RED: transposition and challenges in the transport sector in North Macedonia

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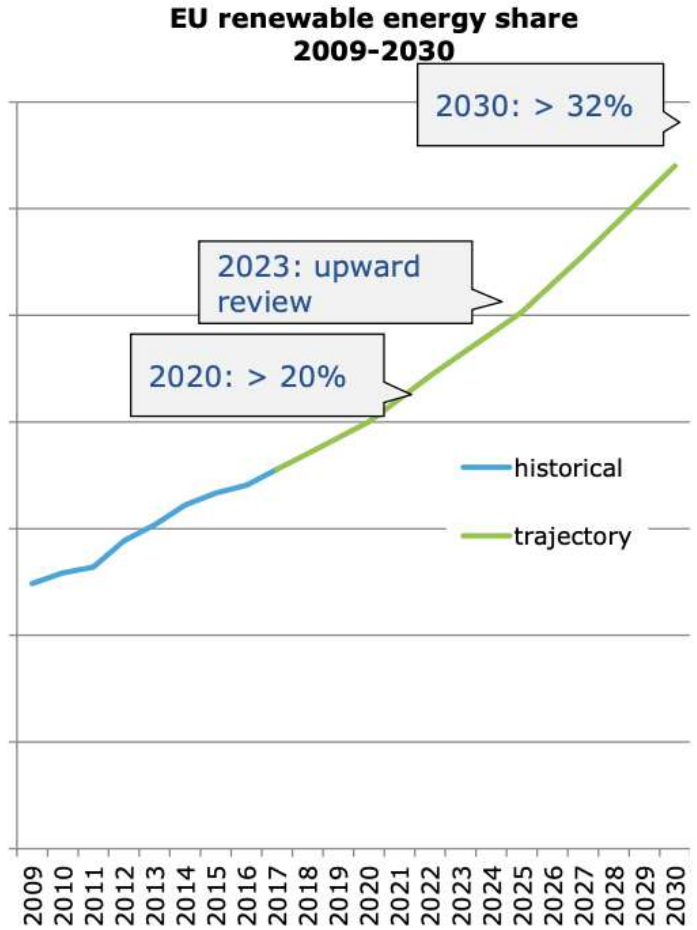
21 November 2023, Tbilisi, Georgia

RED

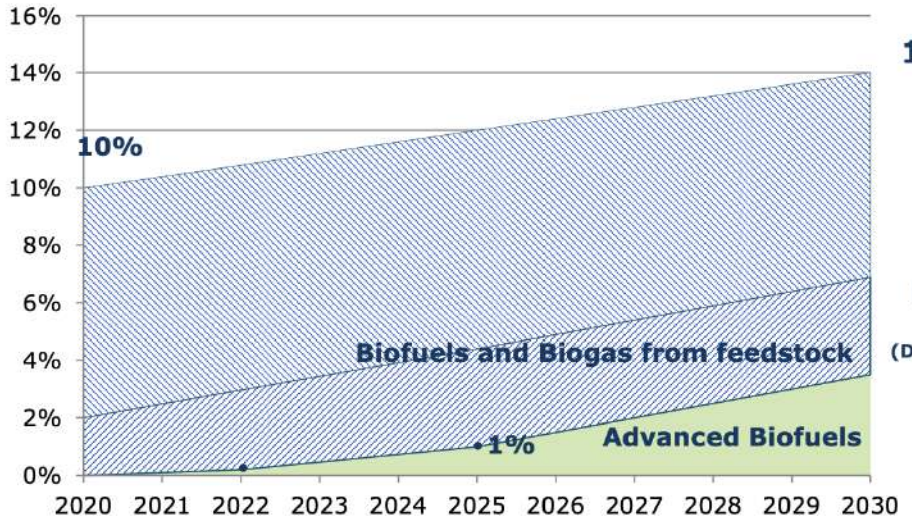
A NEW EUROPEAN APPROACH TO RENEWABLES



- **Binding EU-target of at least 32%** (upward review in 2023)
- Underpinned by **national contributions**
- **Formula** to assess contributions (in case of ambition gap)
- **Collective responsibility** of target achievement
- **Joint measures** (EU financial platform)

RED

MAINSTREAMING RENEWABLE ENERGY IN TRANSPORT



Multipliers

- **Conventional** biofuels, bioliquids and biomass from food and feed crops frozen around 2020 levels
- **High ILUC risk** biofuels first frozen, and then gradually reduced towards 0% by 2030

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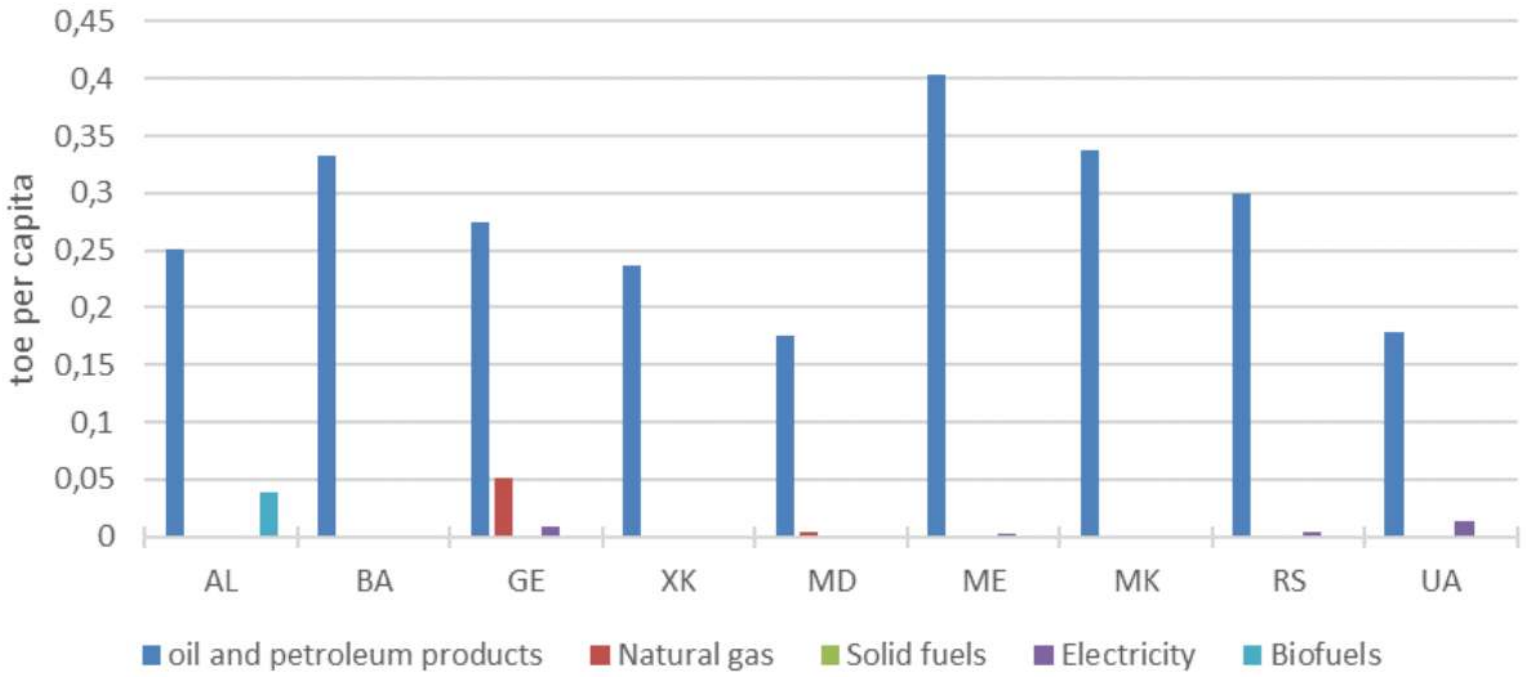


