsk, an analysis of the gasification of six boiler houses is underway.

Furthermore, the Group is actively participating in the development of industrial crypto mining and data centre projects in Siberia, both providing potential sites with connection to electricity and other infrastructure and investment. The key advantages of locating such projects in Siberia are effective power prices, favourable climate conditions and opportunities to provide industrial cooling in combined cooling, heat and power (trigeneration).

En+ Group has installed three pilot charging stations for electric vehicles (EVs) in the Irkutsk Region. This initiative to support the growth of clean energy vehicle use is fully aligned with the Group's strategic focus on climate action. Further development of the network of 'fast' chargers in Irkutsk and the Irkutsk Region will be subject to the continued growth of the local EV market. The region has seen a significant increase in EV use over the past three years. According to Autostat<sup>2</sup> the number of EVs in Russia increased by 71% in 2020 compared to 2019, with more than 60% of EV owners located in Siberia and the Far East of Russia. In the medium term, En+ plans to install 'fast' chargers along motorways heading to Baikalsk, Khuzhir and the Olkhonsky district. In 2021, the Group plans to launch five new stations.

2 Autostat (February 2021), The number of electric vehicles in Russia has exceeded 10 thousand units [www.autostat.ru/news/47243/](http://www.autostat.ru/news/47243/).

# Production cycle

**The transition to a net zero future requires multiple solutions, adapting technology and introducing innovations.**

En+ Group's pathway to net zero is based on implementing energy efficiency solutions and switching to innovative new GHG reduction technologies. Both segments are working on the implementation of modernisation plans, realisation of innovative projects and monitoring of new solutions with consideration for both emissions reduction and cost-effectiveness for the Group's business.

To achieve its ambitious climate goals, the Group intends to implement a set of innovations along the entire production chain.

## Metals segment

### Eco-Söderberg

This technology involves a radical change in the reduction cells in comparison to classic Söderberg technology. The procedure includes maximum sealing of the cell, installation of automatic feeding and integrated gas scrubbing systems, use of optimised anode paste composition, installation of specialised gross emission reduction devices, and minimisation of the anode effect frequency. An Eco-Söderberg cell only needs to be opened for processing treatment twice in six days. The remaining daily operations are carried out without breaking the cover (cryolite-alumina crust) and are performed through special hatches. The technology reduces the frequency of anode effects by more than half, which leads to halving emissions of PFCs.

### Pre-baked anode technology. Construction of new facilities and conversion of most of Söderberg cells to pre-baked anodes

The new Taishet aluminium smelter is still under construction. An RA-400 pilot section was launched at the Sayanogorsk aluminium smelter to test the technology. During the tests, the RA-400 was upgraded to a current of 435 kA and power consumption of 12,900 kWh. At the same time, fluorine emissions did not exceed 0.22 kg/t. The design of the anode beam was also upgraded to improve gas suction and reduce emissions. All cells of the type are equipped with automatic alumina feeding systems and high-efficiency covers.

In further developments, RUSAL became the world's first aluminium company to successfully create an industrial cell operating at an amperage above 500 kA, and thus with greater sustainability in terms of energy and material balance. This was achieved through the use of non-standard solutions – a totally new configuration with a two-line current supply busbar. This allowed for a symmetrical magnetic field and high MHD stability without the use of a compensation loop. A modular approach was used to create the busbar, which effectively removed the constraints on the capacity build-up. The new cell is smaller than the previous generations.

RA-550 technology is the most environmentally friendly in RUSAL and among its global peers. The total fluoride emissions due to the higher design efficiency of the cell cover are 0.2 kg per tonne of aluminium, which complies with the best global standards of the aluminium industry.

Earlier this year, the Company resolved to upgrade aluminium production at its four key Siberian aluminium smelters, i.e. the Krasnoyarsk, Bratsk, Irkutsk and Novokuznetsk smelters, by switching 50% of their capacity from Eco-Söderberg to pre-baked technology.

Once implemented, the programme will help massively reduce the smelters' emissions of fluorides and resinous substances, including benzo(a)pyrene. This will also reduce energy consumption by 11-18%.

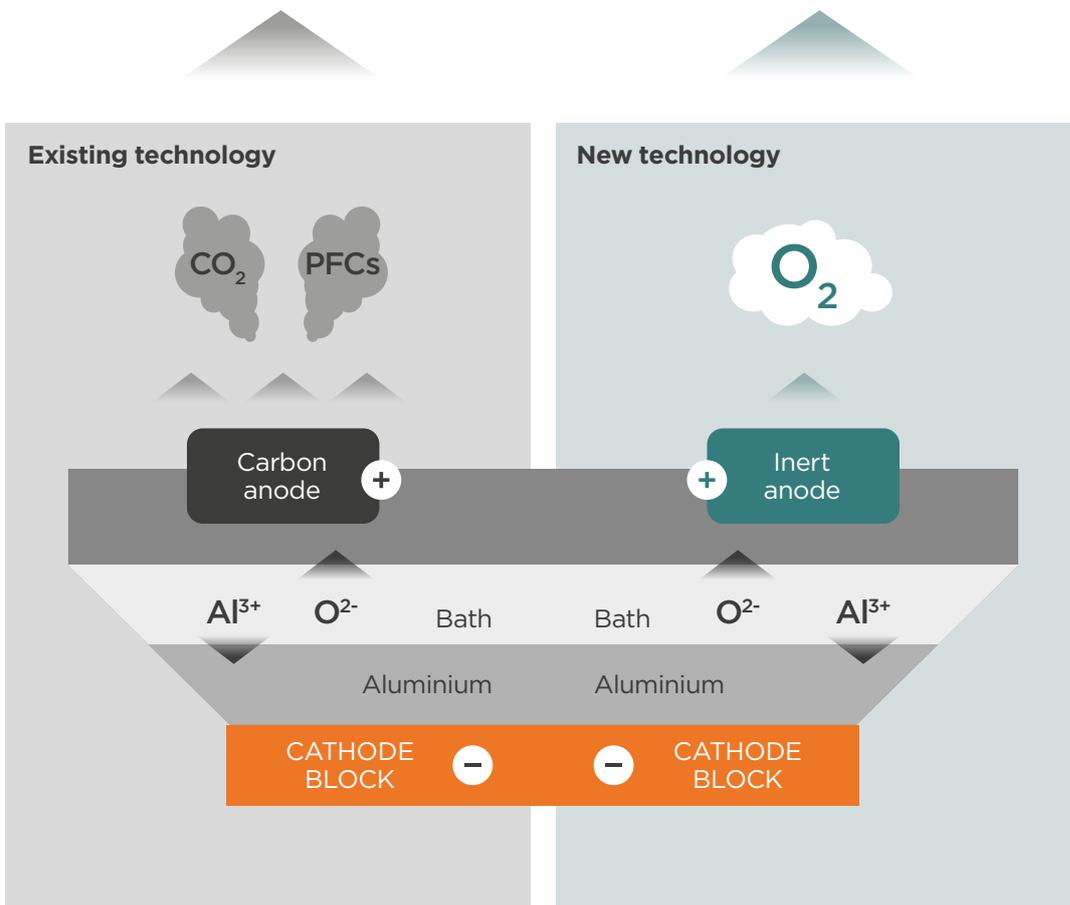
The transition to pre-baked anode technology will significantly reduce GHG emissions at the upgraded reduction facilities.

# 0.9T O<sub>2</sub>

released per 1 T Al produced.  
The equivalent of around  
70 hectares of forest.

In standard aluminium production, the electrolysis process uses a carbon anode which burns up in the atmosphere causing harmful emissions.

En+ inert anode technology eliminates GHG emissions from the smelting process by replacing carbon anodes with inert anodes, which emit oxygen.



“In comparison to full-scope industry average emissions, metal produced with inert anodes has an 85% lower carbon footprint.”

**Rt Hon Lord Barker of Battle,**  
Executive Chairman

Read more about our inert anode technology at [www.enplusgroup.com/en/what-we-do/projects/inert-anode/](https://www.enplusgroup.com/en/what-we-do/projects/inert-anode/)

## Metals segment continued

### Conversion to inert anode technology

RUSAL is the first company in the world to commercially produce aluminium using a fundamentally new inert anode technology at its pilot sites, the Krasnoyarsk aluminium smelter. The inert anodes replace the classic carbon anodes thereby significantly reducing emissions during the reduction process.

RUSAL is the global leader in creating and developing inert anode technology. The technology is recognised as a revolutionary environmental solution in metallurgy that will reduce greenhouse gas emissions to zero during aluminium production.



The use of the technology in actual operations will completely eliminate emissions of greenhouse gases and polyaromatic hydrocarbons. Moreover, the reduced consumption of anodes will reduce operating costs by more than 5%. RUSAL's process engineers are currently working on the sustainability of the technology on industrial prototype cells, reducing production costs and improving the product quality. The main result of the development and testing of inert anode cells is stable aluminium production on an industrial scale.

The current daily capacity of the pilot inert anode cells is over 2 tonnes of aluminium per day, with the cell amperage at 140 kA.

The technology will be introduced as a replacement for the pre-baked anodes (OA-120 potrooms at KrAZ). In the long run, it is planned to convert the remaining Eco-Søderberg capacities at the smelters, and the high-power RA-400 and RA-550 cells, to inert anodes.

### Technologies

Energy sources	Low-emissions technology pathways		Costs	Commercial horizon
<b>Eco-Søderberg</b>				
Clean power	Anode effect frequency	0.4 AE/day	CAPEX USD 34.2 million	till 2026
	Carbon anode consumption	0.5 t/t Al		
	Electricity consumption	15.4 MWh/t Al		
	GHG emissions	2.0 t CO <sub>2</sub> e/t Al		
<b>Pre-baked anode (RA-400; RA-550)</b>				
Clean power	Anode effect frequency	<0.04 AE/day	CAPEX is estimated at USD 4.9 bn <sup>1</sup>	till 2030
	Carbon anode consumption	0.4 t/t Al		
	Electricity consumption	12.8 MWh/t Al		
	GHG emissions	1.5 t CO <sub>2</sub> e/t Al		
<b>Inert anode</b>				
Clean power	Anode effect frequency	0 AE/day	CAPEX - CAPEX of the pre-baked anode OPEX 5% reduction in comparison with the pre-baked anode	till 2050
	Carbon anode consumption	0 t/t Al		
	Electricity consumption	14.8 MWh/t Al		
	GHG emissions	0 t CO <sub>2</sub> e/t Al		

<sup>1</sup> Including the construction of a new modern facility, the Taishet Anode Plant, and VAT.

## Power segment

The Power segment is implementing an extensive modernisation programme, including both HPP and CHP modernisation, and an energy efficiency improvement programme to decrease electricity losses, as well as various projects aimed at reducing its environmental footprint.

### Expansion of solar energy generation

Since 2016, Power segment has worked on researching and designing perovskite solar panels together with the laboratory of the Faculty of Materials Science of Lomonosov Moscow State University. The project is supported by the Russian Science Foundation. In June 2020, a new framework agreement on scientific and technical cooperation was signed between JSC Krasnoyarsk HPP and Lomonosov Moscow State University to develop perovskite/silicon solar tandems.

En+ has piloted a solar plant in Abakan, Russia and produced components for solar plants. The Power segment plans to expand solar energy generation.



### HPP modernisation

#### The New Energy modernisation programme

New Energy is the programme for retrofitting the Angara-Yenisei HPPs chain designed to increase power generation by up to 2.5 TWh per year, with the same amount of water passed through the hydro turbines of the HPPs, a significant reduction in environmental impact and the elimination of greenhouse gas emissions from the CHP plant.

The programme has been ongoing since 2007 and provides for large-scale reconstruction and replacement of the main equipment at the Company's largest Siberian HPPs: Krasnoyarsk, Bratsk, Irkutsk, and Ust-Ilimsk. Hydroelectric generation units are retrofitted, and runners are replaced as part of the programme. The modernised turbines also incorporate an up-to-date runner design that prevents turbine oil leakage into water.

Higher efficiency (max. +8%) is achieved due to the improved blade profile of the new turbine wheels and the materials used. As one of the main goals of the retrofitting is to improve the safety and reliability of the HPP, the risks associated with cavitation are also significantly reduced, and the problem of wear of the HPP generators is solved.

The programme will avoid 2.5 million t CO<sub>2</sub>e emissions by 2025, by partially replacing inefficient coal fired power generation with hydropower. The modernisation programme investment is expected to total USD 284 million in the period to 2026, including funds already invested in the project (~USD 150 million).

In 2020, the programme enabled En+ Group to increase its power output by 1.71 TWh and to prevent GHG emissions of 1.98 mt of CO<sub>2</sub>e in 2020 due to the partial replacement of the energy generated by coal-fired power plants.

**Power segment** continued

**HPP projects**

**Segozerskaya HPP**

As part of the state programme backed by the Capacity Allocation Contracts mechanism for renewable projects, En+ Group is implementing the small-scale Segozerskaya HPP (8.1 MW) in Karelia (Russia). En+ Group has also formed a portfolio of projects with a total installed capacity of about 200 MW. Depending on the results of the project feasibility studies, a decision will be made on when these projects will be implemented.



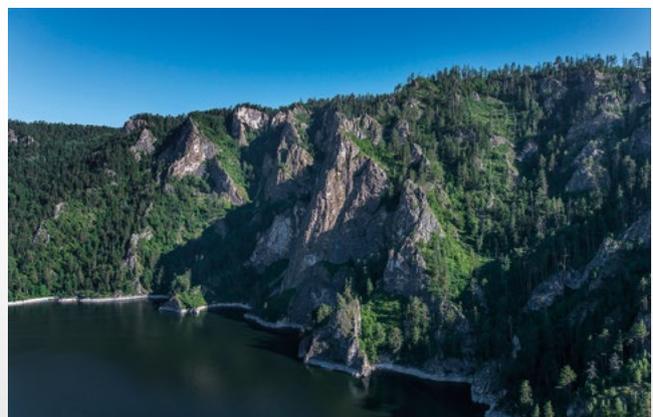
**Telmamskaya HPP**

En+ Group plans to participate in a tender for the construction of generating facilities as part of a project to expand the capacity of the Baikal-Amur Mainline (BAM) and the Trans-Siberian Mainline. Installed capacity of the Telmamskaya HPP is expected to be 450 MW; built using the Capacity Allocation Contracts mechanism, which assumes a guaranteed return on investment. The Company expects the station to be completed by 2030.



**Nizhneboguchany HPP**

En+ Group plans to build the Nizhneboguchany HPP, a fifth large HPP on the Angara River, in Krasnoyarsk Territory. The installed capacity of the Nizhneboguchany HPP is expected to be 660 MW. Average annual electricity generation is expected to be 3,300 million kWh. The Group expects the HPP to be completed by 2030.



### CHP modernisation

The CHP modernisation programme includes projects which improve the operating efficiency of thermal power plants, thus reducing greenhouse gas emissions for any given energy output.

### State programmes for CHP modernisation

The Group participated in the state programmes for CHP modernisation, providing us with a guaranteed return on investment. The Capacity Allocation Contracts will be signed between buyers, market regulator (ATS) and generating companies of the wholesale market, providing the key criteria for modernisation, parameters of capacity supply after the modernisation and return on investment. Through this programme the Group will improve the reliability and safety of 1,445 MW of its CHP capacity (32.9% of the Group's total CHP capacity).

The modernisation programme will enable the reduction of 151.7 kt of CO<sub>2</sub>e emissions. The expected CAPEX of the project from 2020 to 2027 is about USD 230 million.

