

Metals for Clean Energy:

Pathways to solving Europe's raw materials challenge

SNAPSHOT OF REPORT OUTCOMES

Presentation by

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Introducing speakers



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The energy transition is a commodities transition

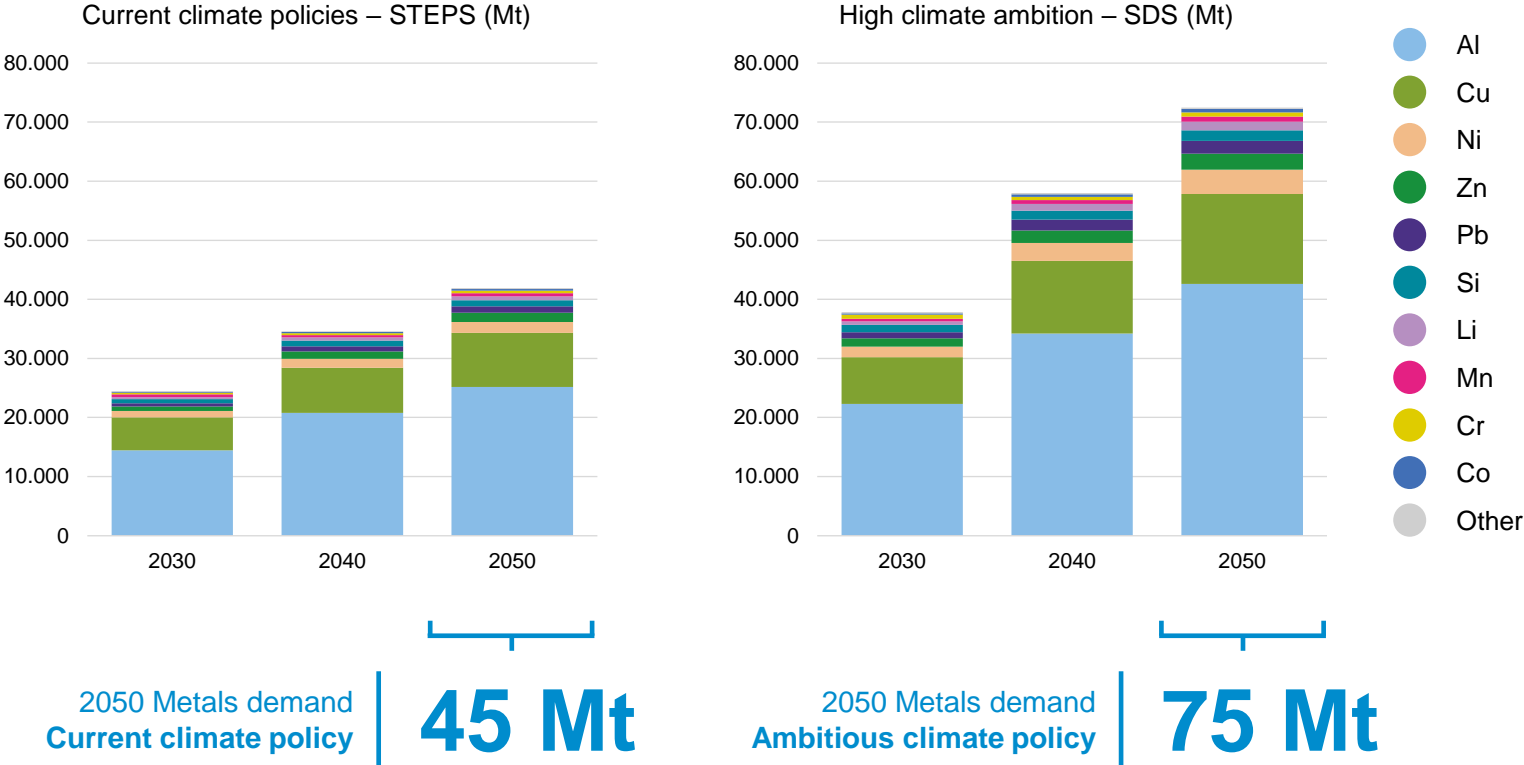
Fact

The faster the world decarbonises, the higher its metals requirements

Question

By how much?

Total metal demand by commodity in a STEPS and SDS scenario respectively (Mt)



New clean energy demand will transform several global metals markets

Fact

All based on metals:
Batteries, Electric
Cars, Solar Panels,
Wind Turbines,
Hydrogen

Question

How will global demand
for metals shift?

% metal required in 2050 for clean energy technologies vs. 2020 overall use (SDS ambitious climate scenario).

Li Lithium	2109%	Si Silicon	62%
Dy Dysprosium	433%	Tb Terbium	62%
Co Cobalt	403%	Cu Copper	51%
Te Tellurium	277%	Al Aluminium	43%
Sc Scandium	204%	Sn Tin	28%
Ni Nickel	168%	Ge Germanium	24%
Pr Praseodymium	110%	Mo Molybdenum	22%
Ga Gallium	77%	Pb Lead	22%
Nd Neodymium	66%	In Indium	17%
Pt Platinum	64%	Zn Zinc	14%
Ir Iridium	63%	Ag Silver	10%



What about demand in Europe?

Until now, batteries, solar panels, magnets have been built elsewhere...



...But Europe has concrete industrial plans to build its own technologies



New European technology production will require a full supply chain

Fact

Europe's accelerated energy transition & concrete domestic technology plans = new metals requirements

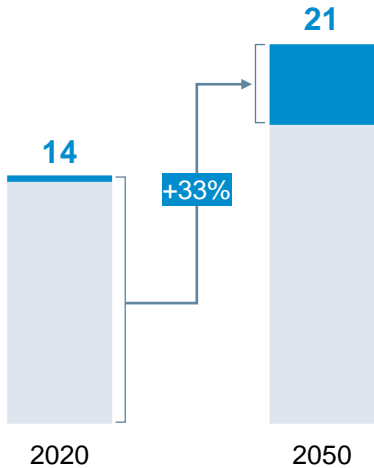
Question

What will happen to Europe's metals markets?