Figure 3: Energy consumption in transport per capita by type of fuel in 2018[14]

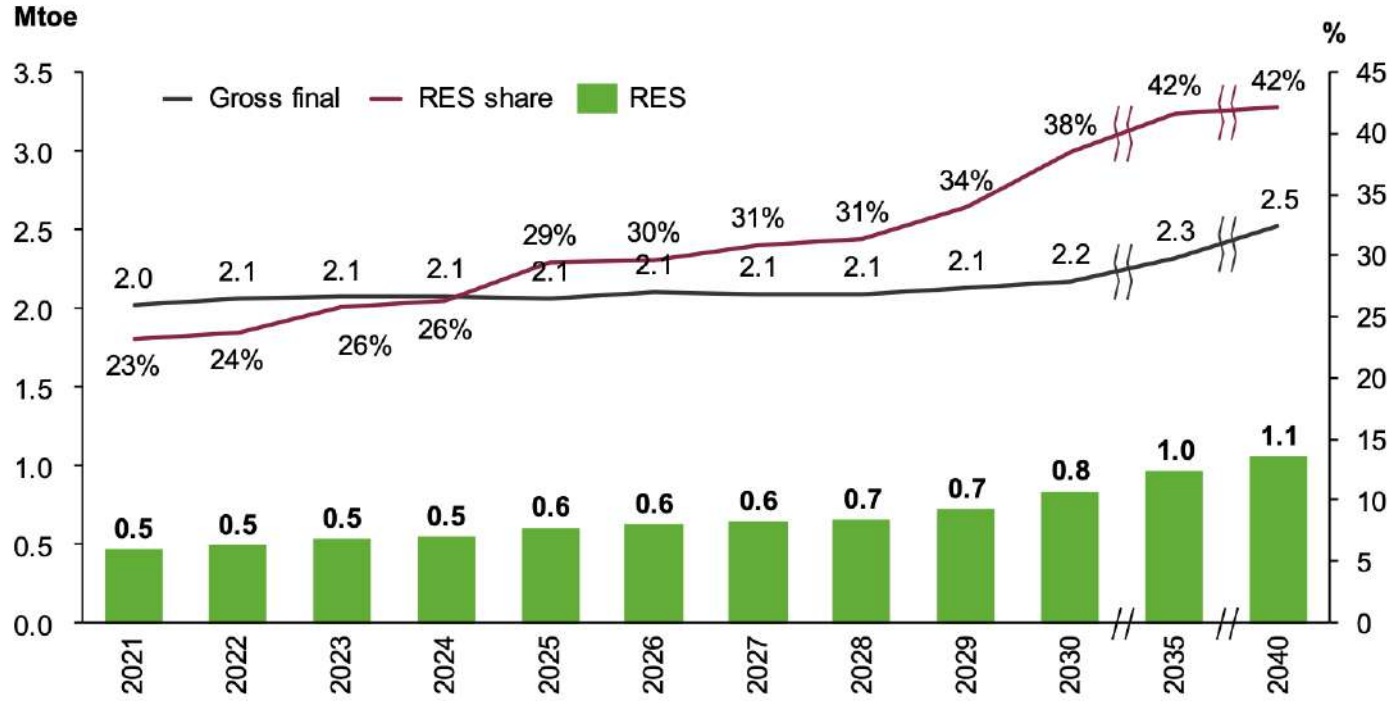
RE Targets

Targets for share of energy from renewable sources in gross final consumption of energy

Contracting Party	2005 Share of energy from renewable sources	2020 Target for share of energy from renewable sources	2030 Target for share of energy from renewable sources
Albania	31,2%	38%	**52,0%**
Bosnia and Herzegovina	34,0%	40%	**43,6%**
Georgia	n/a	n/a	**27,4%**
Kosovo*	18,9%	25%	**32,0%**
Moldova	11,9%	17,0%	**27,0%**
Montenegro	26,3%	33%	**50,0%**
North Macedonia	17,2%	23%	**38,0%**

RE Share – Future estimates

Figure 31. Share of energy from renewable sources in gross final consumption of energy, with an indicative trajectory