### Optimisation of heat supply in Bratsk

Heat to the Central district of Bratsk comes from two sources, namely CHP-6 and the Galachinskiy boiler house (GBH). CHP-6 has better technical and economic parameters than GBH. CHP-6 has a thermal capacity reserve and can fully cover the heat load of the zone currently covered by the GBH. It is proposed to optimise the heat supply scheme of the Bratsk Central district in order to completely shut down the GBH, so that CHP-6 will remain as the only source of heat supply to the Central district upon completion of the project. From 2023, expected GHG emissions reduction is 137 kt of CO<sub>2</sub>e emissions annually. Expected CAPEX of the project from 2018 to 2022 is USD 20 million.

### Optimisation of power consumption of heating network pump stations

The main prerequisite for effective use of frequency control drives (FCDs) on the heat network pumps is their operation under over-sufficient pressure, reducing excessive pressure by means of hydraulic resistance of control valves. Optimisation options alternative to FCDs are:

- Replacement of runners with those of smaller diameter or milling the existing runners to a smaller size.
- Replacement of pumps with less productive ones (either to be purchased or using available stock).
- Replacement of the existing electric engines with those of lower rpm (e.g. 750 rpm instead of 1,000 rpm).

The expected reduction in GHG emissions from the project is 31.4 kt of CO<sub>2</sub>e. Expected CAPEX of the project from 2019 to 2022 is USD 3 million.

### Energy efficiency improvement programme

GHG emissions grow in proportion to energy consumption. Improving energy efficiency is one of the most effective ways to reduce greenhouse gas emissions. One of the measures to improve energy efficiency and, accordingly, to reduce GHG emissions is to decrease electricity losses during transmission from generation facilities to consumption sites. Energy Saving and Energy Efficiency Improvement Programme for 2021-2024 was developed.

The programme defines the key strategic goals and objectives.

## Goals and energy objectives

### Goals

- Reduce losses in the Company's grids.
- Take measures for energy saving and improving energy efficiency.

### Energy objectives

- Reduce electricity losses not exceeding 5% of electricity supplied to the HV/LV grids by 2024.
- Reduce excessive electricity losses to less than 4.5% of electricity supplied to the MV2/LV grids by 2024.
- Reduce technological electricity losses by a value corresponding to the available resources and dynamics of changes in the HV-MV1 grid operation mode and changes in electricity supply to the MV2-LV grids. This will result from organisational and technical measures under the Capital Investment Plan and the Electric Grid Repair and Current Operation Plan.

## Power segment continued

Since 2005 reduction of electricity losses is on the agenda. Significant results had already been achieved; in the previous period since programme was implemented, total losses reduced from 7.87% (2005) to 6.35% (2011), 6.15% (2015) and 5.77% (2020). The level of actual losses from the HV-LV grids is strongly affected by external factors such as the annual share of hydro/heat generation, overall availability of capacity from the wholesale market, and approval of HV power transmission line shutdowns for repairs.

Significant work has also been done to reduce losses in the MV2-LV distribution grids, while excessive losses decreased from 19.3% in 2005 to 7.6% in 2011 (actual) and 6.28% in 2020 (actual). The reduction of excessive electricity losses declared in this programme is achieved by technical measures under the Capital Investment Plan for 2010-2024 to improve the electricity metering systems and organisational measures to improve electricity meter reading procedures.

In 2014, a plan was developed for reducing excessive electricity losses in the MV2-LV grids in two key areas:

- Technical measures implemented under the investment programme to ensure the reliability of the electricity transmission process and the quality of electricity, which has the additional effect of loss reduction as advanced equipment is used, as well as wires and cables having cross-sections selected subject to the existing and future loads.
- Organisational measures intended to optimise the electric grid operation modes.

The implementation costs of the programme are expected to reach around USD 36 million. The expected savings of energy resources is 58 MWh from 2021 to 2024.

## Projects

### Development of data processing centers and sales of electricity for mining

Bit+ is a joint venture of En+ Group and BitRiver, operator of the largest data centre offering colocation services for bitcoin mining in Russia, mining cryptocurrencies at low cost with a low-carbon footprint. Under the partnership, En+ Group provides electricity to Bit+'s new mining operations while BitRiver runs and manages the operations.

### Digital transformation

En+ Group developed smart grids with the aim of reducing the need for standby power, increasing network capacity and reducing electricity losses. The Company implements the process of dynamic optimisation of reactive power in real time and uses calculation results to control the operating mode of generation facilities.

### Electric vehicle charging stations in Irkutsk

En+ Group has installed three pilot charging stations for electric vehicles using CHAdeMO and CCS Combo (Type 2) connectors at DC with power of 50 kW in the Irkutsk Region. In the medium term, En+ plans to install stations along motorways to Baikalsk, Khuzhir, and the Olkhonsky district. Further development of the network of 'fast' chargers in Irkutsk and the Irkutsk Region will be subject to the continued growth of the local EV market.



## Hydrogen contribution

Hydrogen can play an important role in decarbonising hard-to-abate sectors by supplying carbon neutral fuels and feedstock.

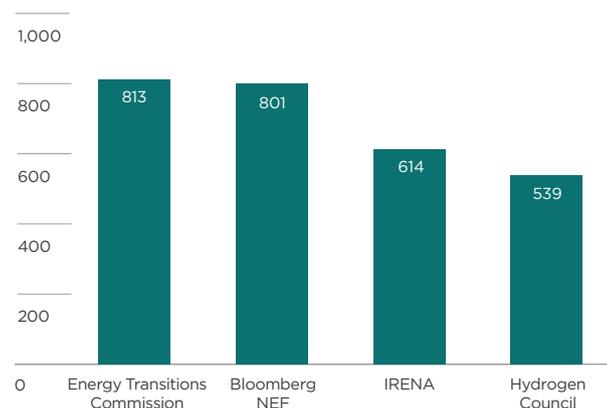
At the beginning of 2021, over 30 countries have released hydrogen development strategies and roadmaps, more than 200 hydrogen projects and ambitious investment plans have been announced, and governments worldwide have committed more than USD 70 billion in public funding. Private sector investments are also increasing.

Current demand for pure hydrogen is around 75 million tonnes. The key consuming sectors are oil refining and ammonia production. Hydrogen can be produced from fossil fuels and biomass, from water, or from a mix of both. Natural gas is currently the primary source of hydrogen production, accounting for around three quarters of the annual global dedicated hydrogen production of around 65 million tonnes.

A key feature of current hydrogen production is that it tends to be consumed at the place of production. The challenge for the coming decades is to create a fundamentally new industry and market, based on the carbon-neutral production of hydrogen, its large-scale storage and long-distance transportation using pipelines, marine tankers, railways and trucks. There is a need to promote the widespread use of clean hydrogen in the energy sector, and the transport and industry sectors – starting with steel, chemicals and large gas turbines, to individual energy sources for households, industrial consumers and the military, and in the transport sector primarily in heavy trucks and buses. There are several initiatives to apply hydrogen as a fuel in trains and ships, passenger cars and drones.

The global demand for clean hydrogen by 2050 is estimated at between 539 and 813 million tonnes, a tenfold increase compared with current levels.

### 2050 Hydrogen Demand Forecast, Mt



In line with these trends, the Group is considering various manufacturing and infrastructure solutions to develop its hydrogen projects in cooperation with international partners.

The first pilot project is the development of a concept for a hydrogen transport infrastructure for Krasnoyarsk. The project consists of the construction of small-scale green hydrogen electrolyzers using carbon neutral electricity from the Krasnoyarsk HPP, which is planned as fuel for buses. The project also includes storage, dispensers and hydrogen fuel cell buses. The Company plans to launch a feasibility study for the project in Q3 2021, to be completed by the end of 2021. In 2022, En+ Group plans to start construction of the project. The preliminary cost of equipment based on the commercial proposals is estimated at USD 2.6 million, while foreign-made buses will cost nearly USD 1.1 million each. The project is to be financed from the Company's own funds. The main aim of the project is to examine new technologies and to assess their feasibility for further implementation at other Group assets, with a view to reducing GHG emissions.

The second pilot project includes green hydrogen production up to 13 ktpa using additional electricity output from existing hydropower plants, as a result of the New Energy modernisation programme. Extra capacities are available at the Irkutsk, Bratsk and Ust-Ilimsk HPPs in the Irkutsk Region. The Company is also considering producing hydrogen using electricity from the Ondskaya HPP, in Karelia. The total capacity considered for hydrogen production is estimated at up to 228 MW, and the cost of hydrogen production is estimated at USD 2.2-3 per kg. Preliminary estimates suggest hydrogen costs, including delivery in the liquefied form, or as ammonia to be exported to South Korea, Japan and Finland are ammonia – USD 4.1-4.5 per kg, and liquefied hydrogen – USD 4.3-5.2 per kg.

The aim of the second pilot project is to test large-scale hydrogen production technologies and to define the future feasibility of hydrogen production, both to apply green hydrogen in technological processes as a substitute for fossil fuels, and for further development as a new business opportunity creating additional value for shareholders.

In parallel, En+ Group is also developing opportunities of giga-scale green hydrogen production using electricity from captive new-build renewable projects (hydro and wind) both in Siberia and in the Far East. For example, En+ is analysing the construction of 1 GW Motyginskaya HPP on the River Angara solely for hydrogen production. The early CAPEX estimate for the project is USD 1.3 billion, with a nine-year construction timeframe and electricity price of USD 42.4 per MWh.

**Power segment** continued

Future hydrogen output is estimated at 115.6 ktpa, with an indicative hydrogen price of USD 2.9 per kg; the price of ammonia being USD 4.9 per kg; and the liquefied hydrogen at USD 4.4 per kg, incl. delivery.

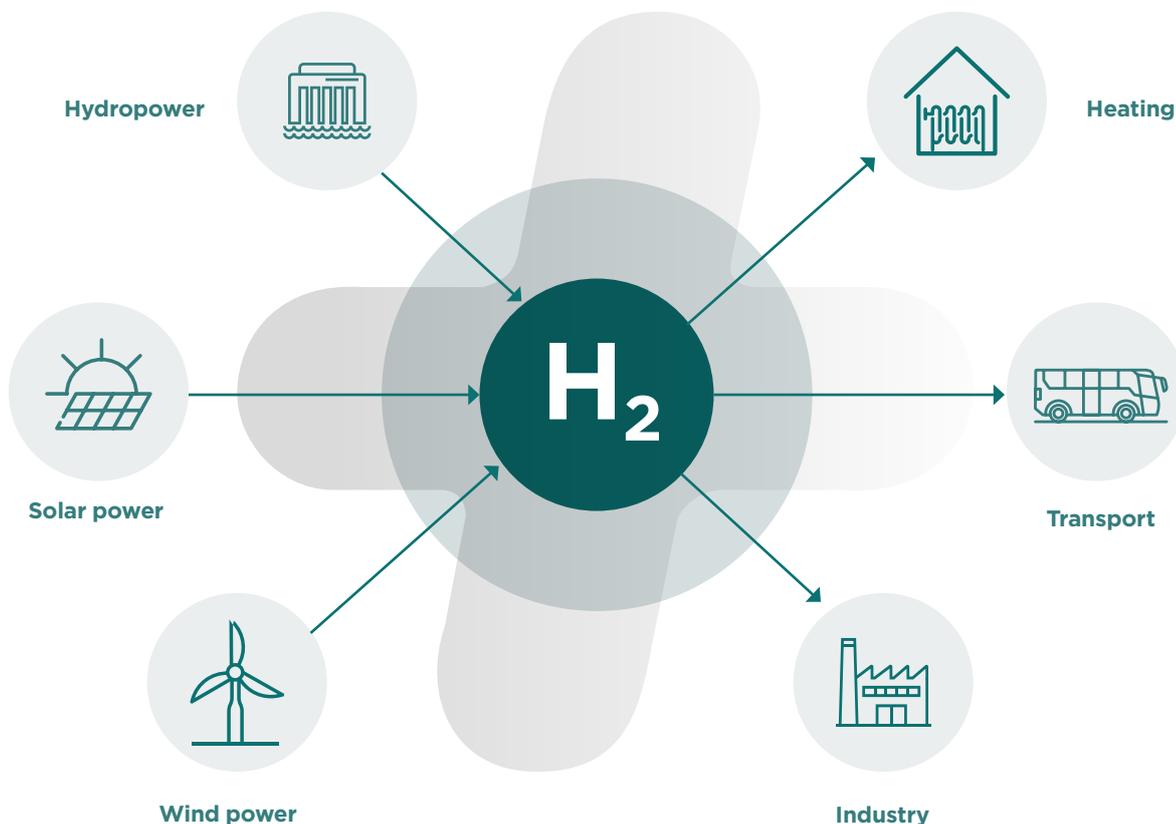
Additionally, since storage and transportation are key issues for developing the hydrogen industry, En+ Group, together with an already approved tank-container manufacturing partner, intends to develop aluminium tank-containers (43.5 m<sup>3</sup> loading space) for road, rail and sea transportation of liquefied hydrogen. The primary purpose of the development of aluminium tank-containers is to create cost-effective means of long-term storage and long-haul transportation of liquefied hydrogen. The key advantages of an aluminium tank-container are lower weight of the internal vessel by 15% in comparison with a stainless steel vessel, larger useful volume of the tank (~3.5 m<sup>3</sup> larger than analogues) and longer lifetime (10 years more than stainless steel analogues). The required period of storage of liquefied hydrogen in aluminium tank-containers is up to 60 days, with minimum product loss due to bleeding. En+ expects that the demand for the containers will reach at least 13.4 thousand and may even reach as many as 47 thousand by 2035. Pilot production is scheduled to begin in 2024.

Based on the results of pilot projects, we will consider the feasibility of green hydrogen as a substitute for fossil fuels in technological processes along the whole value chain of primary aluminium production.

Another step under consideration is the burning of green hydrogen produced by electricity from renewables to achieve the high temperatures needed for alumina refining. Currently the alumina refining process uses medium- and high-temperature steam.

Hydrogen boilers can be used to provide medium temperature steam for the digestion phase of alumina refining, which accounts for about 65% of the energy needed for refining. Hydrogen furnaces can also reach the high temperatures needed for the calcination phase of alumina refining.

Preliminary assessments show that as a result of this, decarbonisation of aluminium could result in a drop in GHG emissions of 2.4 t of CO<sub>2</sub>e per t of aluminium, or of 22% on the industry average.



# Worldwide initiatives – Jamaica and Ireland

**Alumina refineries are key for our Climate Action Plan to reduce GHG emission and set science-based targets for each business unit. We involve and encourage our teams, from workers to top managers, to engage and share knowledge. The real involvement of our staff in climate action is important.**

Our climate project pipeline includes energy and resource efficiency measures; we assess how, in an economically sustainable way, to move to clean energy resources for power, produced separately from steam for loading operations and for general needs. Natural gas and biofuel can be considered as mitigation options, where heavy fuel oil (HFO) and coal are present. We are looking for new opportunities and paying close attention to carbon capture and storage technologies, among which calcium-carbonate technologies look the most promising.

## Winalco

Winalco is looking at projects to both lower GHG footprint and reduce cost per tonne for operations. Projects such as changing the fuel source from HFO to liquid natural gas (LNG) are under assessment.