Base metals
main future demand driver

Al Aluminium (Mt)

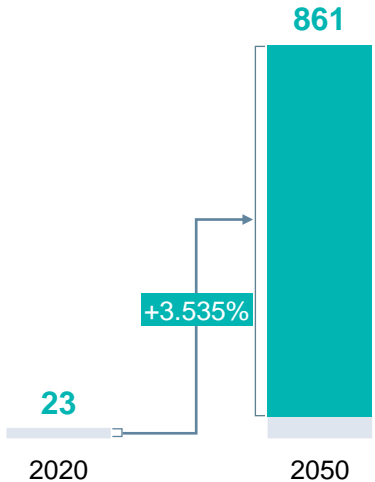


- Top transition uses:
- EVs
 - Solar
 - Electricity networks



Battery materials
transformation from low level

Li Lithium (kt, LCE)

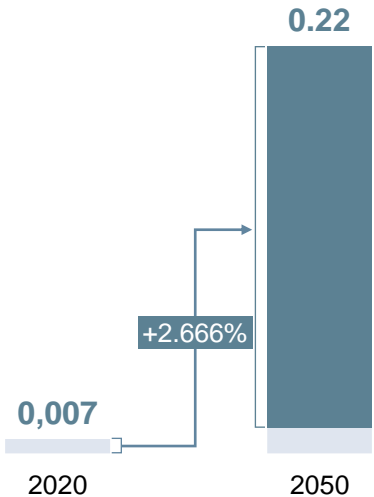


- Top transition uses:
- EVs
 - Battery storage



Rare earths
transformation from low level

Dy Dysprosium (kt)



- Top transition uses:
- EVs
 - Wind

Europe must replace its problematic fossil fuels dependency with a secure and responsible metals supply

Challenge 1

Without urgent action now, Europe's ability to secure the right level of strategic autonomy for energy transition metals beyond 2030 is at risk

Challenge 2

Meeting the energy transition's metals demand only with increased imports from lower regulatory regimes and uncertain partners isn't compatible with the EU's Green Deal sustainability values

Question

How can Europe bridge this real supply gap?

Bridging Europe's energy transition metals supply gap

STARTING POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

END POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability



Five necessary pillars for Europe's metals & clean energy bridge

STARTING POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

STRONGEST IMPACT: NOW → 2040

2035 ONWARDS

END POINT

2050

PILLAR 1

Fulfil domestic mining potential

PILLAR 2

Maintain and increase domestic refining output

PILLAR 3

Secure sustainable imports from reliable partners

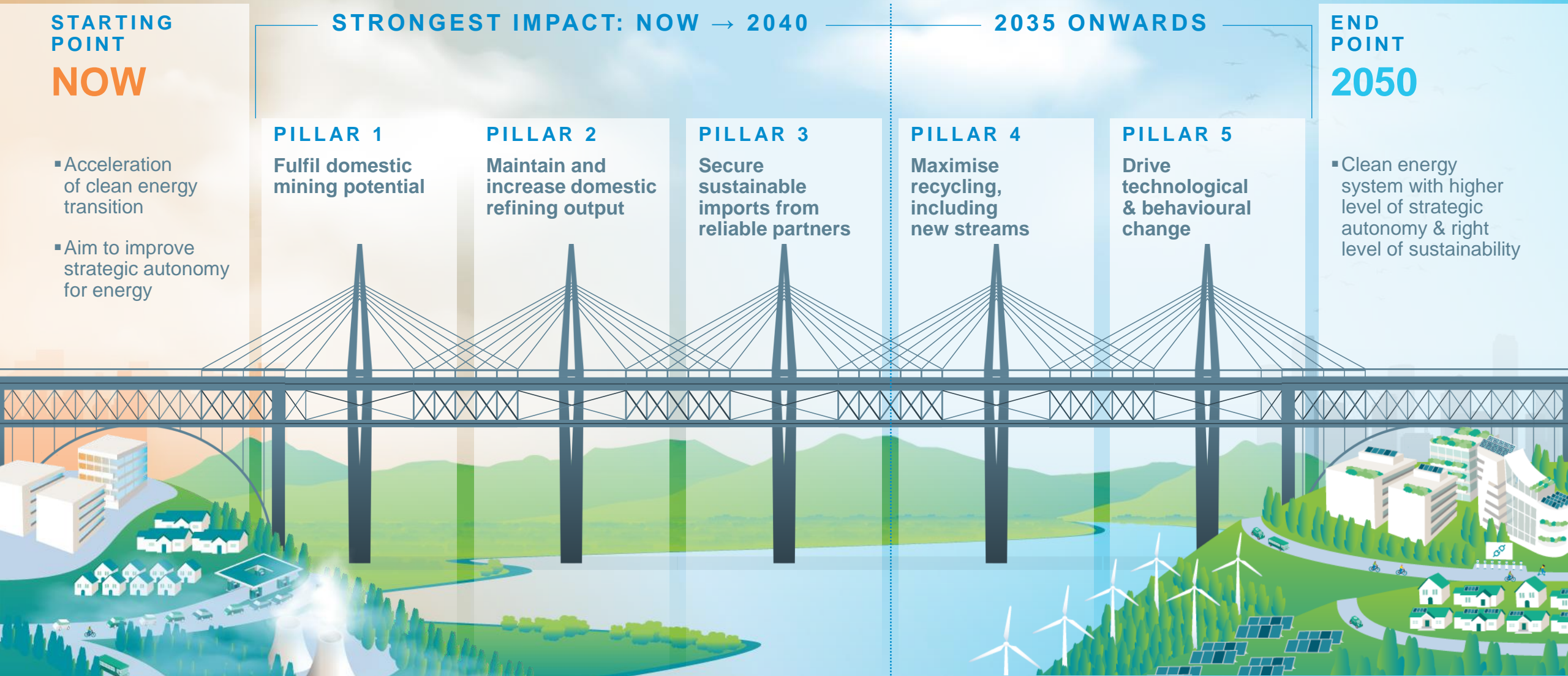
PILLAR 4

Maximise recycling, including new streams

PILLAR 5

Drive technological & behavioural change

- Clean energy system with higher level of strategic autonomy & right level of sustainability



New primary supply is needed between now and 2035

STRONGEST IMPACTS → 2040

PILLAR 1

Fulfilling domestic mining potential

PILLAR 2

Maintain and increase domestic refining output

PILLAR 3

Securing sustainable imports from reliable partners

Early stages of energy transition

Primary metals needed for new technologies



Will be available for recycling in 15 years

Pillar 1: Fulfil domestic mining potential

STARTING
POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

PILLAR 1

Fulfilling domestic mining potential

END
POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability



Europe has high ambitions for mining new energy commodities

Mature markets struggle to keep up with depletion (1/2)