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

Transport evolution

Figure 50. Transport (passenger + freight) evolution

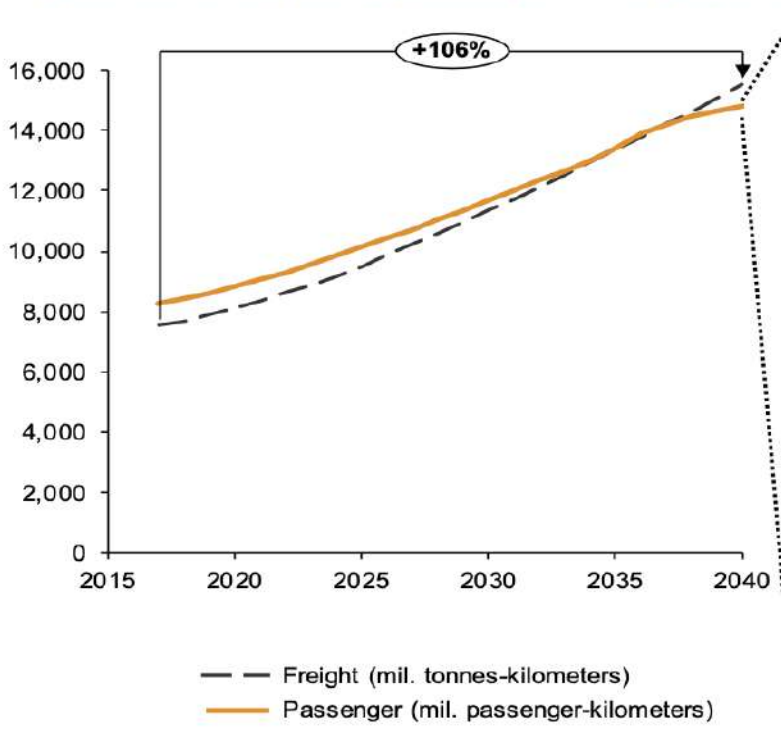
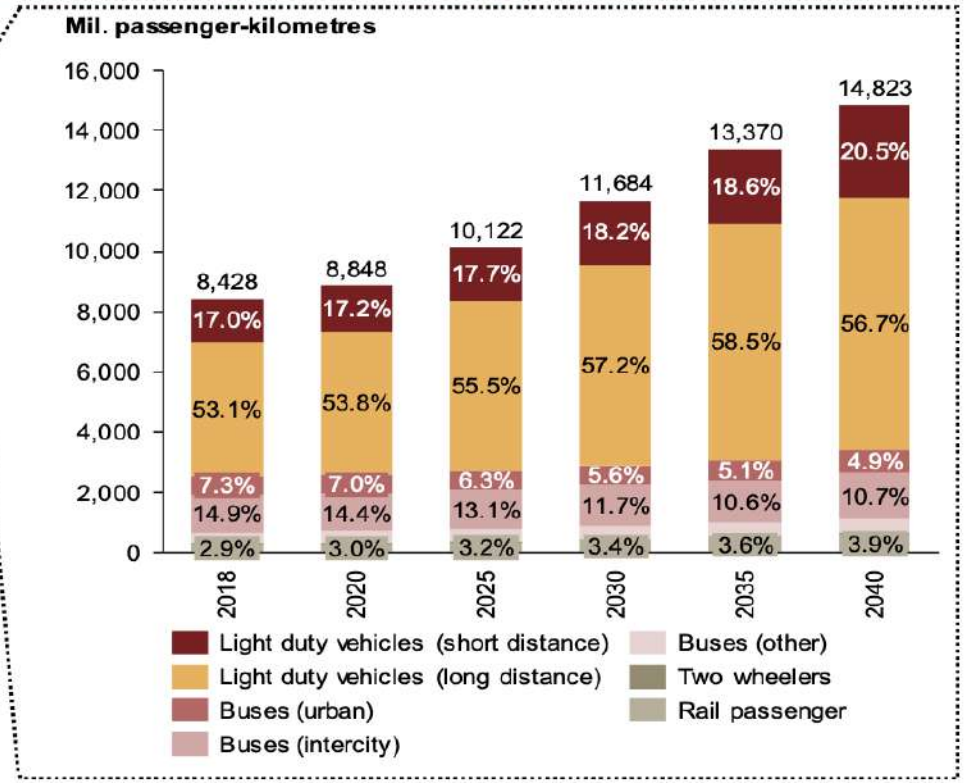


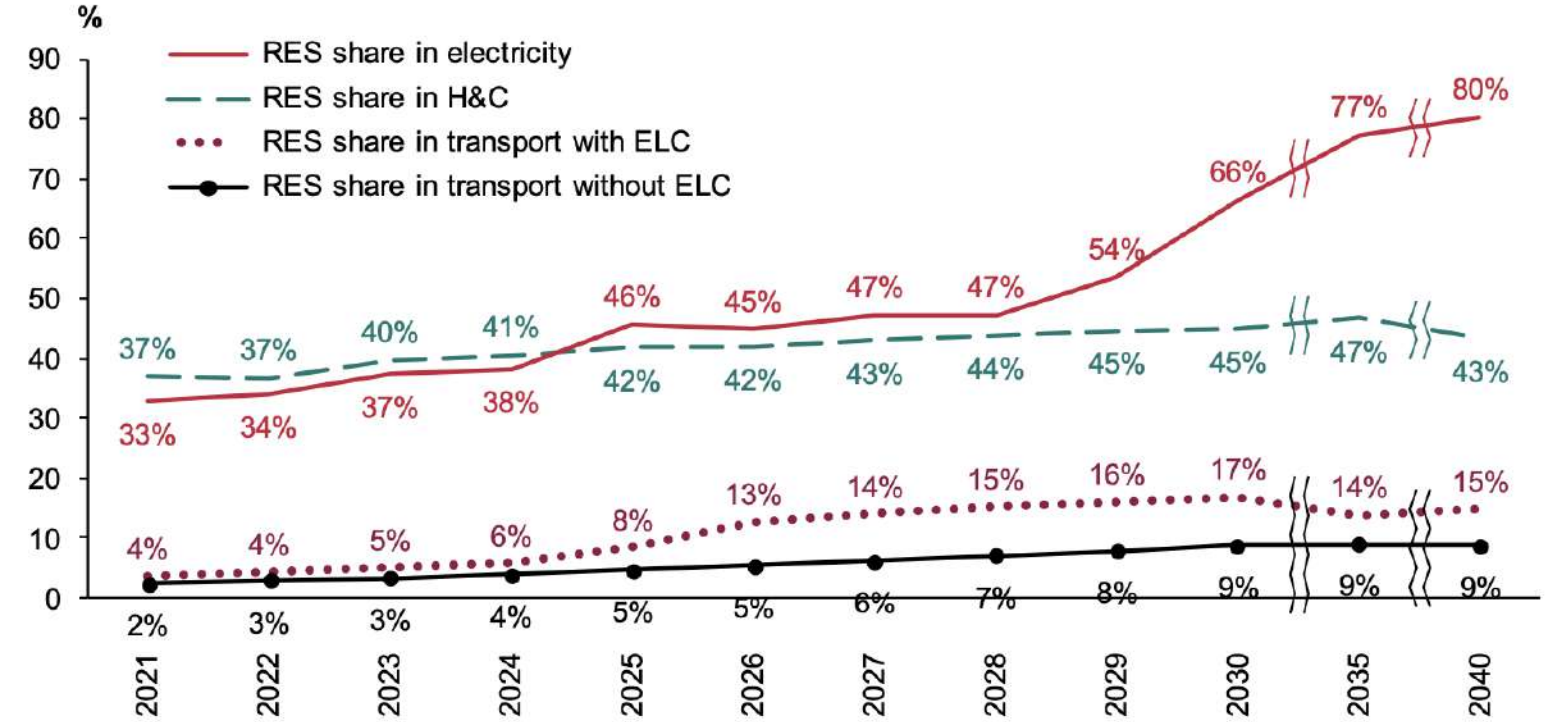
Figure 51. Passenger transport evolution