Winalco has also looked at measures to reduce the GHG footprint of its ancillary facilities. The lighting of the pier at Port Esquivel is now fully solar powered and plans are currently in progress to have the entire port solar powered. At Ewarton, plans are in place to have areas of the plant solar powered where possible, including partial or complete conversion of the plant site lighting to solar power, and partial conversion to solar power of those facilities that are not directly related to production, but are located on the plant territory.



## Aughinish

A low-carbon future including energy efficiency improvements has and continues to be a key strategic goal of Aughinish Alumina. Aughinish's journey of decarbonisation stretches back to the early 2000s when the Combined Heat and Power (CHP) project was initially approved. With the installation completed in 2006, this resulted in the generation of approximately 300 tph of the refinery's steam demand from natural gas and the installation of 160 MW of power generation. This high-efficiency CHP plant with the low levels of CO<sub>2</sub> emitted from the generation of power is second only to renewable generation in Ireland.

In 2012, the refinery converted calcination to natural gas, and in 2014 with the installation of two new gas boilers, completed the change over from heavy fuel oil (HFO) to 100% natural gas. Over this time period, Aughinish has reduced CO<sub>2</sub> emissions per tonne of alumina by 40%, with a 90% reduction in NO<sub>2</sub> and 100% reduction in SO<sub>2</sub>.

Our low-carbon journey means that Aughinish Alumina is now the world's leading low-carbon high-temperature refinery at 0.516 t CO<sub>2</sub>e/t AlO<sub>2</sub>O<sub>3</sub><sup>1</sup>, and, with RUSAL's ALLOW aluminium made from renewable hydropower, it has one of the lowest carbon footprints in the industry.

Decarbonisation continues to be a key strategic goal of Aughinish Alumina and our objectives are in line with the Irish National Climate Action plan, which is looking to achieve a reduction in CO<sub>2</sub> of 51% by 2030.

Aughinish is one of the most energy efficient refineries in the world through continuous improvement and this remains our focus in the years ahead with a plan to reduce carbon emissions by approx. 85,000 t over the next 5 years (2021-2025). The central component of this plan is to reduce heat loss and increase heat recovery in order to reduce our fuel consumption. Specific projects in that plan include the installation of insulation on high temperature liquor and slurry lines, additional heater re-tubes, and the recovery of low grade steam into useable heat.

Apart from efficiency improvements, Aughinish alumina actively focuses on fuel switching, which involve renewable energy boilers of different sizes. Installation of a renewable energy electric boiler (25 MW), which will further reduce Aughinish's carbon footprint has been recognised by EU by giving preliminary approval for grant funding from EU Innovation Fund.

<sup>1</sup> In consistency with the European Union Emissions Trading System (EU ETS).

# Recycling

**There is no way of achieving carbon neutrality objectives without more use of recycling. The recycling of aluminium metal involves the collection, treatment, and processing of both pre- and post-consumer scrap. The use of post-consumer scrap brings the opportunity to significantly reduce the embedded emissions of the product as post-consumer scrap can be considered to have a zero-carbon footprint in terms of its use as an input material in a new process.**

## Global context

- Growth in secondary aluminium consumption in the next decade is expected to outpace primary aluminium (4%pa vs 1%pa growth).
- Share of recycling in overall global aluminium consumption is set to increase from 30% in 2020 to 36% by 2030.
- In absolute terms, secondary aluminium production is set to grow from 26 mt in 2020 to 41 mt in 2030.
- In the EU, the aluminium recycling rate of the automotive sector is among the highest compared to other materials, at over 90 percent.<sup>1</sup>

China has been ahead of the rest of the world in deciding that aluminium scrap is a 'recyclable resource' but as the rest of the world follows, the result is likely to be increased competition for material. China's import of aluminium scrap is widely expected to bounce back this year thanks to new customs rules and higher prices to incentivise aluminium scrap generation and collection.<sup>2</sup> According to the International Aluminium Institute, about 70% of the aluminium ever produced is still in use.

The trend to increase recovery and reuse is clear. Use of process scrap has always been a common practice across our smelters. En+ is also developing post-consumer scrap capacities. Post-consumer scrap will become the fastest growing contributor to the aluminium fabrication cycle, as end users and consumers demand higher recycled content, even in primary alloys.

The trend for increased recycled content is driven by the circular economy and is currently led by automotive producers and OEMs, who are demanding higher recycled content across their entire supply chain, as part of their sustainability programmes and drive for lower carbon footprints. Other sectors, notably packaging/beverage and the building sectors, are also increasing their commitment to recycled content, with some significant improvements planned well before 2030. The majority of the incremental metal requirements for the production of aluminium products needed to meet demand by 2030 and subsequently 2050 will have to come from aluminium scrap.

En+ is positioning to the increased demand for recycled content by introducing scrap recycling programmes in two smelters, KUBAL in Sweden and Volgograd in Russia by 2025. The KUBAL smelter is currently using scrap as a complementary source of metal to its primary aluminium production.

Other smelting sites are under consideration as well. Selective opportunities for post-consumer scrap recycling with foundry alloy consumers may also be possible via the Rheinfelden operations site, where high-end foundry alloys are produced.

<sup>1</sup> European Aluminium(2021), Circular aluminium action plan, [www.european-aluminium.eu/media/2929/2020-05-13-european-aluminium\\_circular-aluminium-action-plan.pdf](http://www.european-aluminium.eu/media/2929/2020-05-13-european-aluminium_circular-aluminium-action-plan.pdf).

<sup>2</sup> Andy Home (February 2021), Scrap gap drives China's copper and aluminium import boom, [www.reuters.com/article/us-china-scrap-ahomeidUSKBN2A9294](http://www.reuters.com/article/us-china-scrap-ahomeidUSKBN2A9294).

### Promotion of recycling in Russian market

One of our priorities is the expansion of the portfolio by adding secondary alloys products. We aim to increase own annual secondary production up to 250,000 tonnes by 2030.

During a pilot project being launched at VgAZ in 2020, some trial consignments of billets were produced from scraps supplied by our clients who are extrusion producers. Now, large-scale renovation is being started at VgAZ, to increase secondary billet production up to 5,500 tonnes.

We also plan to start similar projects at other smelters, beginning with Novokuznetsk AZ, which is specialised at producing foundry alloys.

There is also potential within the recycling development programme to create new production sites entirely aimed at producing secondary aluminium.

Cooperation with the existing domestic aluminium recycling industry is very important for the Company's recycling system development. At present there are over 100 recycling companies in the domestic market, processing aluminium scrap and producing secondary alloys both for export and home production. The total volume of this market reaches up to 500,000 tonnes a year.

To invite these companies to participate in the sustainable development of the Russian aluminium industry, RUSAL initiated the creation of the Recycling and Sustainability sector within the Aluminium Association. The main aims of the sector are increasing transparency and quality in aluminium scrap collecting and the recycling industry, prevention of unfair competition, increasing efficiency of the industry and quality of secondary production.

Another important aspect of recycling activities by the Company is the promotion of the separate collection of waste.

RUSAL, together with the Aluminium Association, has elaborated and represented the position of the aluminium industry concerning EPR (Extended Producer Responsibility) requirements. We have also increased cooperation with aluminium canned drinks producers and reverse vending machines (Pfandautomat) operators. During 2021, RUSAL has participated in a joint project placing reverse vending machines in retail chain stores together with Ecoplatform and 'Legends of Baikal', a soft drinks producer. This direction also includes pilot projects in the separate collection of waste at metro stations.



# Shipping

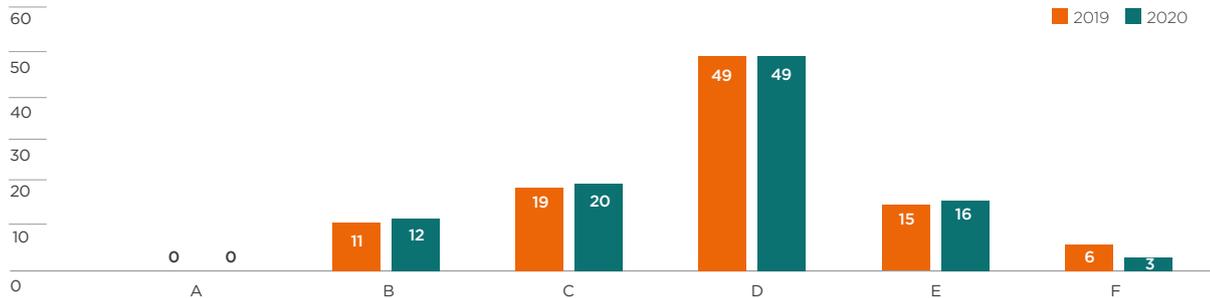
## The International Maritime Organization (IMO) aims to halve GHG emissions by 2050 and has a vision to decarbonise shipping as soon as possible within this century.

This initial IMO GHG strategy, which has been widely criticised as not aligned with the net zero agenda, is planned to be revised in 2023. The IMO is following a two-tier approach to implementing decarbonisation measures, focusing first on a limited set of short-term measures to reduce CO<sub>2</sub> emissions across international shipping by at least 40% by 2030, before embarking on more comprehensive medium- and long-term measures to reduce total annual GHG emissions by at least 50% by 2050, compared with 2008.

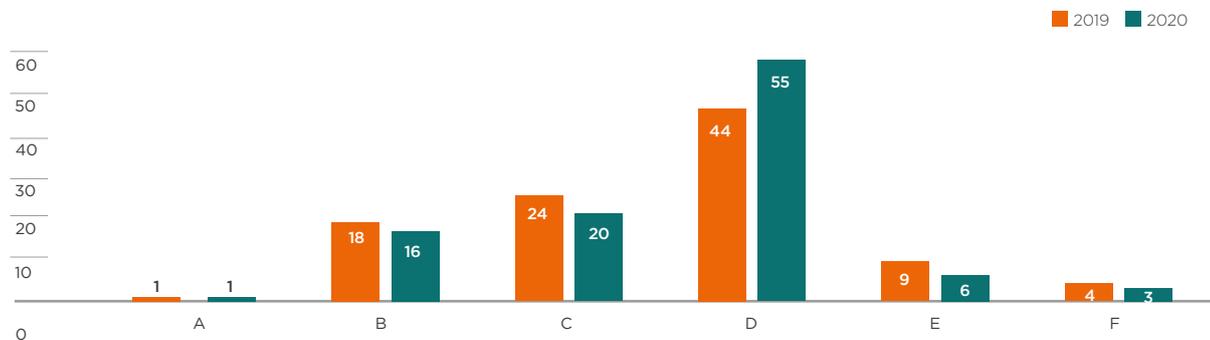
This involves a mandatory carbon intensity indicator Annual Efficiency Ratio (AER) of grams of CO<sub>2</sub> emitted per dwt per nautical mile, which is being introduced along with a rating scheme where all merchant and cruise ships above 5,000 Gross Tonnage (GT) are given a rating of A to E every year.

RUSAL strives to ensure that at least 80% of its raw material freight portfolio consists of bulk carriers compliant with a rating score of D or higher. The focus is on energy efficient bulk carriers emitting fewer grams of CO<sub>2</sub> per ton per nautical mile travelled in order to secure a noticeable reduction of a ship's annual fuel consumption in 2020, while still managing the same amount of freighted tonnes. This also enables a reduced carbon footprint associated with the shipping of our bauxites to an average of 4.6 grams of CO<sub>2</sub>e per dwt per nautical mile (5.3 grams of CO<sub>2</sub>e in 2019).

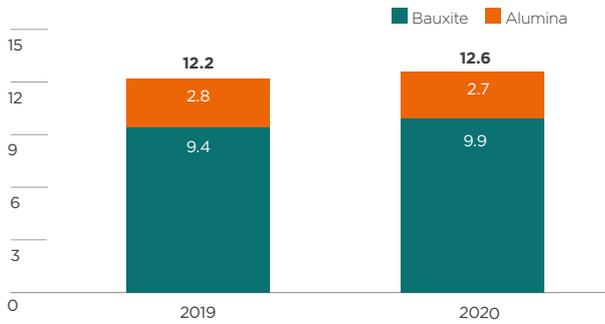
RUSAL GHG Rating Performance Bauxite, %



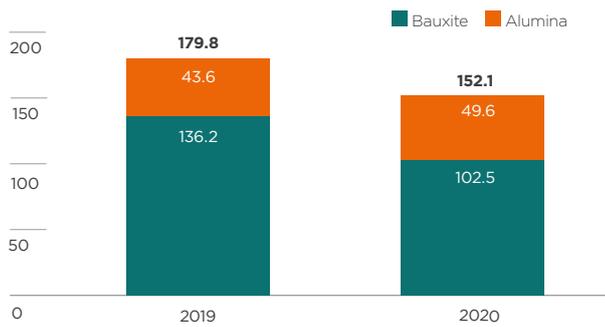
RUSAL GHG Rating Performance Alumina, %



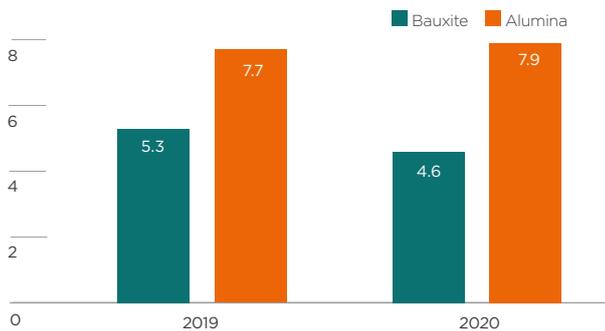
**RUSAL Raw Material Seabourne Trade, mt**



**RUSAL Ships Fuel Oil Consumption, tt**



**Average of Gram CO<sub>2</sub> per ton nautical mile**



### Wind Wings Technologies

Looking ahead, we have been working with our shipping partners Cargill Ocean Transportation to investigate the potential impact of wind propulsion on a Kamsarmax bulk carrier, through the use of rigid wing sails. Initial modelling results of the potential reduction in fuel consumption and so emission, look promising. We are monitoring closely the pilot project Cargill are engaged in with the help of EU Horizon 2020 funding, which looks to have 2 full size foldable wing sails retrofitted on a Kamsarmax during 2022. Once this pilot is on the water, we will look to work with Cargill to trial this technology on round voyages carrying bauxite from Kamsar to Auginish and then a ballast back.



# Nature-based solutions – compensation and neutralisation

**Nature-based solutions involve protecting, restoring and sustainably managing ecosystems, using the tools that nature provides to address issues resulting from climate change. En+ Group is investing in nature as part of the Group’s climate strategy. We work on GHG emissions reduction projects, while improving the lives of local communities and protecting biodiversity.**

## The timeline

2018

### January–December

Throughout 2018, En+ Group, together with the Russian Federal Forestry Agency (Rosleskhoz) and regional forestry ministries began developing a plan for the reforestation of two regions of operation (Krasnoyarsk Territory and Irkutsk Region), and for the provision of fire protection in the Krasnoyarsk Territory.

### September

In September 2018, the following activities were identified as pilot projects:

- Reforestation in the Krasnoyarsk Territory and Irkutsk Region.
- Aerial fire protection in the territory of the Nizhne-Yenisei Forestry.

2019

### March

On 30 March 2019, at the Krasnoyarsk Economic Forum, a trilateral Agreement was signed (by Rosleskhoz, the Government of the Krasnoyarsk Territory and RUSAL) on the implementation of voluntary projects focused on GHG absorption and neutralisation in the Krasnoyarsk Territory.