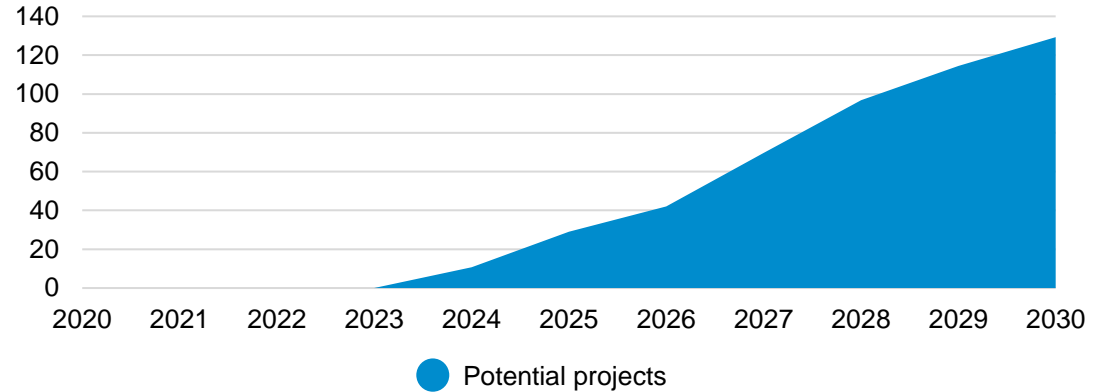
New energy commodities

Lithium, rare earth elements

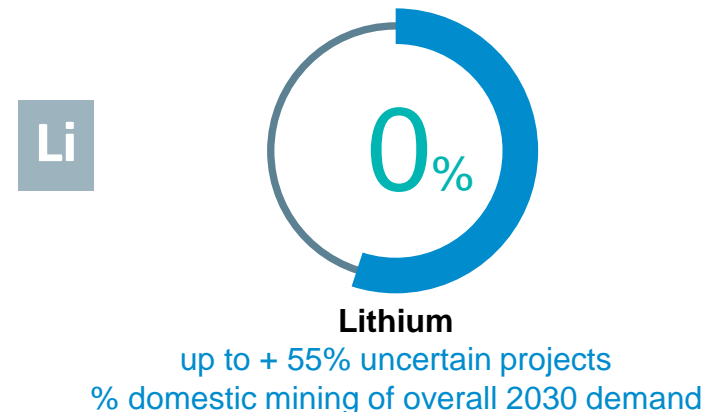
- Large project pipelines, but with a high level of uncertainty
- Potential for up to 55% (lithium) and 80% (dysprosium) self-sufficiency rates by 2030*

European mining projects have several challenges: local opposition, challenging economics, permitting, untested technologies

European mine output (kt)



European self-sufficiency rate



Europe has high ambitions for mining new energy commodities

Mature markets struggle to keep up with depletion (2/2)

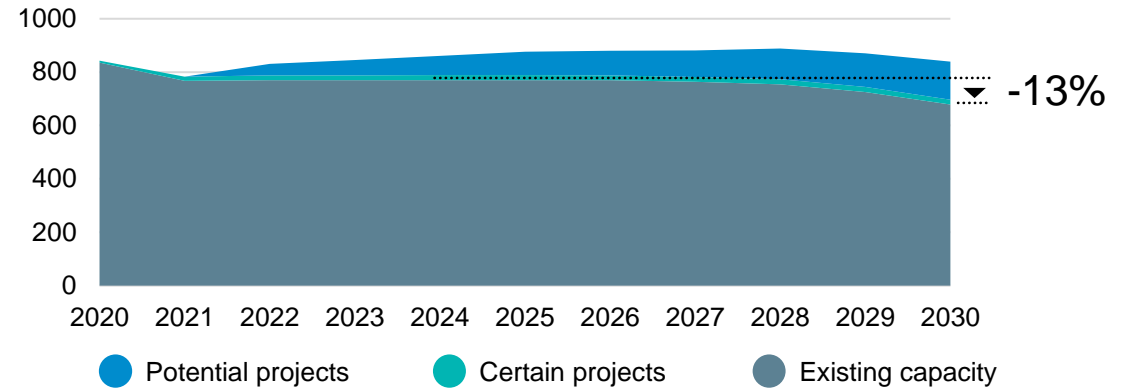
Mature markets

Copper, nickel, cobalt, zinc

- Thinner project pipelines, with mixed certainty
- Limited 2030 self-sufficiency rate (4-25%)
- Depletion ranges from 0% to 19%

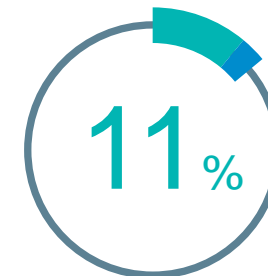
Mining projects have several challenges: local opposition, challenging economics, permitting, untested technologies

European mine output



European self-sufficiency rate

Cu



Copper

up to + 3% uncertain projects
% domestic mining of overall 2030 demand

Pillar 1: Fulfil domestic mining potential

**STARTING
POINT**

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

PILLAR 1

Fulfilling domestic mining potential

Key takeaway:

Political support + high ESG standards required together

**END
POINT**

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability

Pillar 2: Maintain and increase domestic refining output

STARTING POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

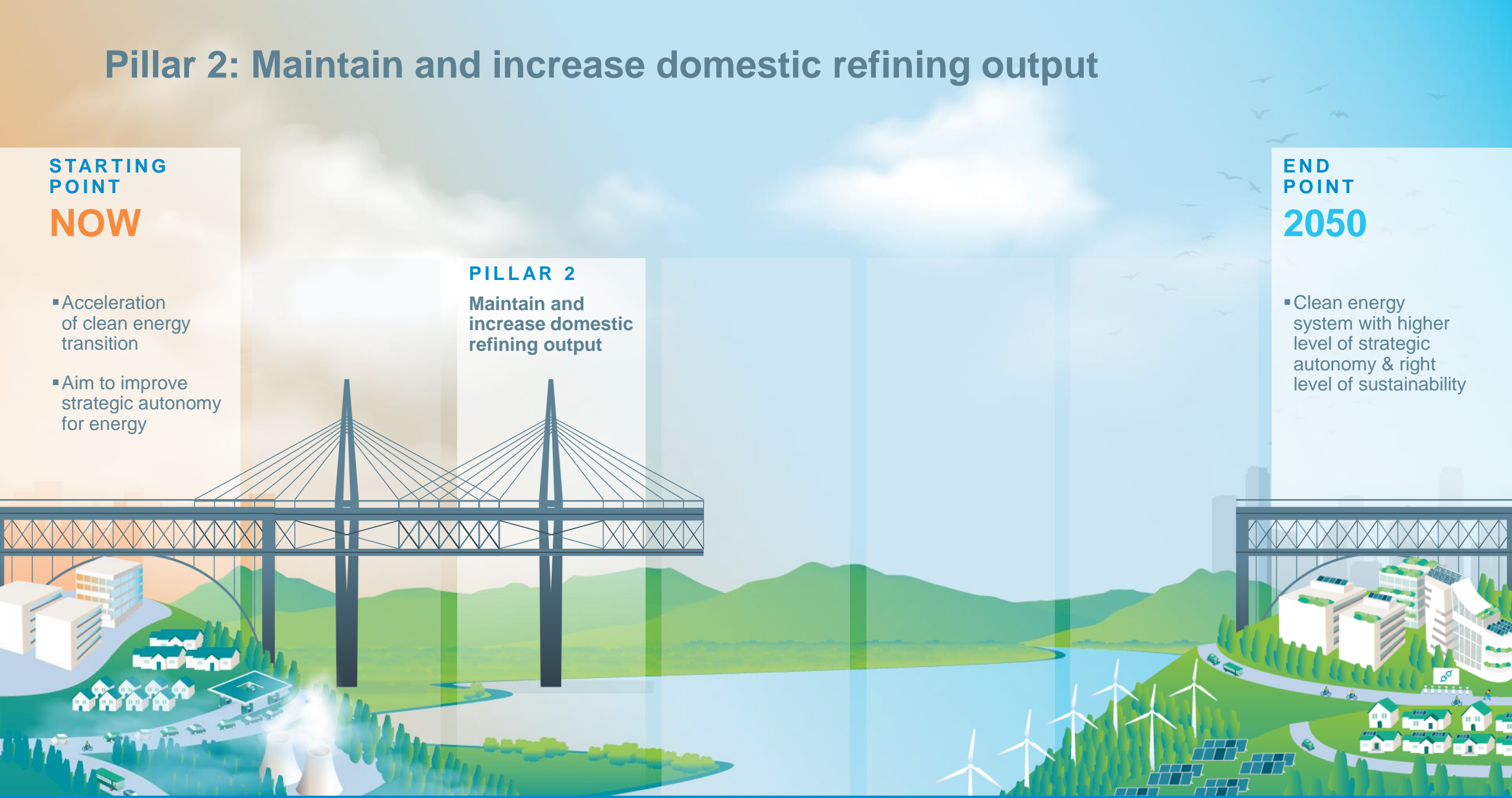
PILLAR 2

Maintain and increase domestic refining output

END POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability



European smelting and refining operations are struggling

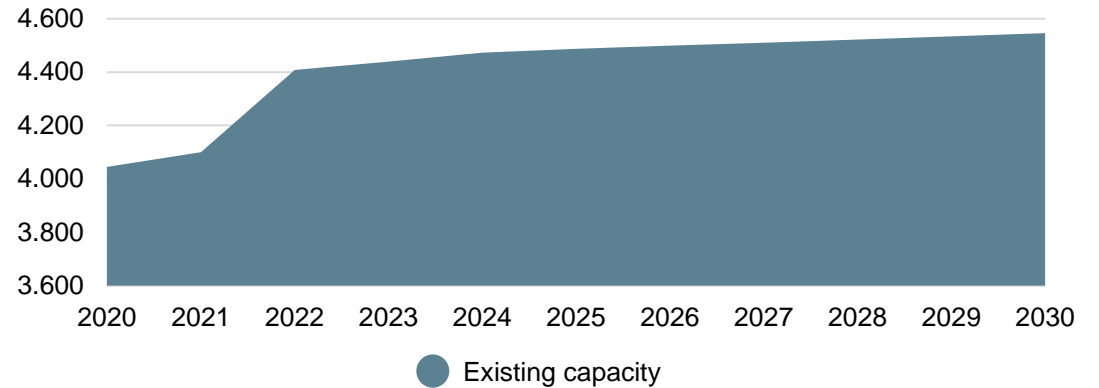
There are no real growth prospects, only few exceptions (1/2)

Struggling markets

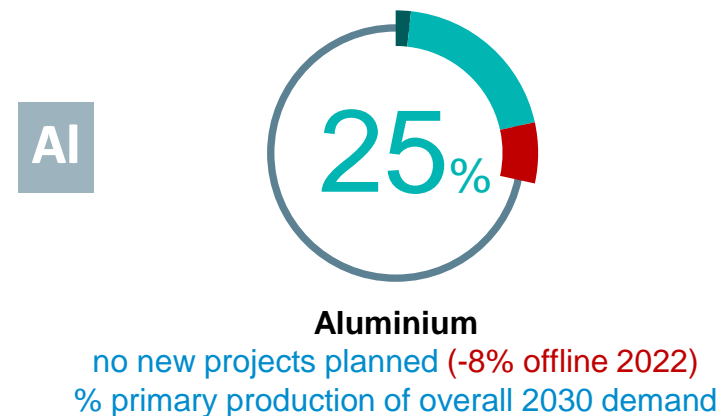
Aluminium, zinc, silicon

- High energy prices have big impact on power intensive smelters, leading to temporary closures (10-40%)
- Low-cost and subsidized imports, leading to trade defence measures