Source: MARKAL input data for the Strategy for energy development up to 2040, project team analyses

RE Targets - transport

Figure 32. Estimated trajectories for the share of renewable energy in final energy consumption in the electricity, heating and cooling and transport sector



Source: MARKAL results from the Strategy for energy development up to 2040, project team analyses

Measures to decarbonization of the transport sector in Macedonia

Priority government support measures

Decarbonization (Renewable energy)	**38% share in gross final energy consumption**					
	66% share in gross electricity production					
	45% share in gross final energy consumption for heating and cooling					
	10% in final energy consumption in transport					
	PM_EE17	Increased use of the railway	√	√	√	√
	PM_EE18	Renewing of the national car fleet	√	√	√	
	PM_EE19	Renewing of other national road fleet	√	√	√	√
	PM_EE20	Advanced mobility	√	√	√	√
	PM_EE21	Construction of the railway to Republic of Bulgaria	√	√	√	√
	PM_EE22	Electrification of the transport	√	√	√	√

*Source: Enterprise Survey ILO/EBRD

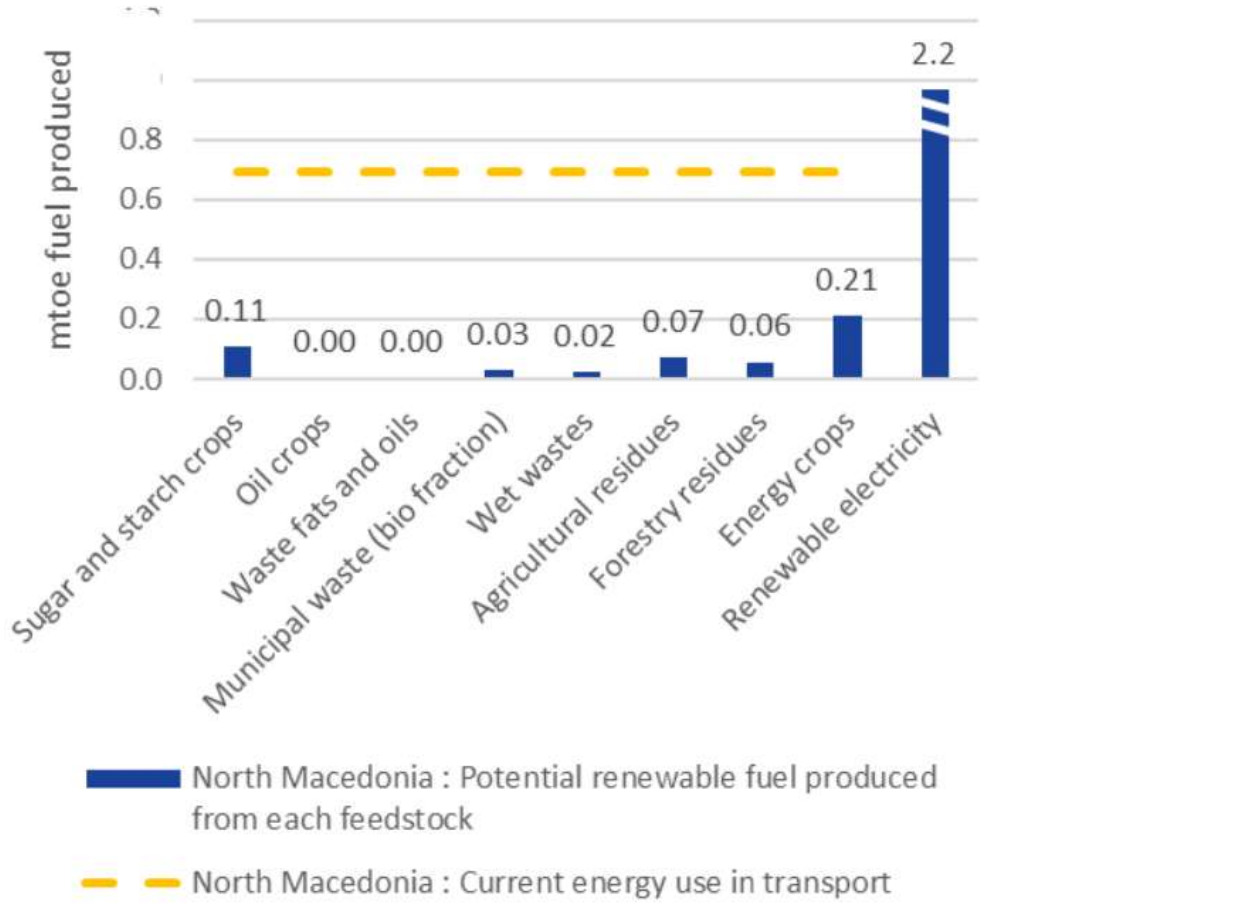
Measures to decarbonization of the transport sector in Macedonia

Priority government support measures

Decarbonization (Renewable energy)	**38% share in gross final energy consumption**			
	66% share in gross electricity production			
	45% share in gross final energy consumption for heating and cooling			
	10% in final energy consumption in transport			
PM_EE17	Increased use of the railway	180.6	180.6	0.0
PM_EE18	Renewing of the national car fleet	1599.5	2167.7	568.2
PM_EE19	Renewing of other national road fleet	2300.0	2300.0	0.0
PM_EE20	Advanced mobility	/	/	/
PM_EE21	Construction of the railway to Republic of Bulgaria	720.0	720.0	0.0
PM_EE22	Electrification of the transport	1201.7	8292.3	7090.6

*Source: Enterprise Survey ILO/EBRD

RE fuels potential



North Macedonia: Potential renewable fuel production, compared to current energy use in road and rail transport