For the reforestation project, an agreement was concluded with the KGBU ‘Dzerzhinskoye lesnichestvo’ to plant 500,000 Scots pine trees over 120 hectares of the Dzerzhinskoye forestry of the Krasnoyarsk Territory.

For the aerial protection project, KGAU ‘Forest Fire Center’ was contracted. For the 2019-2020 forest fire season, air patrols and firefighting were organised on the territory of 505 thousand hectares of the Lower-Yeniseysky forestry in the Krasnoyarsk Territory.

### June

On 6 June 2019, at the St Petersburg International Economic Forum, a similar tripartite agreement was signed (by Rosleskhoz, the Government of the Irkutsk Region and RUSAL) on the implementation of voluntary projects focused on GHG absorption in the Irkutsk Region. Following the signing, an agreement was concluded with the OGAU ‘Leskhoz of the Irkutsk region’ to plant 500,000 Scots pine trees over 125 hectares in the Kirovsky forestry of the Irkutsk Region.

Since 2019 both projects are ongoing, and calculations of absorption are carried out annually.

## Reforestation

The initial purpose of the pilot project was the reforestation of an area of 250 hectares through the planting of one million trees, with a density of 4,000 pcs/ha in the Krasnoyarsk Territory and Irkutsk Region.

A methodology was developed to determine GHG absorption levels of the reforested area, and these results are reflected in the 'National Inventory of Anthropogenic Emissions from Sources and Absorptions of GHGs not Regulated by The Montreal Protocol'<sup>1</sup> (hereinafter – the National Inventory).

At the time of publication, our support has helped to plant over 1.1 million trees since 2019 – 500,000 in the Krasnoyarsk region and 500,000 in the Irkutsk Region in 2019, and an additional 112,000 trees in the Irkutsk Region in 2020.

In 2019 and 2020, supplementary planting was completed, to compensate for the trees that did not survive, and agrotechnical maintenance of the areas was carried out.

Additional maintenance is planned for 2021.

## Aerial firefighting

A set of services to protect forests from fires on an area of at least 500,000 ha on the territory of the Lower-Yenisei Forestry are in place.

Some 505,000 hectares of reserve forest in the Krasnoyarsk Territory has been placed under aerial protection by the Group (i.e. patrolling and extinguishing of fires). The programme includes obtaining existing technology, and the purchase and provision of fire-fighting equipment and paratrooper equipment, as well as the provision of additional staff and training.

Reserve forests are forests that are not used for any economic activity, and are not currently protected. The establishment of forest protection for such forests will shift their status from 'reserve' to 'managed'. This allows the volume of CO<sub>2</sub> absorption to be reflected in the National Inventory. Conservative estimates suggest that the absorption of CO<sub>2</sub> for the area is 0.8-1.0 t CO<sub>2</sub>/ha per annum.

The aerial firefighting protection programme continues within the territory.

## Absorption calculations

### Reflection of the results in the national inventory

Over 440,000 tonnes of CO<sub>2</sub> are annually compensated by the pilot projects, starting from 2019. The Yu. A. Israel Institute of Global Climate and Ecology was engaged to calculate carbon removals. Calculations and results were verified by TÜV Austria, an international independent auditor. Results of the project for 2019 were recorded in the Russian National Report on GHG Emissions and in the Absorption Inventory.

Calculations on GHG absorptions will be carried out annually, to assess the climate benefits of the forestry projects.



## Biodiversity

Topics of climate change and biodiversity are closely interconnected. Sustainable management of biodiversity is critical in addressing climate change.

 To find information about our biodiversity projects and initiatives, please refer to [www.enplusgroup.com/upload/iblock/159/EN\\_Group\\_SR2020.pdf](http://www.enplusgroup.com/upload/iblock/159/EN_Group_SR2020.pdf)

<sup>1</sup> United Nations (September, 1987) Montreal Protocol on Substances that Deplete the Ozone Layer (with annex), <https://treaties.un.org/doc/publication/unts/volume%201522/volume-1522-i-26369-english.pdf>.

# Task Force on Climate-related Financial Disclosures (TCFD)

**The TCFD recommendations of the climate risk analysis conducted for the Metals and Power segments, including transition and physical risks, were implemented for the Group’s consolidated operations in accordance with the TCFD recommendations.**

For more information about the Group’s businesses, see our **Annual report 2020**.

## Governance

The Group’s climate risk corporate governance system outlines the relationship between the Group’s shareholders, the Board, the CEO and the management team, as well as the competencies and duties of the Board committees in relation to managing the global climate change agenda.

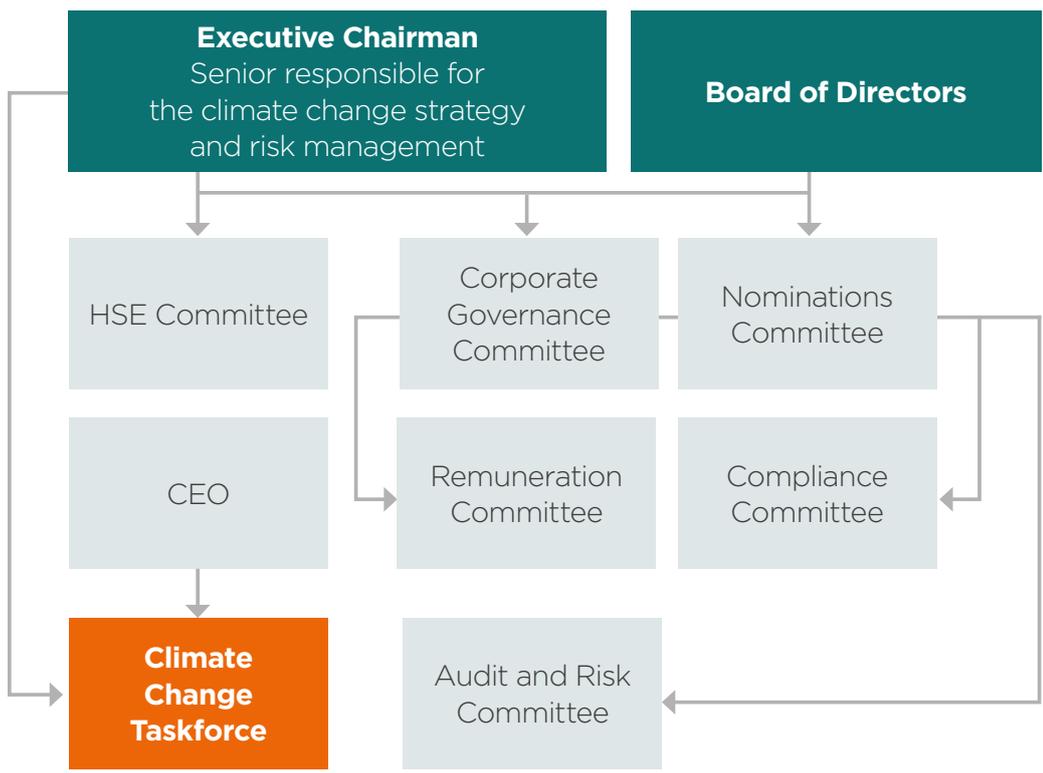
When making strategic decisions concerning climate change, the Group is guided by its environmental policy, whose main objective is the continual reduction of environmental and climate impacts, as well as mitigation and management of related risks, with a view to preventing global temperature rises above 1.5°C.

The Board of Directors possesses strong capacity and competence to respond to climate-related risks and opportunities effectively. The Board oversees the implementation of all ESG-related corporate policies, monitors the attainment of the Company’s environmental protection and climate goals, performs annual analysis of the progress towards climate change goals and the implementation of activities related to climate change, and makes decisions to revisit the targets and implement new activities that will be included in the business plans.

On the subject of climate change, the Board is mainly assisted by the Health, Safety and Environment Committee (HSE Committee). In 2020-2021, the Board and HSE Committee discussed climate-related issues in 18 out of 43 meetings. The main issues related to climate change, which were addressed by the HSE Committee, are as follows:

- Health, safety and environment KPIs
- Environmental risk management
- Results of the environmental audits
- Introduction of the UN Global Compact Business Ambition for 1.5°C initiative
- UN Global Compact’s SDG Ambition Accelerator

## Climate risk governance structure



Should any obstacles or important matters related to climate change arise that require a decision by the Board of Directors, meetings may be held dedicated specifically to the particular climate issue, in order to make an immediate decision such as potential acquisitions and divestitures entailing consideration of climate-related risks.

To manage our pathway to net zero, we have created the En+ Climate Change Taskforce to drive our transformation. The Taskforce is headed by the Chief Operating Officer and reports directly to the Executive Chairman. Each of the transformational verticals is led by a senior executive from our management team. The Taskforce works in continuous collaboration across multiple lines of business. The key objective of the Taskforce is to develop an integrated climate strategy that will enable us to achieve our ambitious net zero GHG emissions goal by assessing climate change risks and opportunities. The Group cooperates with branch managers to stay up to date with the most recent information on risks and opportunities in all regions of operations.

## Strategy

### Risk assessment

The Group has been involved in climate risk assessment for many years. We are working on the development of a climate risk register covering the Group's assets. Climate-associated risks and factors have been identified, analysed and evaluated to make strategic decisions related to global climate change. We define climatic factors as meteorological conditions that can affect manufacturing facilities and business in general (for example, abnormal rainfall and floods or annual temperature increases). Climate risk is the aggregate measure of the probability of climate hazards and their

impact on assets, expressed in terms of recurrence of trends and damage. The expected changes of climate risks were analysed in the context of En+ Group assets. Annual average temperature growth for En+ Group assets until 2050 was analysed according to climate scenarios SSP1-2.6, SSP2-4.5, and SSP5-8.5. Air temperature is expected to rise by 0.03-0.06°C per year at the majority of facilities (at some facilities, some models show a more significant increase, up to 0.1°C per year). The recurrence of days with high air temperature in summer and a decrease in abnormally frosty days in winter are also expected with a greater coincidence of models noted for the summer period.

### Time horizons

En+ Group has identified climate-related risks and opportunities in the short, medium, and long terms. The short term is defined as 0-1 year. The short-term horizon is used to set immediate decarbonisation objectives. The medium term is defined as 2-3 years. The medium-term horizon is used to set objectives which require more than a year for implementation. The long term is defined as up to 10 years. This is a period with a higher uncertainty, during which activities and projects are planned with a high margin of resistance to variable factors.

### Risks and opportunities

#### Physical

The physical risk register lists physical risks that may potentially undermine the Group's operations and supply chain. The register will be updated on a regular basis for both segments. Among the physical risk factors, we consider the probability of severe events (acute risks) such as precipitation and flooding anomalies, abnormal heat and abnormal cold; as well as the chronic risks relevant to the Group's activities, such as average annual temperature increase and precipitation.



## Task Force on Climate-related Financial Disclosure (TCFD) continued

## Metals segment

Sub-category of risks	Risk factor	Risk description	Impact area
Policy and legal	Carbon pricing at the national level and establishment of a regional GHG inventory	Expenses related to the purchase of offset mechanisms  Subject to regulation, mandatory reporting of organisations with emissions of more than 150,000 tons of CO <sub>2</sub> /year - from 1 January 2023	Applicable to bauxite and alumina producers in the CIS, and primary aluminium and silicon producers
	The carbon price is formed within Sakhalin and Kaliningrad, with possible implementation throughout the Russian Federation		
	Introduction of Carbon Border Adjustment Mechanism (CBAM)	Additional carbon pricing burden (unwrought aluminium; aluminium powders and flakes; bars, rods and profiles; wire; plates, sheets, strip, wire of a thickness exceeding 0.2 mm; foil; tubes and pipes; tube or pipe fittings)	Applicable to primary aluminium production (unwrought aluminium) and downstream
Market	Achievement of industry standards for GHG emissions by competitors	Reduced product margins and competitiveness due to high carbon footprint	Applicable to primary aluminium and downstream production only
Technological	High carbon intensity of production processes	Capital expenditure for transition to: - Low-emission energy sources - Energy-efficient and energy-saving solutions - Fuel with a low emission coefficient	Applicable to bauxite and alumina producers
		Capital expenditures on the gradual transition to energy-efficient and energy-saving solutions in production processes	Applicable to downstream, silicon producers and primary aluminium producers
Reputational	Negative perception of the Company by investors, independent shareholders, local communities	A reduction in investment in this sector by financial institutions and the state due to a lack of Company climate policy	Applicable to bauxite and alumina producers
		Low investment appeal of the Company	Applicable to downstream only
		Low investment attractiveness due to the introduction of new 'green' markers on the London Metals Exchange	Applicable to primary aluminium producers

<b>Sub-category of opportunity</b>	<b>Opportunity description</b>	<b>Area</b>
<b>Policy and legal</b>	Company's regular annual reporting on GHG emissions to stakeholders Continuous monitoring of GHG emissions reduction targets Adoption of the methodology to calculate GHG emissions and the carbon footprint of products	Applicable to bauxite producers in the CIS, Africa, Jamaica; alumina producers in the CIS, Africa, Jamaica; silicon producers in Russia; primary aluminium producers in Russia and Sweden, downstream companies
	Introduction of the carbon price criterion to assess the strategic areas of product manufacturing and sales at the national and corporate levels	Applicable to bauxite producers in the CIS; alumina producers in the CIS; primary aluminium producers in Russia and Sweden; silicon producers in Russia
<b>Technological</b>	Use of energy efficient equipment in the process chain and best available technologies (BAT)	Applicable to bauxite producers in the CIS
	Decarbonisation of processes	Applicable to bauxite producers in Africa and Jamaica; alumina producers in the CIS, Africa, Jamaica
	Increasing investment attractiveness through low-carbon products	Applicable to silicon producers in Russia; downstream companies
	Use of more efficient production and distribution processes	Applicable to silicon producers in Russia
	Increasing investment in the production of inert anodes as well as high-ampere production	Applicable to primary aluminium producers in Russia and Sweden
	Reduction of capital costs for new construction or renovation by reducing the cost of money through green funding or a taxonomy linked to the Group's low-carbon products	Applicable to En+ Group
<b>Market</b>	Increased demand for materials used in the transition to a decarbonised energy system (expansion of polycrystalline silicon production used in PV panels)	Applicable to silicon producers in Russia
	Increased demand for the Company's products by promoting a low-carbon product line (ALLOW aluminium) against the backdrop of tighter international carbon regulations (e.g. introduction of carbon border adjustment)	Applicable to primary aluminium producers
	New market access	
<b>Reputational</b>	Investments in climate projects, according to the criteria for designating projects as climate projects	Applicable to bauxite and alumina producers in the CIS, Africa, Jamaica
	Increased demand for materials used in the transition to a decarbonised power system (aluminium used in the production of PV panels and components of wind generators)	Applicable to primary aluminium producers