European metal outlook



European self-sufficiency rate



European smelting and refining operations are struggling

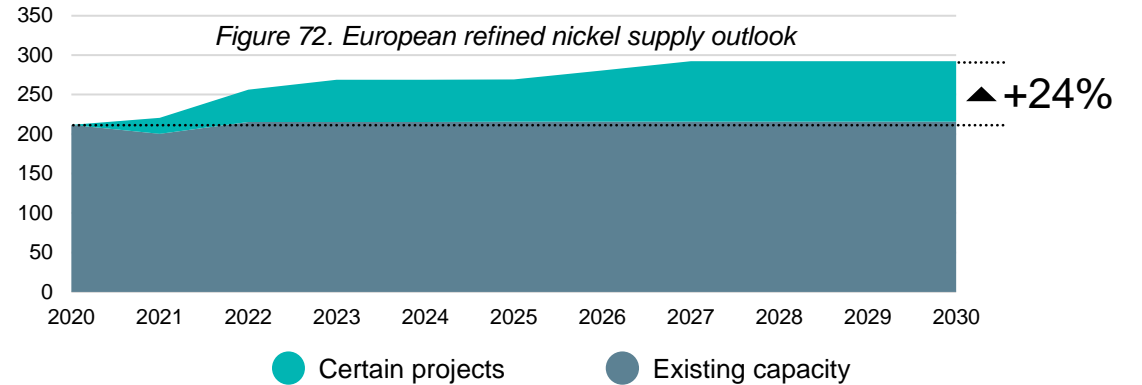
There are no real growth prospects, only few exceptions (2/2)

Metal growth potential

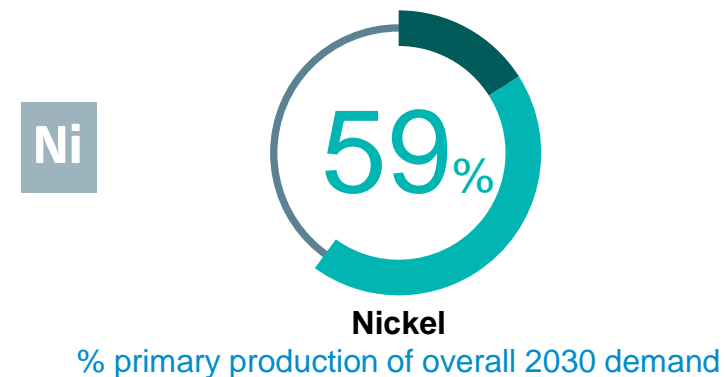
Nickel, lithium, rare earth elements

- Medium-sized growth potential
- New refining projects announced for nickel and lithium and rare earth elements

European metal output



European self-sufficiency rate



Pillar 2: Maintain and increase domestic refining output

STARTING POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

PILLAR 2

Maintain and increase domestic refining output

Key takeaway:

New capacity will require stronger business conditions

END POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability

Pillar 3: Secure sustainable imports from reliable partners

STARTING
POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

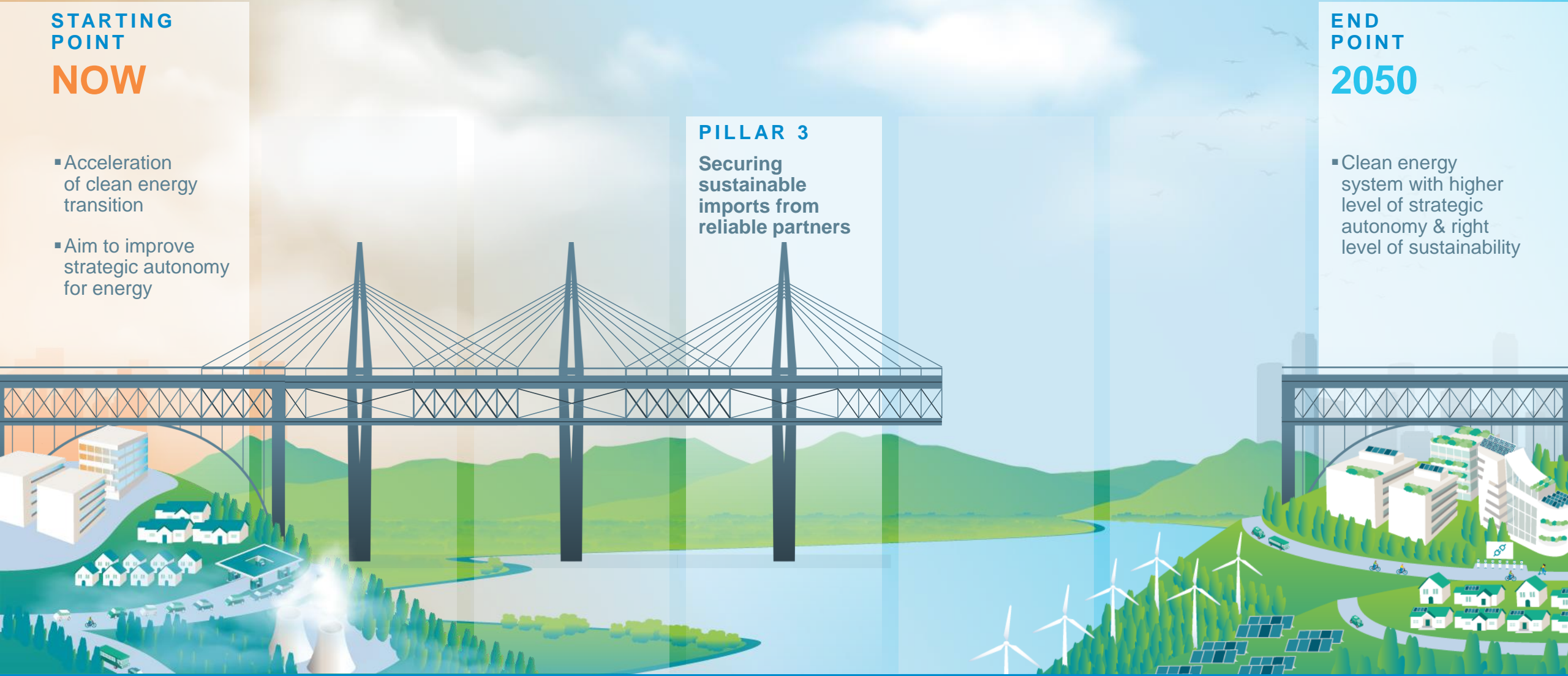
PILLAR 3

Securing sustainable imports from reliable partners

END
POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability

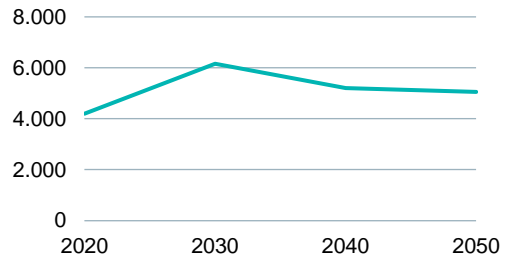


Europe will rely on imports for short-medium term demand growth

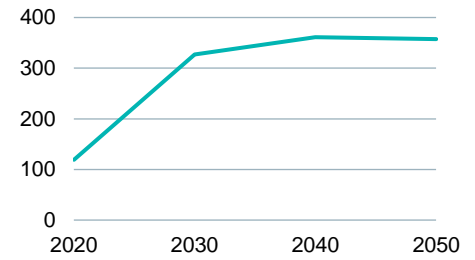
Securing sustainable imports from reliable partners (1/2)