Perspectives for RES-T contributions

Table 53: Potential RES-T contributions from all options in North Macedonia

Option		Contribution to RES-T target (%) incl. multiple counting	Amount of renewable fuel used (ktoe)
Biofuels and liquid RFNBOs	1. Crop-based biofuels in road transport	2.0%	15.6
	2. Liquid fuels produced from Annex IX B feedstocks in road transport	3.4%	13.3
	3. Liquid advanced Biofuels (based on Annex IX A feedstocks) in road transport	3.1%	11.9
	4. Liquid RFNBOs in road transport	0.58%	4.49
	5. Renewable methane in road transport	0.44%	1.7
	6. Renewable liquid fuels in shipping	0.0%	0.00
	7. Renewable liquid fuels in aviation	0.0%	0.00
	8. Renewable liquid fuels in rail	0.0%	0.00
Electricity	9. Rail electrification	0.608%	3.2
	10. Electric public transport (bus, trolleybus, tram, metro)	0.010%	0.03
	11. Electric road vehicles (passenger cars and trucks)	0.352%	0.69
Hydrogen	12. Hydrogen in rail	0.003%	0.02
	13. Hydrogen bus and coach (urban bus, long distance coaches)	0.004%	0.03
	14. Hydrogen road vehicles (passenger cars and trucks)	0.088%	0.69
	15. Hydrogen in refineries	0.0%	0.00
Total		10.5%	51.6

Interesting facts – discussion

PERCEPTION OF ENERGY

28% TRANSPORT

22% RESIDENTIAL

8% NON-RESIDENTIAL

INDUSTRY ALONE CONTRIBUTES TO 1% OF ANUAL INCREASE IN ENERGY CONSUMPTION

COVID-19 CRISIS CONTRIBUTED ONLY 1.6% DECLINE IN ENERGY CONSUMPTION DUE TO LOWER INDUSTRIAL ACTIVITY IN SOME REGIONS

32% INDUSTRY (heat is the primary problem)

8% CONSTRUCTION INDUSTRY

ECONOMIC GROWTH AND ENERGY DEMAND ARE LINKED

ENERGY IS EVERYWHERE

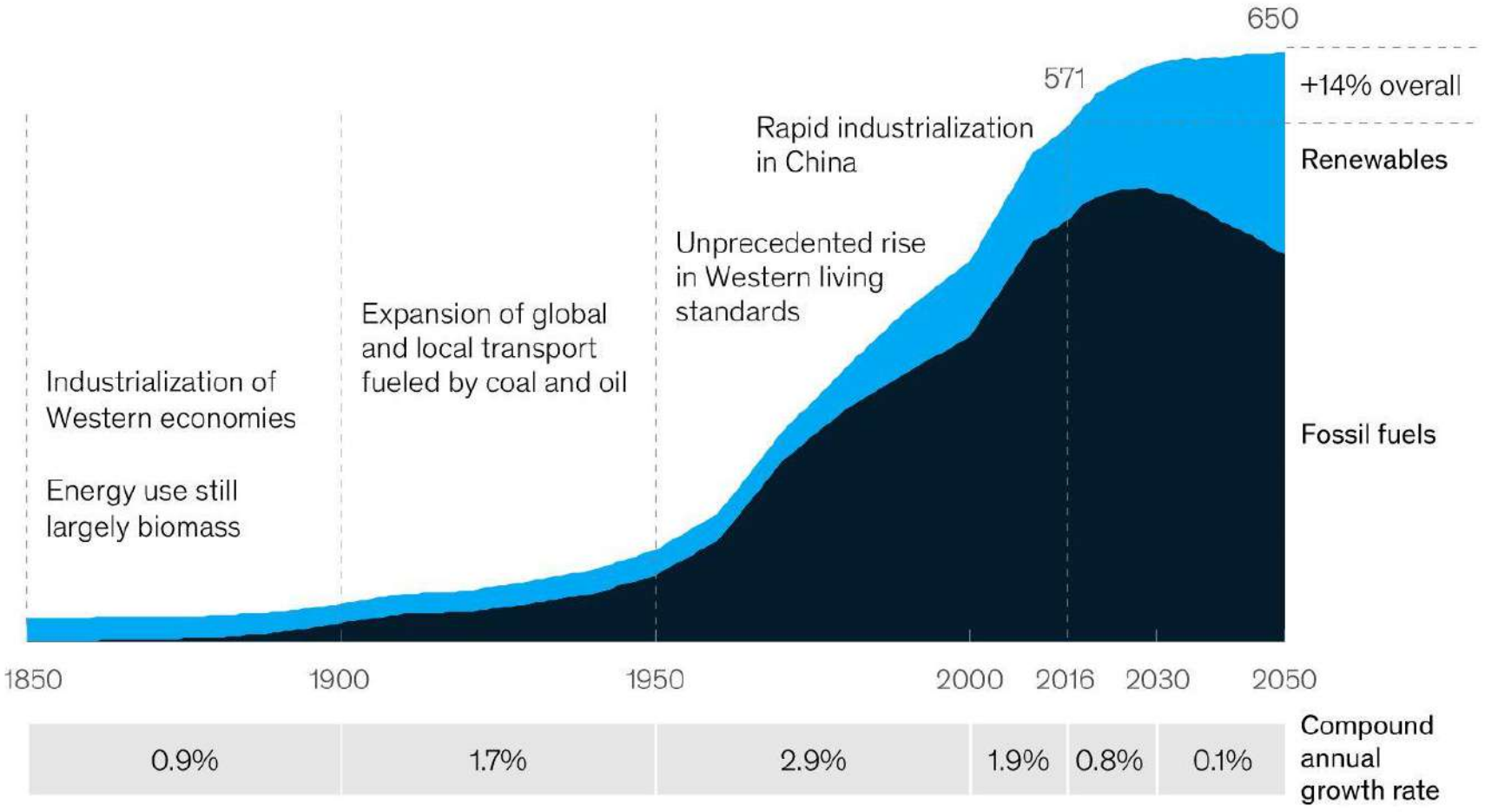
- Your average apartment requires around 65 MWh of energy to be built
- Your average combustion car requires around 17 MWh of energy to be built
- Your average electric car requires around 47.6 MWh of energy to be built
- Your average toilet paper roll requires around 0.7 kWh of energy to be produced
- Your average bread (1kg) requires around 5 kWh of energy to be produced
- Your average tomatoes (1kg greenhouse) require around 7.5 kWh of energy to be produced
- Your average t-shirt requires 0.4 kWh of energy to be produced