**Task Force on Climate-related Financial Disclosure (TCFD)** continued**Power segment**

<b>Sub-category of risks</b>	<b>Risk factor</b>	<b>Risk description</b>	<b>Impact area</b>
<b>Policy and legal</b>	Carbon pricing at the national level and establishment of a regional GHG inventory.	Expenses related to the purchase of offset mechanisms	Applicable to coal power plant and coal mining companies
	The carbon price is formed within Sakhalin and Kaliningrad, with possible implementation throughout the Russian Federation	Subject to regulation, mandatory reporting of organisations with emissions of more than 150,000 tons of CO <sub>2</sub> /year – from 1 January 2023	
	Approval of a national plan of action for adaptation to climate change	Costs of organising adaptation measures and minimising the impact of global climate change	Applicable to hydropower producers
	Introduction of Carbon Border Adjustment Mechanism (CBAM)	Additional carbon pricing burden	Applicable to coal mining companies
	Introduction of Carbon Border Adjustment Mechanism (CBAM)	Reduced demand for electricity	Applicable to coal power plants, gas-fired power plants and hydropower generation
	GHG emissions from reservoirs estimation	Increase in carbon intensity of energy production due to detected methane emissions from reservoirs (International Hydropower Association), and as a result, the cost of reducing the identified GHG emissions	Applicable to hydropower generation
<b>Market</b>	Decline in demand for coal generation	Reduced product margins and competitiveness	Applicable to coal power plants
	Coal industry divestments	Reduced demand for coal products due to the transition to low-carbon economic development	Applicable to coal mining companies
<b>Technological</b>	Investment capping for hydrogeneration	No investment, or reduced investment bound to ESG metrics, as well as non-compliance with the definition of renewable energy generation	Applicable to hydropower producers
	High carbon intensity of production processes	Capital expenditures on the gradual transition to energy-efficient and energy-saving solutions in production processes	Applicable to coal power plants, gas-fired power plants, and coal mining companies
	Replacement of switching equipment	Increase in the carbon intensity of production due to the use of gas-efficient switching equipment	Applicable to electric grid company only
	Implementation of the New Energy programme	Failure to achieve the declared efficiency of the hydraulic wheel	Applicable to hydropower producers
<b>Reputational</b>	Negative perception of the Company by investors and independent shareholders	Low investment appeal of the Company and reduced investment in the coal industry	Applicable to coal power plants, gas-fired power plants, and coal mining companies

<b>Sub-category of opportunity</b>	<b>Opportunity description</b>	<b>Area</b>
<b>Policy and legal</b>	Increasing investment attractiveness through publication of reports with low-carbon electricity suppliers	Applicable to electric grid company
	Increasing investment attractiveness through publication of reports of a low-carbon footprint	Applicable to hydropower producers
	Introduction of the carbon price criterion to assess the strategic direction of product manufacturing and sales at the national and corporate levels	Applicable to coal mining companies, coal power plants
	Company's regular annual reporting of GHG emissions to stakeholders Continuous monitoring of GHG emissions reduction targets Adoption of the methodology to calculate GHG emissions and the carbon footprint of products	Applicable to coal mining plants, gas-fired power plants, coal power plants
	Regulatory Impacts for coal industry policy directions: - Bank lending - Licensing regulations - Regulation of the use of coal in the domestic market - Development of transport infrastructure - Attracting investment from domestic and external coal consumers	Applicable to coal power plants
<b>Technology</b>	Increasing investment in the production of low-carbon generation, CCUS technologies	Applicable to coal mining plants, gas-fired power plants, coal power plants
<b>Market</b>	Implementation of climate projects for the construction of small hydropower stations	Applicable to hydropower producers
	Increased demand for less carbon-intensive gas generation and, as a result, increased product competitiveness	Applicable to gas-fired power plants

**Task Force on Climate-related Financial Disclosure (TCFD) continued**

**Risk management**

Risk assessment is an ongoing process involving the entire organisation and is implemented by staff at all levels of the Company. Managers at all levels are responsible for the timely identification and assessment of risks, development of risk management activities and communication of risks to all of the Company’s stakeholders within their area of responsibility, and also for ensuring that identified risks are included in risk maps for the Group’s divisions and in the Group’s corporate risk map in a timely and complete manner.

En+ Group appreciates the necessity to integrate the climate-related risks identification, assessment and management processes into the Company’s risk management process. The HSE Committee currently oversees climate-related risks and reports them to the Board of Directors to enable the Board to address the risks.

**Metrics and targets**

The GHG emissions calculations were implemented in compliance with the GHG Protocol. The GHG emissions calculation for the Metals segment is certified by independent authority TÜV Rheinland as part of the audit and GHG verification process.

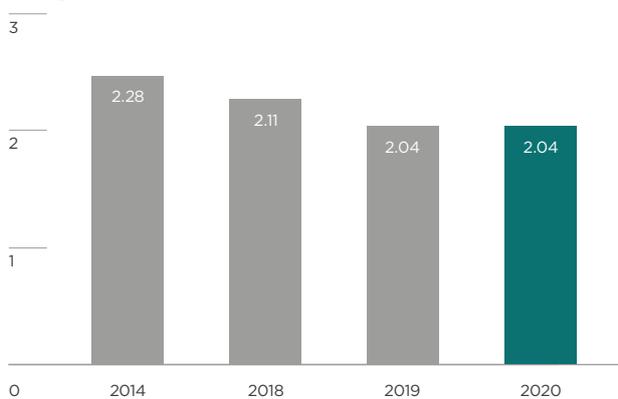
In 2018 and 2019 we reduced our direct GHG emissions intensity to 2.11 and 2.04 tonnes of CO<sub>2</sub>e per tonne of aluminium from electrolysis (Scope 1 here includes only electrolysis). In 2020, the intensity of GHG emissions from electrolysis operations was 2.04 t CO<sub>2</sub>e/t Al – an 11% decrease compared to the 2014 baseline.

 For more information about our climate change targets, please see **Our Strategic Approach p.14**

**Direct (Scope 1) and indirect (Scope 2) greenhouse gas emissions of En+ Group, mt CO<sub>2</sub>e<sup>1</sup>**



**Intensity of GHG emissions from electrolysis operations, t CO<sub>2</sub>e/t Al**



<sup>1</sup> Direct and indirect greenhouse emissions for the Metals segment do not include emissions from downstream entities, which amounted to 148.3 kt CO<sub>2</sub>e in 2020.

# Partnerships and Cooperation supporting our net zero journey

## Customers and industry associations

**We proactively build partnerships to deepen the decarbonisation of the value chain, to expand access to low-carbon aluminium, and to promote deployment of low-carbon solutions and technologies.**

### Our 2021 highlights:

2021

#### January

In January, RUSAL partnered with Henan Mingtai Aluminum, the large Chinese aluminium processing enterprise, to deliver low-carbon aluminium products to customers in response to growing market demand.

#### February

In February, RUSAL was named the preferred global supplier of high-quality primary foundry alloys under its ALLOW brand for Kosei to supply wheel and auto components with a guaranteed low-carbon footprint worldwide.

In February, RUSAL partnered with Hodaka, the innovative producer of high-quality aluminium alloys, to deliver aluminium products with a low-carbon footprint for a number of downstream applications.

#### July

In July, RUSAL and the Ball Corporation announced a partnership to test ultra low-carbon aluminium produced with inert anode technology for aerosols and other containers, substantially reducing the carbon footprint of slugs, cans, and bottles.

## Advocacy

Recognising that global change cannot come from one actor alone, En+ Group seeks to unite the industry and encourages like-minded peers to advocate for market change towards a green economy.

### UN Global Compact (UNGC)

The UNGC is the world's largest corporate sustainability initiative, with the aim of supporting the UN Sustainable Development Goals and a sustainable future for our planet. The UN Global Compact catalyses change, providing member companies with advice on best practices, resources and networking opportunities.

In 2021, En+ Group became one of the global partners of the Climate Ambition Accelerator, one of the four programmes carried out by the UNGC to accelerate corporate commitment to the Global Goals.

### World Business Council on Sustainable Development (WBCSD)

The WBCSD is the leading voice of corporate sustainability, a global, CEO-led organisation of over 200 leading businesses working together to accelerate the transition to a sustainable world. En+ Group joined WBCSD in the spring of 2021.

WBCSD builds impactful coalitions and networks that facilitate the sharing of knowledge, enable and accelerate the adoption of standards and tools, and create advocacy inputs for common policy asks. These, in turn, allow members to accelerate the transformation of major economic systems, in line with the SDGs and the Paris Agreement.

### Business 20 (B20)

En+ Group and RUSAL are among companies preparing policy recommendations on climate change, carbon pricing, sustainable development and the green energy transition through B20 for the leaders of the Group of Twenty (G20), an international forum for 19 leading world economies and the European Union.

In 2021, En+ Group and RUSAL participated in the B20 working group Energy & Resource Efficiency Task Force. The suggestions, such as 'using materials with a high degree of recycling without losing their original qualities, as well as goods with a low-carbon footprint' were included in the final document of the Task Force. The Task Force also incorporated proposals such as 'cross-country trade of internationally transferred mitigation outcomes (ITMOs) and other offsetting certificates that countries can account against their NDCs', thus supporting En+ Group's vision of cross-border green certificate recognition.

## Partnerships and Cooperation supporting our net zero journey continued

En+ Group also participated in the work of B20 Action Council on Sustainability and Global Emergency. The Action Council included En+ Group's recommendations of promotion of green certificates, voluntary carbon markets and disclosure of carbon footprints, minimising the use of new resources and exploiting recycled materials with low-carbon footprints.

### **BRICS (Brazil, Russia, India, China, South Africa) Business Council**

En+ Group chairs the Russian part of the Energy and Green Economy Working Group at BRICS Business Council. During the Indian BRICS presidency in 2021, the recommendations of the Energy and Green Economy Working Group built on those suggested by En+ Group in 2020 within the BRICS Russian presidency. Key recommendations, such as carbon footprint disclosure and green certificates will once again be presented for the BRICS Leaders' Summit in India in 2021.

### **International Chamber of Commerce (ICC) Russia**

The ICC works to promote international trade services, investment and responsible business conduct. Being a member of the Commission on Economics of Climate Change and Sustainable Development at the Russian National Committee of the ICC (ICC Russia), RUSAL's experts are involved in developing ICC-Russian recommendations on sustainable development, low-carbon development, and green financing. Sergey Chestnoy, official representative for external relations at RUSAL, holds the position of the Chairman of the ICC Russia Commission on the Economics of Climate Change and Sustainable Development.

### **Business and Industry Advisory Committee to the OECD (BIAC)**

En+ Group and RUSAL are members of the Business and Industry Advisory Committee to the OECD (BIAC) and contribute to the OECD's work on climate change, circular economy, resource efficiency and sustainable materials management. The [May 2020 – May 2021 Annual Report Business at OECD](#) includes a number of BIAC statements that reflect the need to procure low-carbon goods with high recyclability rates together with consideration of market mechanisms such as carbon content disclosure. It also examines the effects of disguised restrictions on trade in respect of products and materials with low-carbon footprints independently verified by certified organisations.

### **UN High-Level Political Forum on Sustainable Development**

The first Voluntary National Review (VNR) of Russia's progress in the implementation of the 2030 Agenda for Sustainable Development covers En+ Group's activities in the sustainability field. The New Energy hydropower plants modernisation programme was mentioned in the VNR as a successful example of SDG 7 (Affordable and clean energy) implementation. The Group's programme to preserve the Lake Baikal ecosystem was included in the VNR as an example of SDG 15 (Life on land) implementation. The VNR was presented at the UN High-Level Political Forum on Sustainable Development in July 2020. RUSAL's contribution to SDG 8 (Decent work and economic growth), SDG 12 (Responsible consumption and production), and SDG 13 (Climate action) was mentioned in the document.

### **Japanese Climate Leadership Partnership**

In December 2020, RUSAL joined the Japanese Climate Leadership Partnership and contributed to the Future Aluminium Forum organised by Aluminium International Today, an English language journal dedicated to the production and processing of aluminium. In a keynote speech, RUSAL highlighted zero carbon aluminium as a game changer for the industry.

### **International Policy Coalition for Sustainable Growth**

In 2021, En+ Group became a Knowledge Partner at the International Policy Coalition for Sustainable Growth launched by the US Chamber of Commerce. The International Policy Coalition for Sustainable Growth shared En+ Group's [approach](#) to green trade liberalisation on its website.

### **The U.S. – Russia Business Council (USRBC)**

En+ Group and RUSAL are members of the U.S. – Russia Business Council. USRBC shared on its website our "Green Aluminium Vision", En+ Group's ambition to lead the aluminium industry into the green economy via nine key initiatives. In January 2021 the USRBC also published on its site the [news](#) about En+ Group setting sector beating targets for GHG emissions reductions.

 Read En+ Group's approach to green trade liberalisation at [www.greengrowthpolicy.com/blog/greeningtrade](http://www.greengrowthpolicy.com/blog/greeningtrade)

## Transparency and certification

En+ Group supports the notion that emissions transparency is the first step towards increased climate commitments. The Group both discloses its own emissions and promotes industry-wide disclosure.

We engage with customers and end users to increase the transparency of our product's climate impacts, driving decarbonisation of the value chain:

- In 2017, RUSAL was the first to include the guaranteed carbon footprint of its products in commercial contracts, accompanied by externally verified statements of carbon footprint and energy source.
- As part of our 2050 net zero journey, we will further ramp up transparency of our product climate impacts, enabling our customers to make informed decisions for their product design and material sourcing. This will be achieved through continued climate disclosures through the partnerships listed below, customer support and webinars to share our expertise in carbon footprint calculation methodologies and disclosures, environmental product declarations, and digital traceability of our metal, among others.
- Leading by example, we communicate to our customers the full-scope carbon footprint of our products, externally verified by independent auditors. Our carbon footprint is assessed in line with ISO 14067:2018 and the International Aluminium Institute's 2018 Carbon Footprint Technical Support Document. Our carbon footprint is traceable to individual smelters.

**We continually and vigorously urge the aluminium industry to unify the measurement and disclosure of the carbon footprint of products. This is critical for consistency and comparability of data used by customers. Currently, the industry lacks an authoritative and readily comparable carbon footprint assessment methodology.**



### Aluminium Stewardship Initiative (ASI)

This global, multi-stakeholder, non-profit standards and certification organisation unites stakeholders across the aluminium value chain through a commitment to maximise the contribution of aluminium to a sustainable society. RUSAL is an active member of the ASI. At the ASI's annual Board election in 2021, Alexey Spirin, Director of the Environmental and Climate Risk Management Department, was elected to the Production and Transformation seat.

We support adding a new ASI requirement, to require companies operating smelters to establish a GHG emissions reduction plan consistent with a below 1.5-degree scenario.

### International Aluminium Institute (IAI)

The IAI is a platform through which the aluminium industry aims to demonstrate both its responsibility in producing metal and the potential benefits arising from the sustainable application of aluminium. IAI collects industry data, and encourages and assists in continuous progress in the safe and environmentally sound production of aluminium. RUSAL has been a member of the IAI since 2002.

In 2017, we co-initiated the IAI Greenhouse Gas Working Group. In 2018, the Group published a common methodology for the disclosure of carbon footprints specific to the aluminium industry.

RUSAL contributed to the preparation of industry pathways to net zero by the IAI, published in March 2021.<sup>1</sup>

<sup>1</sup> International Aluminium Institute (March 2021), Decarbonisation pathways, [www.international-aluminium.org/wp-content/uploads/2021/03/Aluminium-Sector-GHG-Pathways-to-2050.zip](http://www.international-aluminium.org/wp-content/uploads/2021/03/Aluminium-Sector-GHG-Pathways-to-2050.zip).

## Partnerships and Cooperation supporting our net zero journey continued

### Carbon Disclosure Project (CDP)

This international organisation runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. CDP aims to normalise environmental reporting and risk management, and drive disclosure, insight and action towards a sustainable economy. RUSAL has been involved in the CDP since 2015 and has committed to full disclosure of its GHG emissions. In 2020, RUSAL received an 'A-' rating, marking the first time an aluminium producer received such a high rating from the CDP.