More limited import reliance

Al Aluminium (Mt)

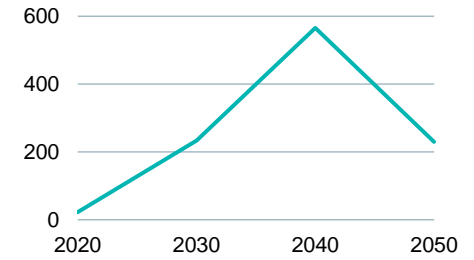


Si Silicon (kt)

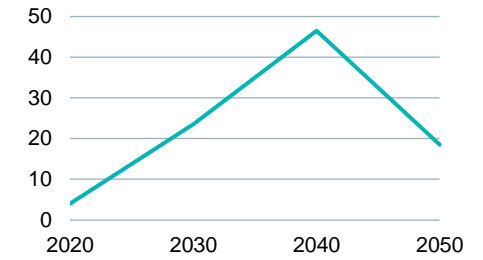


Strongly growing imports

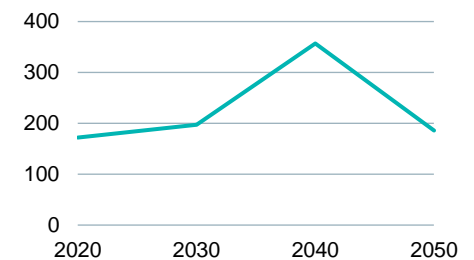
Li Lithium (kt)



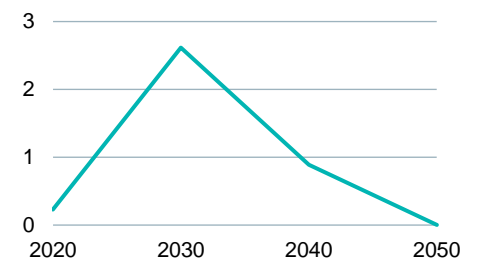
Co Cobalt (kt)



Ni Nickel (kt)



Nd Neodymium (kt)



Securing sustainable imports from reliable partners

Key challenges: availability, sustainability, diversification (2/2)



Availability

Can Europe secure the imported metals its energy transition needs?

Risk of 2030 supply bottlenecks for copper, lithium, nickel, cobalt, rare earths



Sustainability

Do we want to swap existing fossil fuel dependencies for new metals dependencies at low sustainability standards?

Certified responsible import partners needed



Diversification

Can Europe maintain its currently high diversification as metals requirements increase?

Risk of growing dependency on China, Russia

Pillar 3: Secure sustainable imports from reliable partners

STARTING POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

PILLAR 3

Securing sustainable imports from reliable partners

Key takeaway:

EU challenged to secure sustainable & diversified imports in tight global markets

END POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability

Recycling and technology/behavioural change will take effect after 2035

STRONGEST IMPACTS → 2035-2050

PILLAR 4
Maximise recycling, including new streams

PILLAR 5
Driving technological & behavioural change

Later stages of energy transition

Metals from 1st generation products to start recycling loop



Recycling a permanent supply source to Europe's industries

Pillar 4: Maximise recycling, including new streams

STARTING
POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

PILLAR 4

Maximise recycling, including new streams

END
POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability



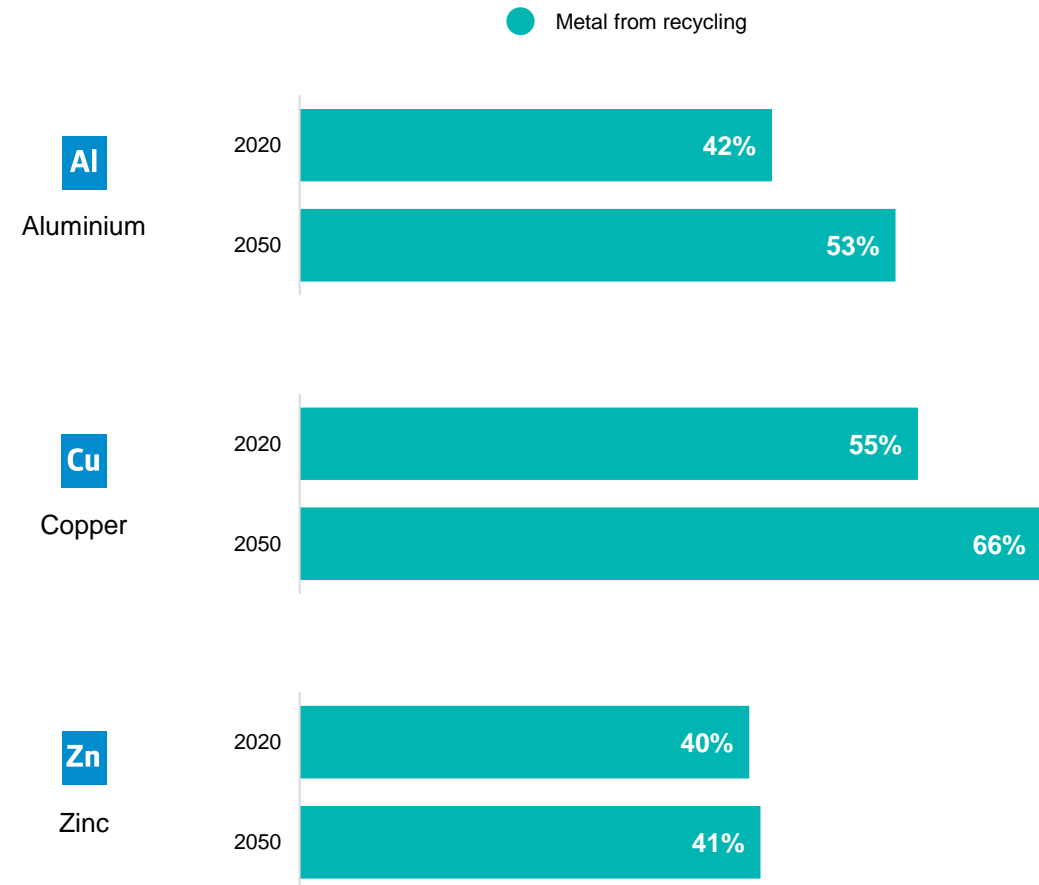
Recycling is Europe's key driver in creating strategic autonomy