1 Wind turbine 3.5 MW or 1 Solar panel 300 W

- Your average apartment requires around 18.5h of wind or 24.7 years of solar to be built
- Your average combustion car requires around 5h of wind or 6.5 years of solar to be built
- Your average electric car requires around 13.6h of wind or 18 years of solar to be built
- Your average toilet paper roll requires around 1 second of wind or 2.3h of solar to be produced
- Your average bread (1kg) requires around 5 seconds of wind or 16.6h of solar to be produced
- Your average tomatoes (1kg greenhouse) require around 7.7 seconds of wind or 25h of solar to be produced
- Your average t-shirt requires half a second of wind or 1.3h of solar to be produced

ENERGY IS PREREQUISITE FOR DEVELOPMENT

Global primary energy demand, millions of terajoules



Source: McKinsey Energy Insights' Global Perspective, January 2019

End of ICE

Table 17 **Countries that have announced a 100% ZEV sales target, ICE ban or target for ICE free fleet**

Country	Target year – 100% ZEV sales target or ICE sales ban	Target year – ICE free fleet
Costa Rica	2050	
Denmark	2030	
France	2040	
Iceland	2030	
Ireland	2030	
Israel	2030	2045
Netherlands	2030	2045
Norway	2025	
Portugal	2040	
Slovenia	2030	
Spain	2040	2050
Sri Lanka		2040
United Kingdom	2040	