### Carbon Pricing Leadership Coalition (CPLC)

En+ Group and RUSAL are the only two Russian members of CPLC, a voluntary partnership under the auspices of the World Bank to advance global carbon pricing. En+ Group contributed language to the [CPLC Carbon Pricing Leadership Report 2020/2021](#). As part of En+ Group's transition towards net zero, in 2021 Lord Barker, Executive Chairman of En+ Group was appointed as one of the two [CPLC High-Level Assembly Co-Chairs](#).

### The London Metal Exchange (LME)

We proactively engage with leading industry bodies to drive forward more unified practices across the industry. The LME is an international nexus of the metals trade and one which has a massive impact on the entire market. Since 2019, En+ Group has been actively calling on the LME to introduce new disclosure rules on emissions on the exchange. Our mission is to drive emissions transparency and disclosure – the first meaningful step in carbon reduction – across the aluminium sector.

Following a thorough consultation with various key aluminium industry stakeholders, in December 2020 the LME announced its first meaningful step towards carbon neutrality and unveiled the 'LME passport', a new trading platform that hinges on providing the option for greater transparency and access in respect of sustainably produced metal.

## Energy Transition

As the largest independent hydropower producer, En+ Group places the energy transition at the core of its values. The future green economy will largely be shaped by the energy transition, and will depend on renewable energy sources. Through energy-focused partnerships, we aim to increase exposure around the future possibilities surrounding renewable energy.

### International Hydropower Association (IHA)

The IHA is a non-profit membership organisation committed to advancing sustainable hydropower, representing the global voice of the hydropower community. IHA is the custodian of the Hydropower Sustainability Assessment Protocol, the point of reference for the industry.

In 2020, the Group's Executive Chairman, Lord Barker, called on the organisation to bring hydropower to the forefront of the climate discussion. The call to action was met with unanimous approval from the IHA Board, following which, the IHA has been working to increase its visibility among hard-to-abate industries, and produce the [San Jose declaration](#).

### Global Sustainable Electricity Partnership (GSEP)

GSEP is a CEO-led alliance of leading global electricity companies promoting electrification and sustainable energy development. GSEP promotes cleaner electricity generation, energy efficiency and electrification as pathways towards global development and climate goals. EuroSibEnergO joined GSEP in 2015. In 2021, GSEP published a report on electrification, with both the Metals and Power segments of En+ Group participating in the study.



## Climate Focused

Operating among the hard-to-abate sectors, En+ Group is aware of the climate impact the industries can have. We thus believe it is essential to reduce our GHG emissions to ensure a contribution to the global efforts to mitigate climate change and align with the 1.5°C scenario.

Low-carbon transitions are also valued by the financial sector. In January 2021, RUSAL signed its second sustainability-linked pre-export finance facility with Societe Generale for up to USD 200 million. This loan is secured, inter alia, by the assignment of proceeds from ALLOW offtake contracts.

The additional partnerships below also support our climate ambitions:

### **Conferences of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC)**

En+ Group and RUSAL regularly attend UN Climate Change Conferences. In 2021, En+ Group and RUSAL acted as experts for the Russian delegation, participating in the activities of the UNFCCC, including preparation for the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow.

### **Intergovernmental Panel on Climate Change (IPCC)**

In relation to climate, RUSAL participated in the EU-Russia Climate Conference events, made suggestions on requested topics, and shared its knowledge to the Intergovernmental Panel on Climate Change (IPCC). RUSAL also took part in the development of the “2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories”, the methodology for GHG emissions calculation from the primary aluminium production. The new methodology for Alumina refineries emissions calculation was introduced by Alexey Spirin, former head of GHG emissions regulation unit of HSE Department of RUSAL, who was one of the Lead Authors, and Andrey Panov, the Director of Engineering & Process Directorate of Alumina Production of RUSAL, who was among one of the contributed authors.

### **Science Based Targets initiative (SBTi) and Business Ambition for 1.5C**

In September 2019, En+ Group joined the SBTi and Business Ambition for 1.5°C and committed to setting science-based emissions reduction targets (‘SBTs’) in line with the recommendations described in the IPCC Assessment Reports and aligned with the 1.5°C trajectory.

In May 2020, En+ Group signed a post-COVID-19 Green Recovery Call-To-Action initiated by the UNGC and the Business Ambition for 1.5°C, calling on governments and policymakers to match the ambitions of companies already committed to the 1.5°C target, and align with the net zero emissions target well before 2050.



## Partnerships and Cooperation supporting our net zero journey continued



### Aluminium for Climate (ACI)

En+ Group has been among the key members of the World Economic Forum's Aluminium for Climate initiative since its inception in September 2019. Launched at the 2019 UN Climate Week, the programme forms part of WEF's Mission Possible, aimed at accelerating the decarbonisation of hard-to-abate industries. Aluminium for Climate provides a forum for the industry to agree on multi-stakeholder approaches to tackling the aluminium industry's most pressing environmental concerns.

### Race to Zero

Founded by the Climate Champions, Race to Zero is a global campaign that mobilises a coalition of leading net zero initiatives to rally leadership and support from businesses, cities, regions, and investors for a zero-carbon recovery that unlocks inclusive, sustainable growth.

The objective is to build momentum around the shift to a decarbonised economy ahead of COP26, where governments must strengthen their contributions to the Paris Agreement. In 2020, En+ Group became a member of the umbrella initiative as a signatory of the Business Ambition for 1.5°C.

## Regional

Our collaborations and partnerships not only look outward towards international stakeholders, but we also seek to address urgent sustainability issues domestically. Together with climate leaders and our respective industries, we come together to discuss, share, and develop the latest progress in the sustainable development of Russia.

### Climate Partnership of Russia

En+ Group is a partner of the Climate Partnership of Russia. This partnership was established ahead of COP21 as an initiative to consolidate the efforts of Russian businesses to mitigate environmental impacts and encourage Russian companies to move towards a decarbonised, green economy.

### "Hydropower of Russia" Association

The Association is focused on promoting the development of hydropower in Russia and on increasing the reliability and efficiency of hydropower production. It represents domestic hydropower interests at the government level. In 2020, En+ Group took part in developing a national methodology for assessing sustainable hydropower. In 2021-2022 the methodology is expected to be tested, after which it will be released to the public.

### Russian Union of Industrialists and Entrepreneurs

In 2020, RUSAL entered the Committee on Climate Policy and Carbon Regulation, created to consolidate the efforts of Russian companies representing the primary industries, on the climate agenda within the framework of the Russian Union of Industrialists and Entrepreneurs.

# Our recommendations on policy

## Carbon Pricing

Since 2017, in order to assess climate-related risks and opportunities and factor them into investment decisions and business operations, the Group has used an internal carbon price of USD 20/tonne CO<sub>2</sub>e. We evaluate the potential impact of GHG emissions on the financial and economic models of projects and overall economic performance. Carbon pricing has not yet lived up to its full potential to drive emissions reductions, and global carbon pricing policy and implementation requires more attention and further discussion.

### Carbon Pricing Leadership Coalition (CPLC)

En+ Group and RUSAL are the only two Russian members of the Carbon Pricing Leadership Coalition (CPLC), a voluntary partnership under the auspices of the World Bank to advance global carbon pricing. The CPLC was launched on the opening day of the Paris Climate Conference (COP21) in 2015 and brings together more than 300 members, including 34 governments, 172 global companies and 100 strategic partners representing a worldwide network of NGOs, business organisations, and universities, to support understanding of universal carbon pricing implementation.

En+ Group regularly contributes language to CPLC annual reports. In the latest [CPLC Carbon Pricing Leadership Report 2020/2021](#), En+ Group stressed its ambitious targets to become net zero by 2050, covering aluminium production within En+ Group's Metals segment as well as heat and electricity production in the Power segment. The [CPLC Carbon Pricing Leadership Report 2020/2021](#) emphasises that En+ Group is not only looking at a low-carbon hydropower transition, but also exploring innovative approaches to aluminium smelting that use inert anodes.

As part of En+ Group's transition towards net zero, in 2021 Lord Barker, Executive Chairman of En+ Group was appointed as one of the two [CPLC High-Level Assembly Co-Chairs](#). Lord Barker's [welcome address](#) to the CPLC members and strategic partners was released on 8 June 2021. Commenting after his welcome address, Lord Barker [said](#) that as the world turns to focus on the UN Climate Change Conference (COP26) in Glasgow in November 2021, there needs to be a broader discussion on universal carbon pricing and building real climate action momentum. He pointed out that introducing carbon pricing as one of the many essential solutions needed to address the threat of climate change illustrates how achieving inclusive economic growth and climate ambition need not be mutually exclusive.

Earlier, in June 2020, Lord Barker was an official speaker at the CPLC High-Level Dialogue 'Realising the full potential of carbon pricing in a sustainable recovery'. The CPLC published information about En+ Group's Green Aluminium Vision on its website. Speaking at the CPLC Annual Leadership Dialogue panel at the UN Climate Change Conference (COP25) in Madrid in December 2019, Lord Barker [stressed](#) that En+ Group was the first in the industry to systematically introduce commercial contracts with a guaranteed carbon footprint and disclosure of carbon footprint for the smelter of origin.



**Our recommendations on policy** continued

## Carbon Border Adjustment Mechanism

The European Union’s intention to include aluminium in the pilot phase of the Carbon Border Adjustment Mechanism (CBAM) is still under development and there are no details of how it will directly affect En+ Group. It is obvious, that such an intention needs study and further discussion between policymakers, regulators and stakeholders. There is no precedent for carbon border adjustment at state level, and the opportunity will be taken to improve the current draft to help the new mechanism to serve its declared objectives.

The fact is that the EU primary aluminium market has a dramatic (75%) deficit - while the consumption of aluminium has been growing in recent years. Around one third of capacity has closed due to purely economic reasons. So, applied to the aluminium industry, CBAM will not serve its purpose and will not help the EU prevent carbon leakage in primary aluminium production. On the contrary, CBAM would generate extra costs for the downstream sector, which employs 90% of workers of the EU aluminium industry. Thus, EU semi-fabricators will face growth of imports of aluminium products at lower prices, which will drive them out of the domestic market provoking carbon leakage in the downstream sector. It would be unfortunate if CBAM were to cause substitution of domestically produced semi-finished aluminium products by imports of high carbon alternatives - thus negating the aims of CBAM.

In addition, when it comes to primary aluminium production, both direct and indirect emissions (Scope 1+2) must be taken into account. This is because aluminium smelting’s carbon footprint is predominantly dependent on the way the electricity used in the process is produced (up to 40% of the total cost to produce aluminium is electricity).

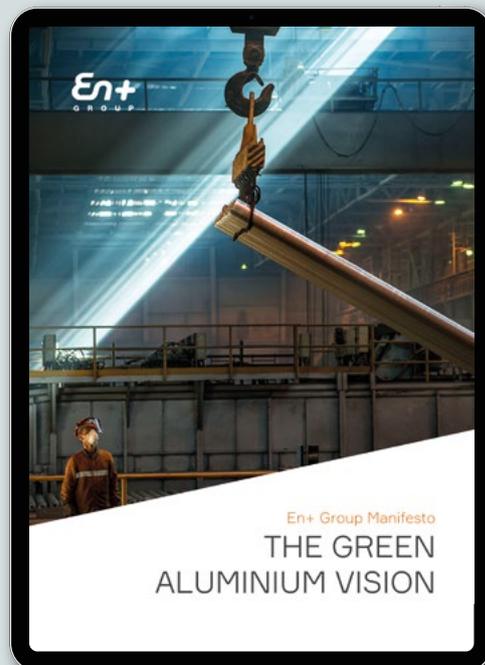
Finally, CBAM should be applied in accordance with the carbon footprint of a specific product and producer, based on an internationally developed and recognised system of verification of carbon footprint. CBAM’s compliance with the WTO also needs to be thoroughly assessed.

## Green Aluminium Vision

In July 2020, En+ Group launched its Green Aluminium Vision. It set out nine principles to lead the industry into the low-carbon economy by developing a new asset class of green aluminium.

1. Determination to reduce emissions across the production process
2. Low-carbon aluminium branding
3. Carbon footprint transparency
4. Circularity
5. Sustainability labelling
6. Liberalisation of trade for low-carbon primary aluminium
7. Elimination of excess capacities to ensure fair and green trade
8. Facilitation of research and development
9. Support for a renewed multilateralism

Read more about our green vision in our manifesto **The Green Aluminium Vision**, [www.enplusgroup.com/upload/iblock/7f5/En\\_-Group-Green-Aluminium-Vision.pdf](http://www.enplusgroup.com/upload/iblock/7f5/En_-Group-Green-Aluminium-Vision.pdf)



# Aluminium industry

## Market Context

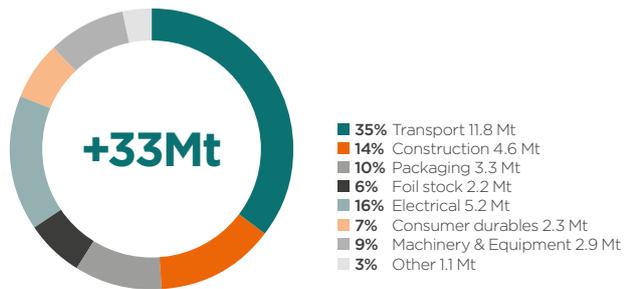
Demand for aluminium has accelerated in the last decade due to its acceptance as the material of choice for applications requiring more lightweight components, corrosion resistance and formability. As climate change and resource scarcity gained global acceptance and began to influence both geopolitical and socioeconomic trends, the criticality of reducing GHG emissions across the global industrial base was recognised with a renewed sense of urgency.

Looking forward to 2030, the global aluminium market is set to grow by 33 mt, led by the transportation, packaging, and infrastructure sectors, which on a combined basis will achieve an average CAGR of 3% over this period.<sup>1</sup> In each of these sectors, the intensity of use of aluminium has increased above the long-term consumption growth trend, due to the industrial commitment to reduce carbon footprints across the entire manufacturing supply chain. This creates additional demand and use for low-carbon aluminium as a further opportunity to decarbonise and lower emissions.

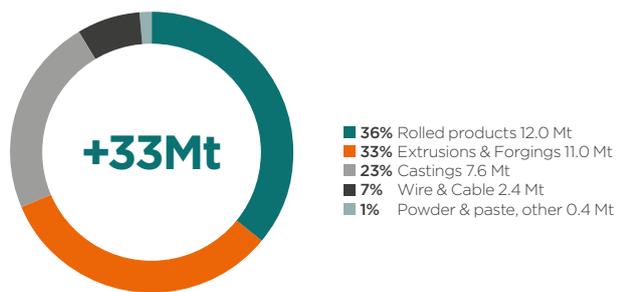
The focus on mobility, the circular economy and climate change during the post-pandemic recovery translates directly across to the transport, packaging, renewable energy, and infrastructure sectors, adding to additional demand growth for the metal.

### Incremental-use demand, in 2030 vs 2020<sup>2</sup>

#### By segments



#### By products



## Alloyed aluminium

Alloyed aluminium product demand will be driven by key segment growth, with existing demand trends showing improvement due to improved global consumption and intensity of use.

### Transportation

Rolled products will continue to see demand benefit from the increased use of aluminium body sheet in existing and new automotive platforms for exterior and interior panels, as well as the benefits of lightweighting in the aviation, rail and ship building industries.