Massive potential after 2040 for new energy commodities (1/2)

Mature markets

Aluminium, Copper, Zinc

- Recycling can supply 40-65% of Europe's base metals demand in 2050
- Addressing recycling bottlenecks will further raise rates:
 - Improved collection and sorting systems
 - Smarter product design
 - Control of scrap leakage



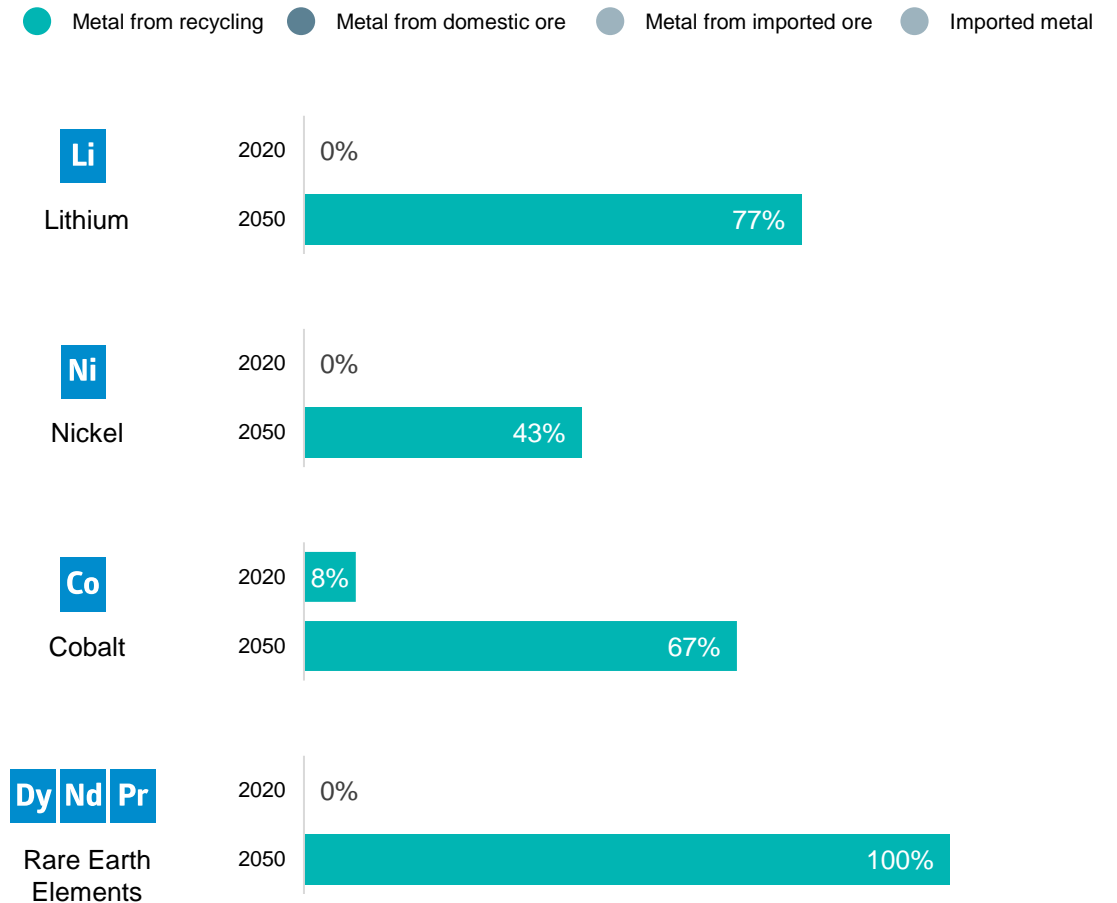
Recycling is Europe's key driver in creating strategic autonomy

Massive potential after 2040 for new energy commodities (2/2)

New energy commodities

Lithium, cobalt, nickel, rare earth elements

- Recycling volumes will rise after 2040, with potential for:
 - 65-75% of Europe's 2050 battery cathode needs*
 - 200% of Europe's 2050 rare earths needs*
- High supply from electric vehicles with 15 years expected lifetime
- Required:
 - New recycling capacity
 - Process improvements
 - Economic viability



Pillar 4: Maximise recycling, including new streams

STARTING POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

PILLAR 4

Maximise recycling, including new streams

Key takeaway:

Recycling is Europe's major long-term self sufficiency potential, requiring action now

END POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability

Pillar 5: Drive technological and behavioural change

STARTING
POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

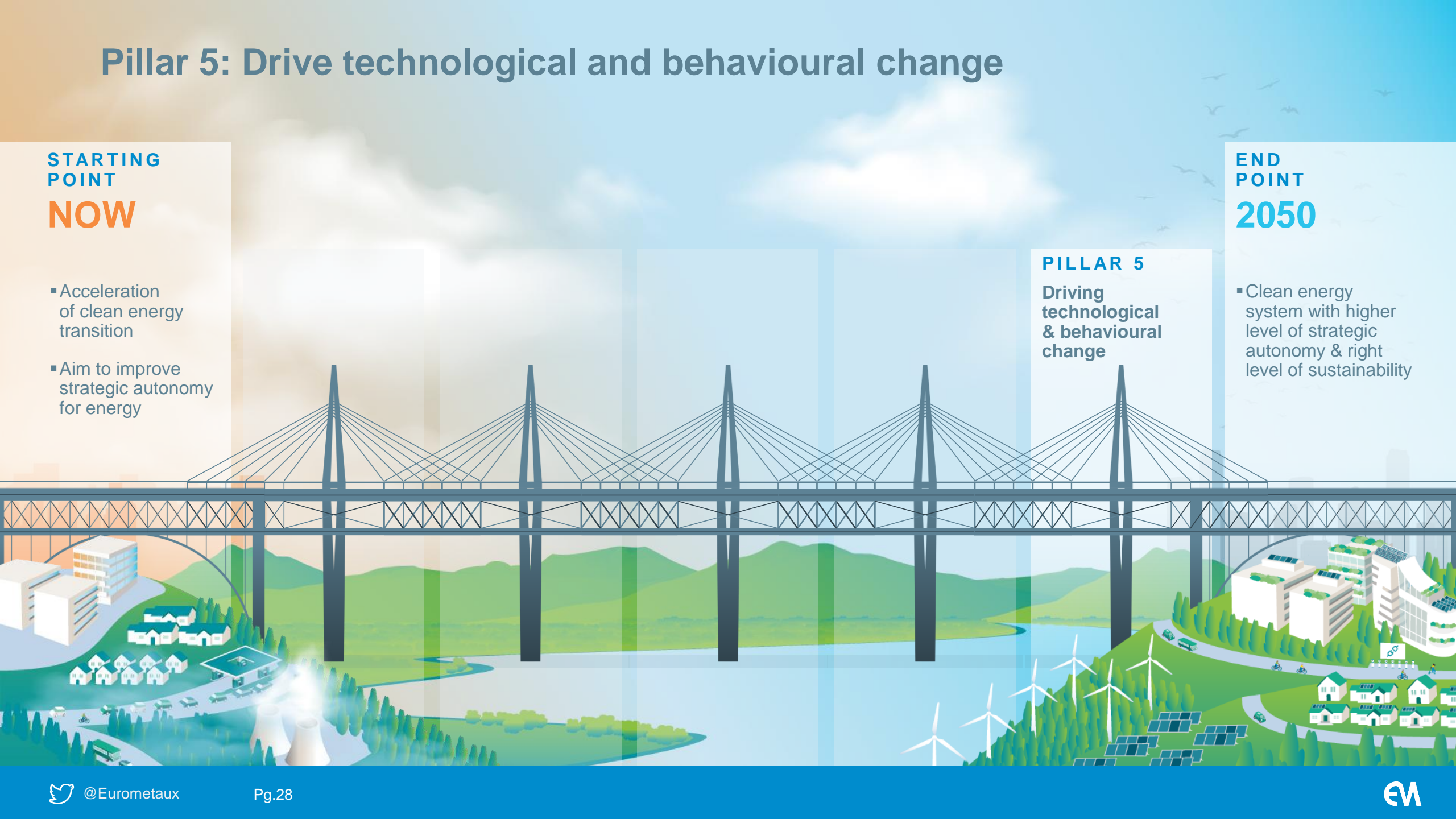
END
POINT

2050

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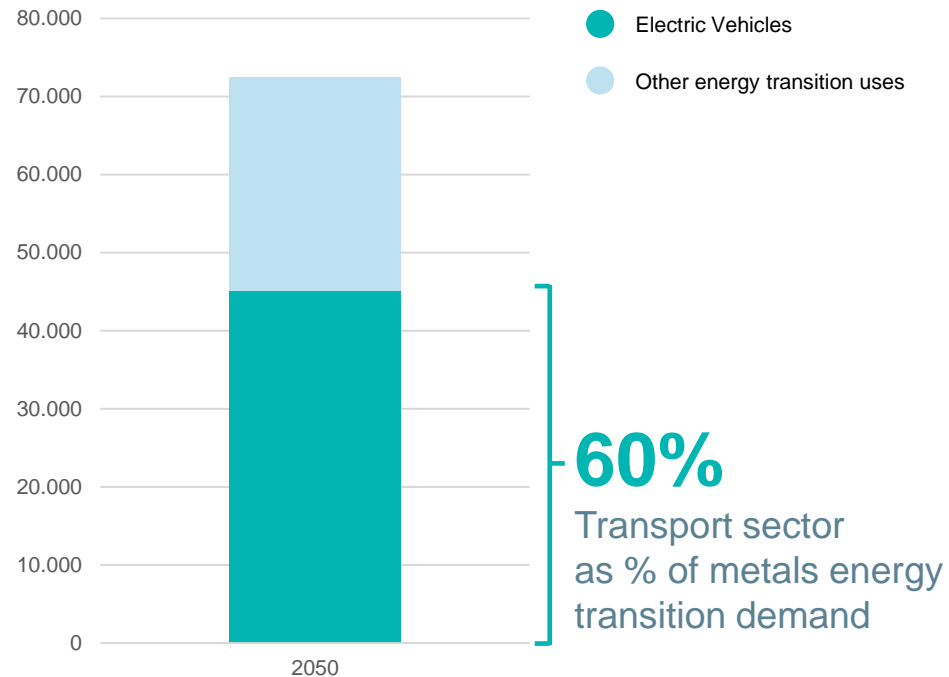
PILLAR 5

Driving
technological
& behavioural
change



Technological and behavioral change can reduce our demand

Time is needed to achieve measurable impact



Impacts will be longer term

Innovation and substitution

- Europe: frontrunner in R&D to reduce metals intensities in products
- Substitution in focus: cobalt in batteries, non-rare earth magnets

Behavioral change

- Transport sector represents 60% of metals demand + big supply risks
- Shared economy can here make a real difference (but not quantified)

Pillar 5: Drive technological and behavioural change

STARTING
POINT

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END
POINT

2050

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PILLAR 5

Driving technological & behavioural change

Key takeaway:

Further efforts needed if longer-term change will be realised

Conclusion: 10 EU actions to bridge its looming metals supply gap

STARTING POINT

NOW

- Acceleration of clean energy transition
- Aim to improve strategic autonomy for energy

NOW → 2040

PILLAR 1

Fulfil domestic mining potential

- Take forward viable mining projects
- Set high ESG standards

PILLAR 2

Maintain and increase domestic refining output

- Prevent further closures of existing capacity
- Support new refineries for battery metals & rare earths

PILLAR 3

Secure sustainable imports from reliable partners

- Diversify trade partners while driving ESG
- Source from certified, responsible suppliers

2035 ONWARDS

PILLAR 4

Maximise recycling, including new streams

- Remove current bottlenecks on collection, sorting and retention
- Invest into new recycling for batteries, PV, magnets

PILLAR 5

Drive technological & behavioural change

- Ensure continued R&D leadership on optimisation
- Investigate how to evolve consumption patterns in the transport sector

END POINT

2050

- Clean energy system with higher level of strategic autonomy & right level of sustainability

Read more!



www.eurometaux.eu/metalscleanenergy



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Metals for Clean Energy: Pathways to solving Europe's raw materials challenge