HISTORY OF ELECTRIC CARS - 19TH CENTURY

1828

FIRST MOTOR

Anyos Jedlik's electromotor

1832-39

FULL SIZE CAR

Robert Anderson creates first EV

1834

DC MOTOR

The Davenports create a DC electric motor

1859

LEAD ACID BATTERY

Gaston Planté's rechargeable battery

1884

PRODUCTION CAR

Thomas Parker small scale production EV

1891

MORRISON ELECTRIC

First successful United States EV

1897

ELECTRIC TAXIS

Hit the streets of London and NYC

1898

PORSCHE P1

Ferdinand Porsche built his first car, the P1

1900

FIRST HYBRID

Ferdinand Porsche designs the first hybrid

HISTORY OF ELECTRIC CARS - 20TH CENTURY

UNECE

1902

MODEL-T FORD

Mass production. Hugely popular, quite cheap

1912

STARTER MOTOR

No more hand cranking for petrol engines

1935

THE WILDERNESS

By 1935 there are practically no EVs on the roads

1935-70

THE LOST YEARS

A successful oil industry runs the show

1971

LUNAR ROVER

Boeing built the first Lunar Roving Vehicle, the LV-1

1972

HYBRID GODFATHER

Victor Woak builds full-size hybrid vehicle

1990

ZEV MANDATE

California passes its Zero Emission Vehicle Mandate

1997

ZEV RESPONSE

The GM EV1, Honda EV Plus, etc produced

HISTORY OF ELECTRIC CARS - 21ST CENTURY

UNECE

2002

CALIFORNIA SUED

Manufacturers throw their toys out the pram

2005

CRUSHING DEFEAT

GM recalls and crushes all of their EV1s

2006

TESLA ROADSTER

First performance EV is produced

2009

NISSAN LEAF

First affordable, practical electric car

2012

RENAULT ZOE

Another affordable, well designed EV

2019

PORSCHE TAYCAN

Porsche go back to the form of the P1

2019-20

MODEL 3

Affordable Tesla becomes most popular EV ever

2020

FORD MUSTANG

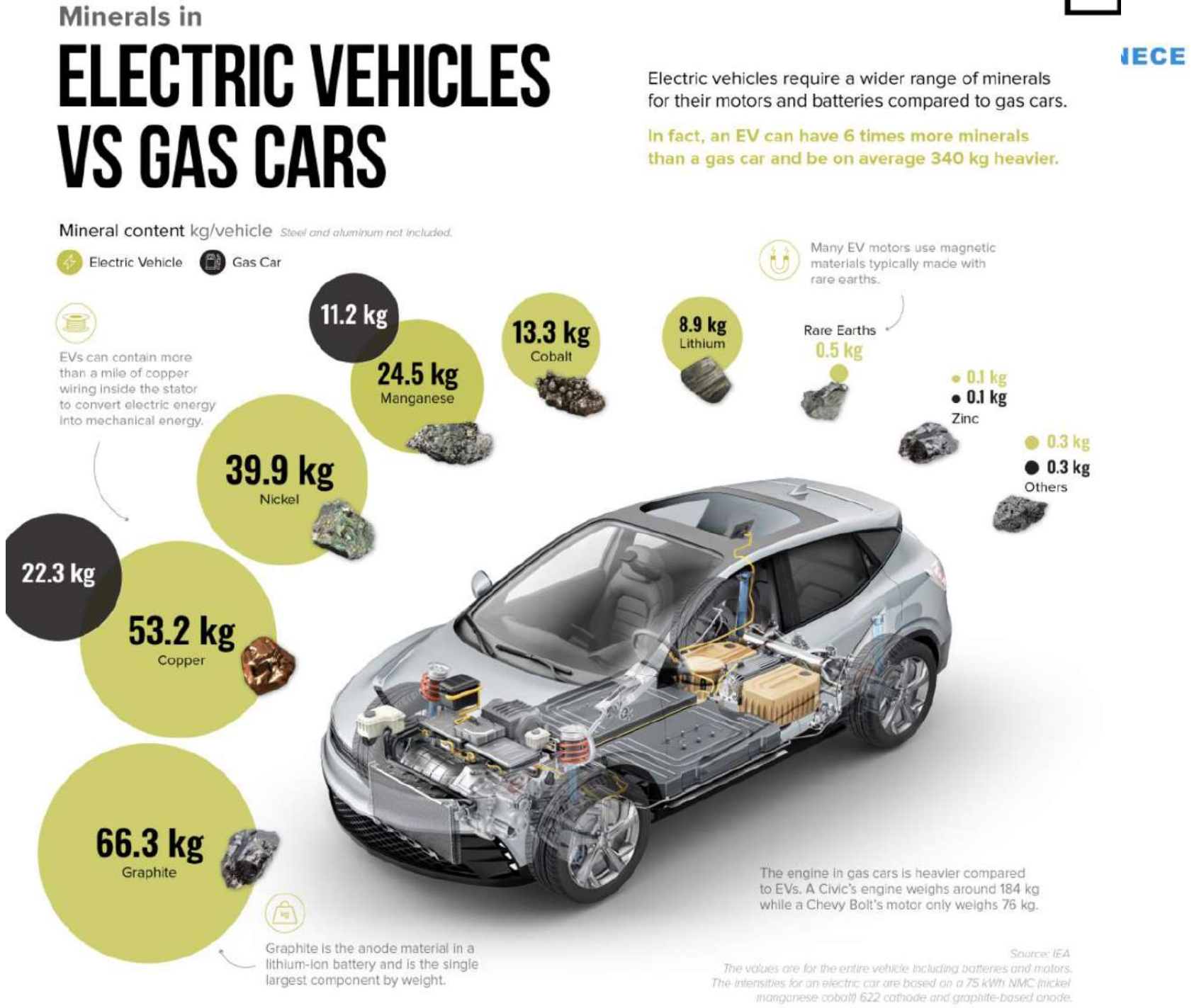
Ford electrify their mustang

2020-21

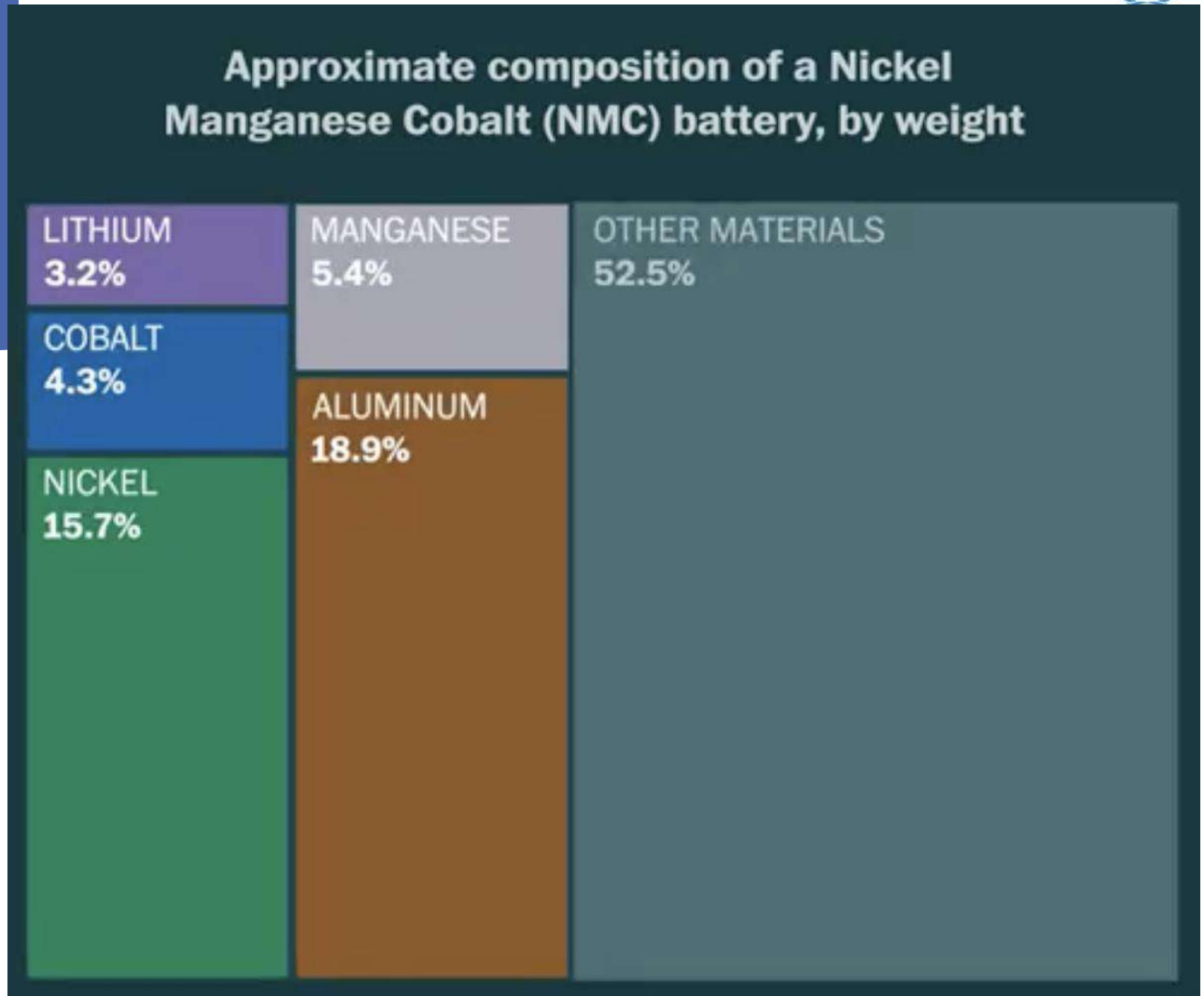
MAINSTREAM?