### Construction and Infrastructure

Demand for aluminium sheet and plate and extrusions continues to increase, as applications grow for exterior and interior building cladding. This is driven by the energy efficiency requirements of LEED certification and other 'green' building standards and requirements to reduce embodied carbon emerging worldwide.

### Packaging

The increase in demand for aluminium can sheet requiring rolled products. Glass and plastic substitution, both well underway, translate to an incremental demand of over 300 kt of aluminium in 2021 alone, as new can manufacturing capacities are commissioned globally. Aluminium demand in packaging is projected to grow at 3.8% CAGR in the next ten years.

<sup>1</sup> Based on Wood Mackenzie's total consumption forecasts of the following key economies: Germany, Japan, US and Canada, China, India, South Korea and Brazil.  
<sup>2</sup> Ibid.

**Aluminium industry** continued

Roughly 40% of the incremental demand, or 13 mt of the 33 mt, will be driven by the 'green energy transition' that is critical in order to address and achieve established global warming targets.<sup>3</sup>

Aluminium will be a key material for the green energy transition, and its use contributes to reduce carbon emissions through the growth of alternative green energy technologies.

Three main segments will drive the demand for aluminium over the green energy transition period:

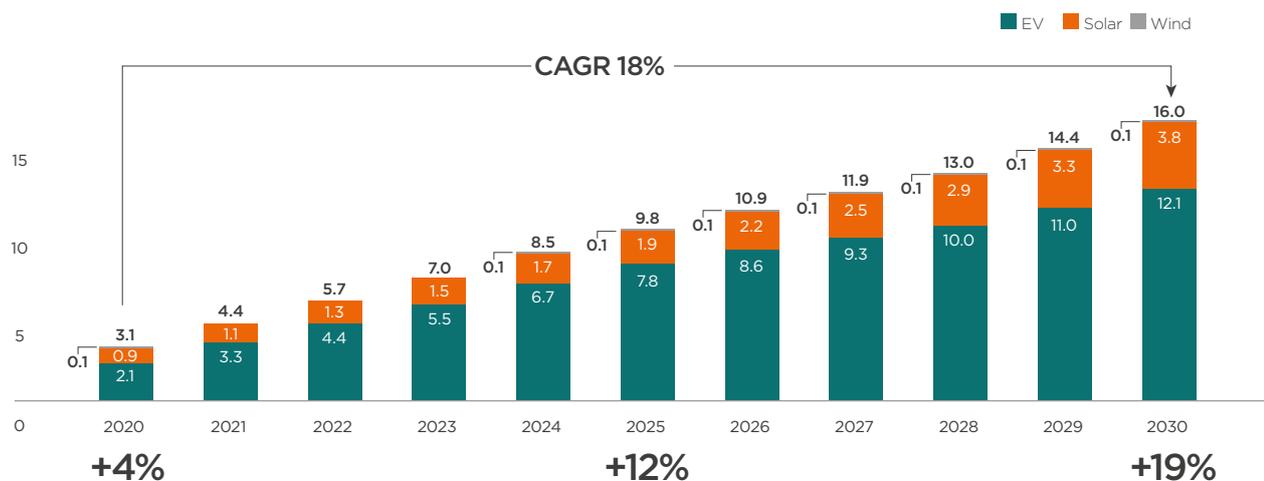
1. Electric vehicle demand: globally accepted as the new standard platform for all major automotive OEMs.
2. Solar energy demand: growing acceptance due to reduced capital, operating costs, and improvements in efficiency due to improved technology.
3. Wind energy demand: represents a 1% share of total green demand related to aluminium.

The demand covered by these three segments represents 3.1 mt or 4% of the global demand for aluminium in 2020, and is forecasted to grow to 16 mt or 19% of global aluminium demand in 2030, as shown in the graph below.<sup>4</sup>

Note that 10 million tonnes of this growth comes from the EV automotive segment, which requires twice as much aluminium as internal combustion engines or ICE vehicles. The solar segment quadruples its aluminium demand over the same period, as aluminium is the material of choice due to its light weight and corrosion resistance, and photovoltaic frames are specifying more ultra-thin extruded aluminium profiles in their design criteria.



**Primary aluminium demand attributed to green energy transition, kt<sup>5</sup>**



<sup>3</sup> Based on Wood Mackenzie's total consumption forecasts of the following key economies: Germany, Japan, US and Canada, China, India, South Korea and Brazil.

<sup>4</sup> Goldman Sachs (June 2021), Green Metals Solving Aluminium's Climate Paradox.

<sup>5</sup> Ibid.

## Market supply and response

The total metal requirement balance, taking into account, the demand growth, shows that primary aluminium and recycled aluminium supply must increase by 17.4 mt, and 15.4 mt respectively in the next decade. China is expected to increase its primary capacity to 45 mt, per the government's announced production cap regulation. This implies that the rest of the world (ROW) must add 10.2 mt of primary aluminium smelting capacity over the next 10 years, with the balance coming from recycled aluminium.

Looking at primary aluminium consumption and production balance based on announced projects, the primary market is heading toward a 0.5 mt deficit in 2030, having started from a 2.0 mt surplus in 2020. Total primary demand including China is expected to increase by 16.4 mt.

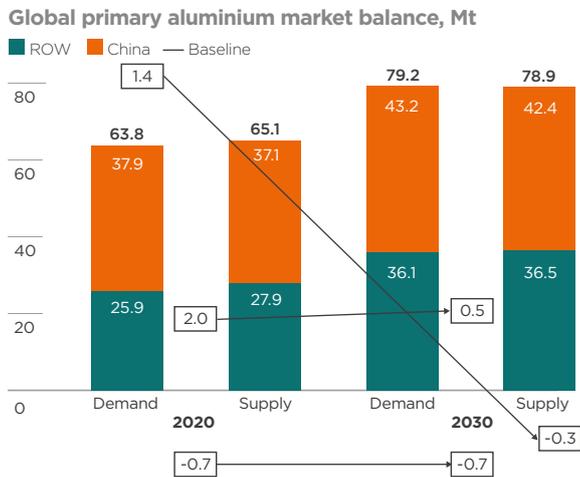
# 33Mt

Global Total metal requirement to increase by 33Mt with larger contribution from secondary metal

Total metal requirement in 2020&2030, Mt



**Aluminium industry** continued



**Market dynamics**

The incremental demand of 33 mt and associated increase in supply of 26 mt LCA, and 7 mt of non-LCA, will create a different set of market dynamics and opportunities for primary based LCA. If we assume that the 13 mt of aluminium required just to meet the demand for the ‘green energy transition’ mentioned above, must be LCA, in the EV and solar segments, then there is only 12 mt of LCA remaining to meet the outstanding 20 mt of incremental demand. This demand includes packaging, as well as other sectors that have launched their GHG abatement programmes and are planning to be part of the circular economy. The use of recycled aluminium can increase as well, driven by the need to meet both demand and lower carbon footprint simultaneously.

Total low-carbon aluminium (LCA) supply, which includes primary LCA plus recycled aluminium, is set to grow by 26.4 mt, almost evenly split between China and ROW. Primary LCA supply is expected to increase from 14.2 mt to 17.8 mt (mostly from existing LCA producers), non-LCA supply from 11.7 mt to 18.3 mt in ROW. This implies that for primary aluminium over the next decade, increase from the supply side.

Current warehouse stocks of aluminium available on the LME are approximately 1.5 mt. Stocks that are locked up in financing deals in non-LME and private warehouses are estimated to be close to 7 mt. It is important to realise that the majority of this warehoused metal is not LCA.

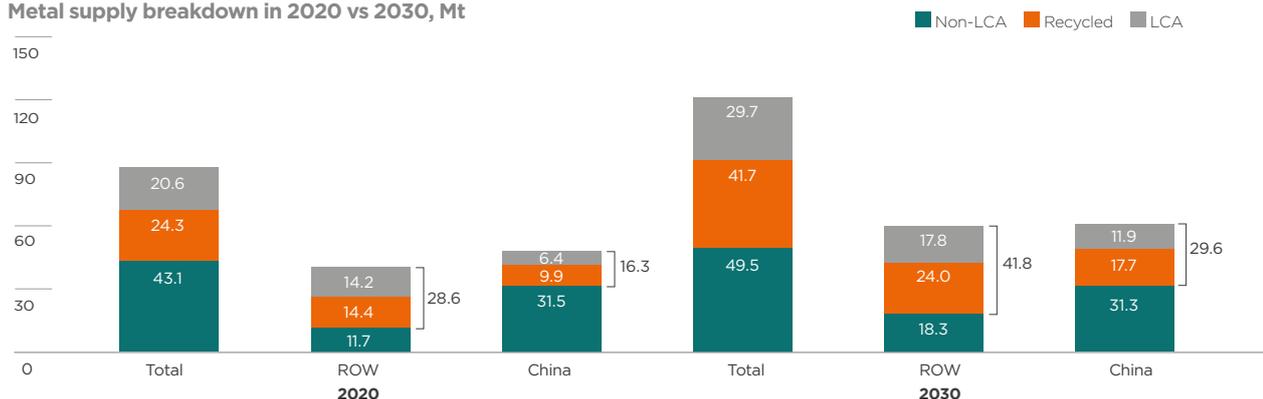
Growth assumptions are based on current definitions of LCA levels linked to Scope 1 and Scope 2 emissions. However, it is highly likely that this definition of LCA will become stricter and more exacting over the next ten years, and drop below the 4 tn CO<sub>2</sub> level for full Scope requirements. Ultimately, by 2030, it is believed that LCA supply would be segmented, based on CO<sub>2</sub> intensity, into 0-2tn, 2-4tn and 4-6tn categories.

In such an evolving and changing carbon-based market dynamic, the Company, with its ALLOW portfolio, will be well positioned to meet existing and future LCA demand. That demand can certainly increase to represent 100% of the 32 mt outlined above, as the push to meet global emissions goals intensifies.

**CAGR, 2020-2030, %**

	Total	China	ROW
Non-LCA	1.4	-0.1	4.6
Recycled	5.6	5.9	5.3
LCA	3.7	6.4	2.2

**Metal supply breakdown in 2020 vs 2030, Mt**



# Power sector overview

## Making the pillars of energy transition count

There is a global consensus that any reduction in emissions by 2030 for the power sector predominantly relies on already available technologies and techniques, including energy efficiency measures for system flexibility, generation and grid, usage of greener energy sources, electrification of transport, electrification of heat energy, regulations supporting transformation of power sector architecture, power market design, and others. According to the IEA, during this period annual global investment to maximise the rapid deployment of available technologies should scale up to around USD 5 trillion (compared to around USD 2.3 trillion in recent years). Of this, USD 1.3 trillion per year should be allocated to renewables (solar, wind, hydro, geothermal).

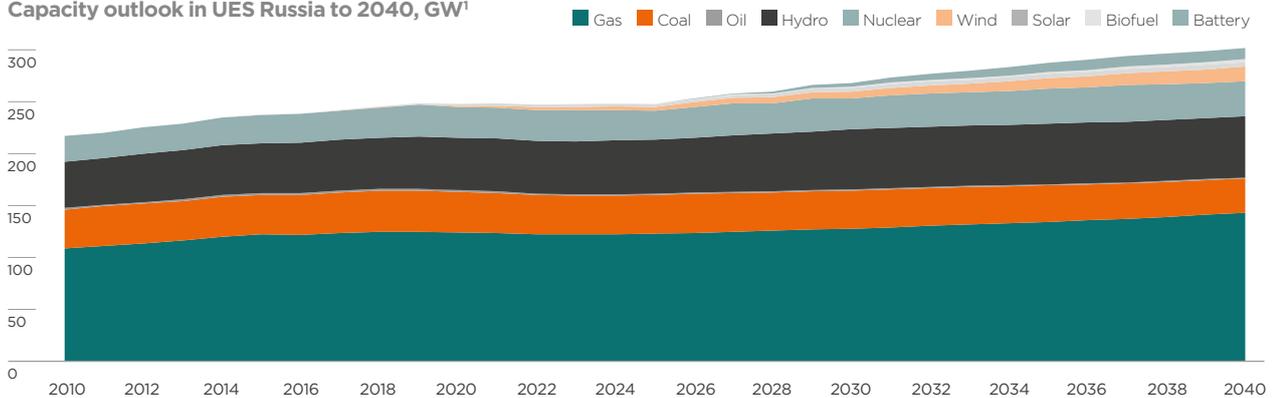
The Energy Transitions Commission (ETC), representing an important coalition of global leaders in the energy landscape, estimates that gross investment relating to building up new economies in the next 30 years could amount to USD 2.1-3.6 trillion a year, of which the power sector alone will need around USD 1.1-1.6 trillion of annual investments.

Explicit state support will be required to create a policy environment, and associated measures, for identifying investment needs, assessing risks, and mobilising and channelling funds in support of power sector transformation (whilst accounting for ‘just socio-economic regional transition’). All actors in this process (governments, regulators, research and innovation facilities, energy producers, energy consumers and financial institutions) are expected to commit to and uphold the same climate abatement goals and share responsibility for their delivery.

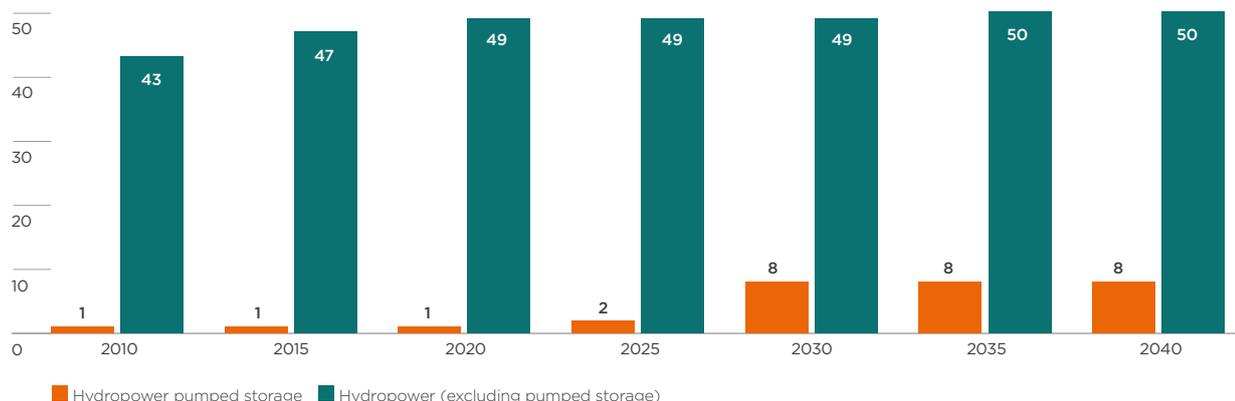
### Capacity outlook in Russia

- By 2040 the share of fossil-fuelled power plants in the capacity mix will slip eight percentage points from 67% to around 59%, with nuclear and hydropower remaining around 12% and 20% respectively.
- The share of renewables (mainly wind, solar, and biofuel) is destined to rise from 1% to exceed 7%.
- Storage capacity will become increasingly important and will start impacting the sector from around 2025, with the share increasing to around 3.5% by 2040.
- Between now and 2040, Russia’s overall generating capacity will grow about 1% per year on average.

Capacity outlook in UES Russia to 2040, GW<sup>1</sup>



<sup>1</sup> SEEPX Energy (March 2021), Russian Power Sector 2010-40 Datasheet Overview, [www.seepx.com/\\_webedit/uploaded-files/All%20Files/Free%20Content/Russian%20Power%20Sector%202040%20Outlook%2028updated%20March%202021%29.xlsx](http://www.seepx.com/_webedit/uploaded-files/All%20Files/Free%20Content/Russian%20Power%20Sector%202040%20Outlook%2028updated%20March%202021%29.xlsx).

Hydropower capacity outlook by main type to 2040, GW<sup>2</sup>

### Hydropower

- Hydropower capacity will grow on average by around 0.8% per year.
- UES Russia's hydropower capacity will grow from around 49.9 GW in 2019 to just over 58.6 GW in 2040.
- Most of the additions will enter the system after 2026. The Group's power generation assets are located in the Angara and the Yenisei. The Group operates four HPPs, including three of the five largest in Russia, or twenty largest globally, in terms of installed electricity capacity.

### Renewables

- Russia's commitment towards renewable energy (wind, solar, and small hydro) has been lukewarm due to the high energy intensity of Russia's industry, dependence on heat energy supply for district heating and technical vulnerabilities in an aging power infrastructure.
- Looking to the near term, there is also little sign of urgency to require more renewable power generation, since Russia's low-carbon energy sources (large hydropower and nuclear) already exceed 30% of the overall capacity mix.
- Wind capacity is expected to set a keen pace, growing on average 13.9% per year to 2040. New wind projects will enjoy an accelerated growth trend to 2025, on average 30% per year, and then remain somewhat steady, growing by 8.6% per year to 2040.
- Solar is also expected to continue its rapid growth at an average annual rate of 4.7% per year to 2040. As solar is more established in Russia, expected annual average growth is around 6% per year to 2025, after which solar capacity will grow by about 4% to 2040.
- In 2025–35, we expect about 6.3 GW of renewable capacity additions. Our estimation is based on a committed 400 billion roubles of funding for renewable projects, approved in the second quarter of 2019, until 2035, and an allocated quota by technology type. Out of the total renewable quota for the centralised power system (6.3 GW), Russia plans to launch 2.6 GW of solar, 3.4 GW of wind, and 0.2 GW of hydropower below 25 MW.
- The growing pressure on industrials to decarbonise could open greater potential for Russia's renewables.

### Hydrogen

- Russia's official commitment to hydrogen as part of its energy policy was first made in Russia's Energy Strategy to 2035.
- The modest piece dedicated to hydrogen identifies Russia's ambition to be among the global leaders of hydrogen production and export, with a target of 2 million tonnes by 2035).
- In October 2020, the government approved a road map for developing a hydrogen energy industry to 2024. The road map envisages the emergence of first measures for state support and lists priority pilot projects by mid-2021, the pilot testing of the application for hydrogen in railroad transportation by 2024, hydrogen production by nuclear power plants by 2023, and hydrogen-ready gas turbines by 2024.

### Grids for electric vehicles

- The integration of digital technologies into the distribution infrastructure (6-10 kV) to support new loads, such as electric transport, is predominantly led by Rosseti, as part of its digital transformation to 2030 and '30/30 Programme'.
- Rosseti plans to create a network of 1,000 charging stations in Russia's 30 largest cities and on 30 motorways by 2024. The latter also implies standardising charging quality and reliability, as well as rolling out smart device applications.
- This Russia-wide electric infrastructure programme includes both private and public transport.

<sup>2</sup> SEEPX Energy (March 2021), Russian Power Sector 2010–40 Datasheet Overview, [www.seepx.com/\\_webedit/uploaded-files/All%20Files/Free%20Content/Russian%20Power%20Sector%202040%20Outlook%20%28updated%20March%202021%29.xlsx](http://www.seepx.com/_webedit/uploaded-files/All%20Files/Free%20Content/Russian%20Power%20Sector%202040%20Outlook%20%28updated%20March%202021%29.xlsx).

# Appendix

## Glossary

### Units of measurement

bn	Billion
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> e	CO <sub>2</sub> equivalent
CO <sub>2</sub> e/t Al	CO <sub>2</sub> equivalent per tonne of aluminium
EUR	Euro
GT	Gross tonnage
GW	Gigawatt (one million kilowatts)
GWh	Gigawatt-hour (one million kilowatt-hours)
h	Hour
ha	Hectare
kA	Kiloampere
kg	Kilogram
kt	Thousand metric tonnes
kV	Kilovolt
kWh	Kilowatt-hour, a unit of measurement for produced electricity
mn	Million
mt	Million metric tonnes
MW	Megawatt (one thousand kilowatt), a unit of measurement for electrical power capacity
MWh	Megawatt-hour
pa	Pascal
pcs/ha	Pieces per hectare
rpm	Revolutions per minute
RUB	Rouble
t, tonne	One metric tonne (one thousand kilograms)
TWh	Terawatt-hour (one billion kilowatt-hours)
USD	United States dollar
y	Year

**Glossary** continued**Terms and abbreviations**

1.5-degree scenario	The Paris Agreement, legally binding international treaty on climate change, adopted by 196 parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels
30/30 Programme	The programme of Rosseti until 2024 for the development of charging infrastructure for electric cars
AE	Anode effect
AER	Annual efficiency ratio
AGK	Achinsk Alumina Refinery, an indirect wholly owned subsidiary of RUSAL incorporated under the laws of the Russian Federation
Al	Aluminium
AI	Artificial intelligence
ALLOW	Low-carbon aluminium brand of RUSAL
ASI	Aluminium Stewardship Initiative
ATS	Alternative Trading System
Aughinish	Aughinish Alumina Refinery, Aughinish Alumina, or Aughinish Alumina Limited, an indirect wholly owned subsidiary of RUSAL incorporated in Ireland
B20	Business 20
B&C	Building and Construction
BAM	Baikal-Amur Mainline
BIAC	Business and Industry Advisory Committee to the OECD
Board	Board of Directors of the Company
BoAZ	Boguchansky Aluminium Smelter, the aluminium smelter project involving the construction of a 600 thousand tpa greenfield aluminium smelter on a 230-hectare site, located approximately 8 km to the south-east of the settlement of Tayozhny in the Krasnoyarsk Region, and approximately 160 km (212 km by road) from the Boguchanskaya hydropower plant, as described on pages 25 and 27 of RUSAL Annual Report 2020
BrAZ	Bratsk Aluminium Smelter or PJSC RUSAL Bratsk, an indirect wholly owned subsidiary of RUSAL incorporated under the laws of the Russian Federation
BRICS	Brazil, Russia, India, China and South Africa
CAGR	Compound annual growth rate
CAPEX	Capital expenditures
Carbon footprint	Total amount of greenhouse gases, produced by a person, organisation, event, product, city, state, directly or indirectly
Carbon removal	The process in which carbon dioxide gas (CO <sub>2</sub> ) is removed from the atmosphere and sequestered for long periods of time
CBAM	Carbon Border Adjustment Mechanism
CCS	Combined charging system
CCUS	Carbon capture, utilisation and storage
CBAM	Carbon Border Adjustment Mechanism
Carbon footprint	Total amount of greenhouse gases, produced by a person, organisation, event, product, city, state, directly or indirectly
Carbon removal	The process in which carbon dioxide gas (CO <sub>2</sub> ) is removed from the atmosphere and sequestered for long periods of time

CCS	Combined Charging System
CCU	Carbon Capture and Utilisation
CCUS	Carbon Capture, Utilisation and Storage
CDP	The Carbon Disclosure Project (CDP) is an international non-profit organisation headquartered in London that operates an information system whereby any company, city or region can voluntarily disclose its level of environmental pollution. The CDP is considered the most authoritative non-profit organisation that assesses the performance of companies in the areas of environmental impact, availability of strategy, corporate governance and risk management systems related to climate change issues
CEO	Chief Executive Officer
CHP	Combined heat and power plant
Circular economy	A model in which products and materials are designed in such a way that they can be reused, remanufactured, recycled or recovered and thus maintained in the economy for as long as possible
CIS	Commonwealth of Independent States
Climate change	A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods
COP21	Conference of the Parties, 21st United Nations Climate Change conference
COP25	Conference of the Parties, 25th United Nations Climate Change conference
COP26	Conference of the Parties, 26th United Nations Climate Change conference
CPLC	Carbon Pricing Leadership Coalition
CSA	Capacity Supply Agreement
DC connector	Direct current connector
Decarbonisation	The process by which countries, individuals or other entities aim to achieve zero fossil carbon existence
EN+ GROUP, En+, En+ Group, we, the Company, the Group	EN+ GROUP IPJSC and its subsidiaries, whose results are included in the consolidated financial statements prepared in accordance with the International Financial Reporting Standards
ESG	Environmental, Social and Governance
ETC	Energy Transformation Commission
EU	European Union
EU ETS	European Union Emissions Trading System
EuroSibEnerg	JSC EuroSibEnerg, a 100% subsidiary of En+ Group managing its power facilities
EV	Electric vehicle
FCD	Frequency control drive
Fossil fuel	Carbon-based fuels from fossil hydrocarbon deposits, including coal, oil, and natural gas
Friguia	Friguia Alumina Refinery
G20	The Group of Twenty
GBH	Galachinskiy boiler house
GHG	Greenhouse gas
GHG emissions Scope 1	Direct greenhouse gas emissions from sources owned or controlled by the Company, e.g., emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment. Direct CO <sub>2</sub> emissions from the combustion of biomass are not included in Scope 1, as they are reported separately

## Glossary continued

GHG emissions Scope 2	Indirect energy greenhouse gas emissions. Scope 2 accounts for GHG emissions resulting from the generation of purchased heat and electricity consumed by a company. Purchased heat and electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the company. Scope 2 emissions physically occur at the facility where heat and electricity are generated
GHG emissions Scope 3	All indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions
GHGP	The GHG Protocol Corporate Accounting and Reporting Standard provides requirements and guidance for companies and other organisations preparing a corporate-level GHG emissions inventory
GSEP	The Global Sustainable Electricity Partnership
Hard-to-abate industry	Industry, which is included among 7 industries (aluminium, cement, steel, chemicals, shipping, trucking, and aviation) and accounts for more than 30% of global emissions
HFO	Heavy fuel oil
HPA	High purity aluminium
HPP	Hydropower plant
HSE Committee	Health, Safety and Environment Committee
HV/LV	High voltage and low voltage
IA	Inert anode
IAI	International Aluminium Institute
ICC	International Chamber of Commerce Russia
ICE	Internal combustion engine
IEA	International Energy Agency
IESK	Irkutsk Electric Grid Company
IHA	International Hydropower Association
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
I-REC	International Renewable Energy Certificates
IRENA	International Renewable Energy Agency
Irkutskenergo	Irkutsk Public Joint Stock Company of Energetics and Electrification, a power generating company controlled by En+ which owns more than 30% of Irkutskenergo's issued share capital
IrKAZ	Irkutsk Aluminium Smelter, a branch of RUSAL Bratsk in Shelekhov, Russia
ISO 14067:2018	International standard, which specifies principles and guidelines for the quantification and reporting of the carbon footprint of a product
ITMO	Internationally transferred mitigation outcomes
JSC	Joint Stock Company
KAZ	Kandalaksha Aluminium Smelter, a branch of RUSAL Ural JSC
KGAU	Krasnoyarsk State Agrarian University
KGBU	Regional state government institution
KhAZ	Khakas Aluminium Smelters
KrAZ	Krasnoyarsk Aluminium Smelter or JSC RUSAL Krasnoyarsk, an indirect wholly owned subsidiary of RUSAL incorporated under the laws of the Russian Federation
KUBAL	Kubikenborg Aluminium AB, an indirect wholly owned subsidiary of RUSAL incorporated in Sweden

LCA	Low-carbon aluminium
LEED	Leadership in Energy and Environmental Design
LLC	Limited liability company
LME	London Metal Exchange
LNG	Liquefied natural gas
LSE	London Stock Exchange
Management Team	Executive Directors and officers of the Company
Metals segment	The segment comprising of RUSAL (56.88% owned by En+ Group). RUSAL's power facilities are included in the Metals segment
MHD	Magnetohydrodynamics
Montreal Protocol	The Montreal Protocol on Substances that Deplete the Ozone Layer, also known simply as the Montreal Protocol, is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion
NDC	New distribution capability
Net zero	Net zero means that emissions must not only be reduced but, since they cannot be avoided completely, must be balanced by absorbing an equal amount of greenhouse gases, primarily CO <sub>2</sub> , through climate projects: forestry projects, carbon capture, utilisation and storage (CCUS) projects
NGO	Non-governmental organisation
NkAZ	Novokuznetsk Aluminium Smelter or JSC RUSAL Novokuznetsk, an indirect wholly owned subsidiary of RUSAL incorporated under the laws of the Russian Federation
OECD	The Organisation for Economic Cooperation and Development
OEM	Original equipment manufacturer
OPEX	Operational expenditure
Paris Agreement	The Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) was adopted on December 2015 in Paris, France, at the 21st session of the Conference of the Parties (COP) to the UNFCCC. One of the goals of the Paris Agreement is holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels
PFA	Perfluoroalkoxy
PFC	Perfluorocarbon
PLC	Public limited company
Power segment	The segment predominantly comprising power facilities owned by En+ Group. The Power segment engages in all aspects of the power industry, including electric power generation, power trading, and supply
R&D	Research and development
RA-550	RA-550 technology is recognised as a model solution in the sphere of aluminium reduction by leading experts in the global aluminium industry
Recycling	Reprocessing of products or components of products that have become waste, to make new materials
Reforestation	Planting of forests on lands that have previously contained forests but that have been converted to some other use
ROW	Rest of the world
RSPP	Russian Union of Industrialists and Entrepreneurs

**Glossary** continued

RUSAL, UC RUSAL	United Company RUSAL, international public joint-stock company (UC RUSAL, IPJSC) (formerly United Company RUSAL Plc), a company incorporated under the laws of Jersey with limited liability and continued in the Russian Federation as an international company (56.88% owned by En+ Group)
SBT	Science-based target
SBTi	Science Based Targets initiative, a joint initiative by CDP, UN Global Compact, World Resources Institute and WWF that was established to drive corporate ambition and help businesses pursue bolder solutions to climate change
SDG	Sustainable Development Goals
SPP	Solar power plant
SUBR	North Urals Bauxite Mine
TCFD	Task Force on Climate-related Financial Disclosures
UN	The United Nations
UNFCCC	The United Nations Framework Convention on Climate Change
UNGC	United Nations Global Compact
UN SDGs	United Nations Sustainable Development Goals
USRBC	The U.S.-Russia Business Council
VgAZ	Volgograd Aluminium Smelter, a branch of RUSAL Ural JSC
VNR	Voluntary National Review
WBCSD	World Business Council on Sustainable Development
WEF	The World Economic Forum
Windalco	West Indies Alumina Company, a company incorporated in Jamaica, in which RUSAL indirectly holds a 100% stake
WTO	The World Trade Organisation
UES	Unified Electric System
UN	The United Nations
UNFCCC	The United Nations Framework Convention on Climate Change
UNGC	United Nations Global Compact
UN SDGs	United Nation's Sustainable Development Goals
USRBC	The U.S. – Russia Business Council
VgAZ	Volgograd Aluminium Smelter, a branch of RUSAL Ural JSC
VAP	Value-added products. Includes wire rod, foundry alloys, billets, slabs, high purity, and others
VNR	Voluntary National Review
WBCSD	World Business Council on Sustainable Development
WEF	The World Economic Forum
WTO	The World Trade Organisation
Windalco	West Indies Alumina Company, a company incorporated in Jamaica, in which RUSAL indirectly holds a 100% stake

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