A plethora of new EVs

Material consumption



Material consumption



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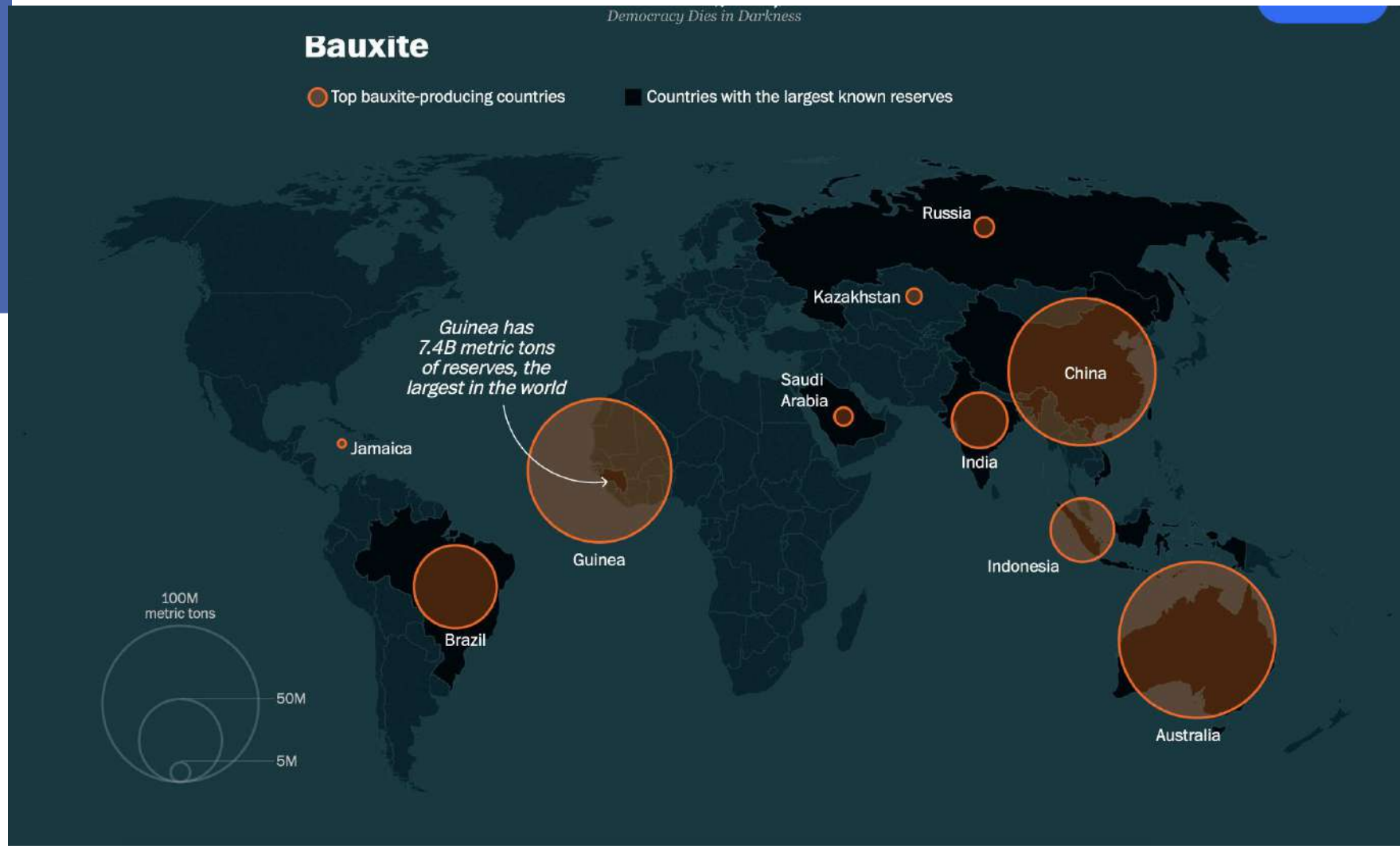

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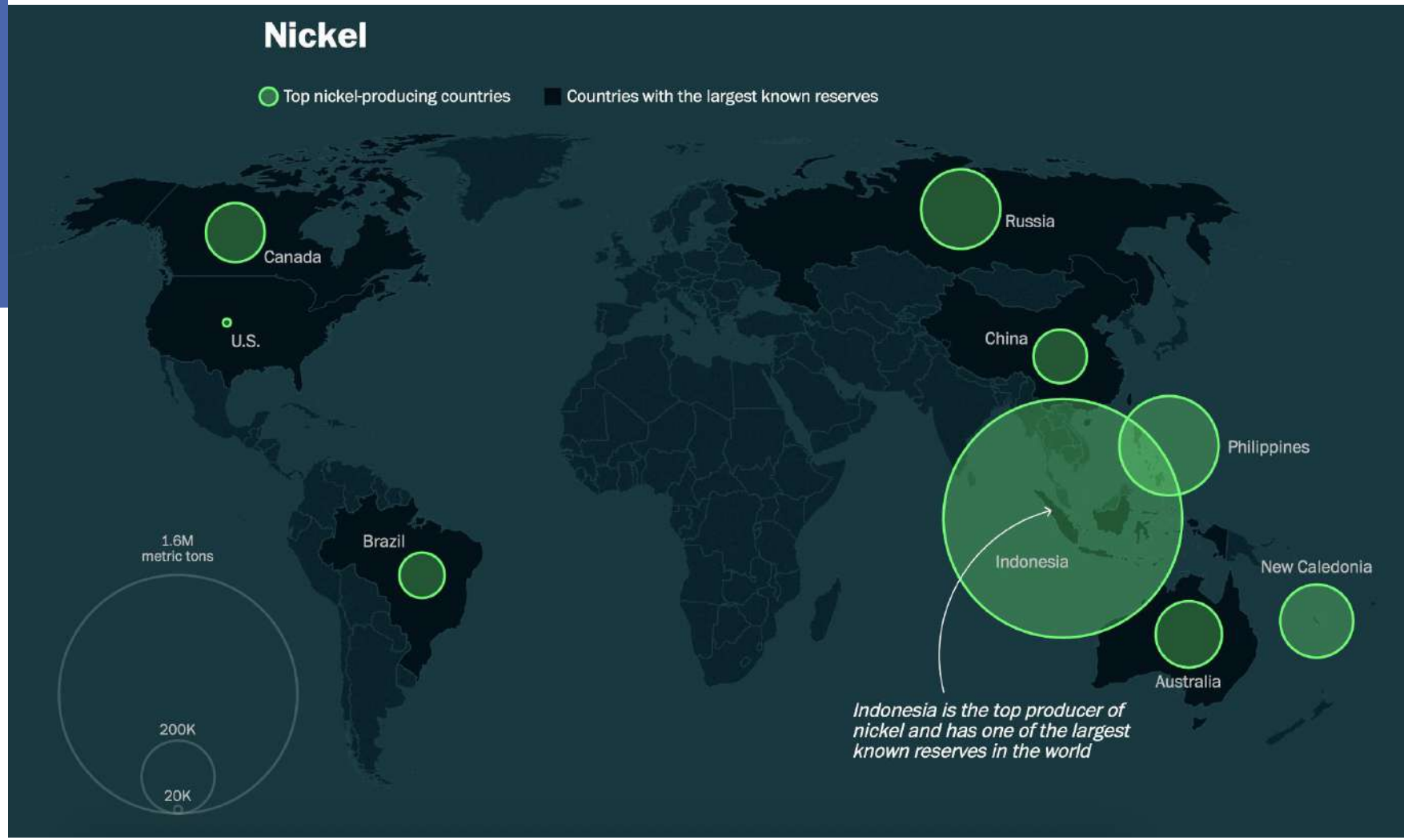

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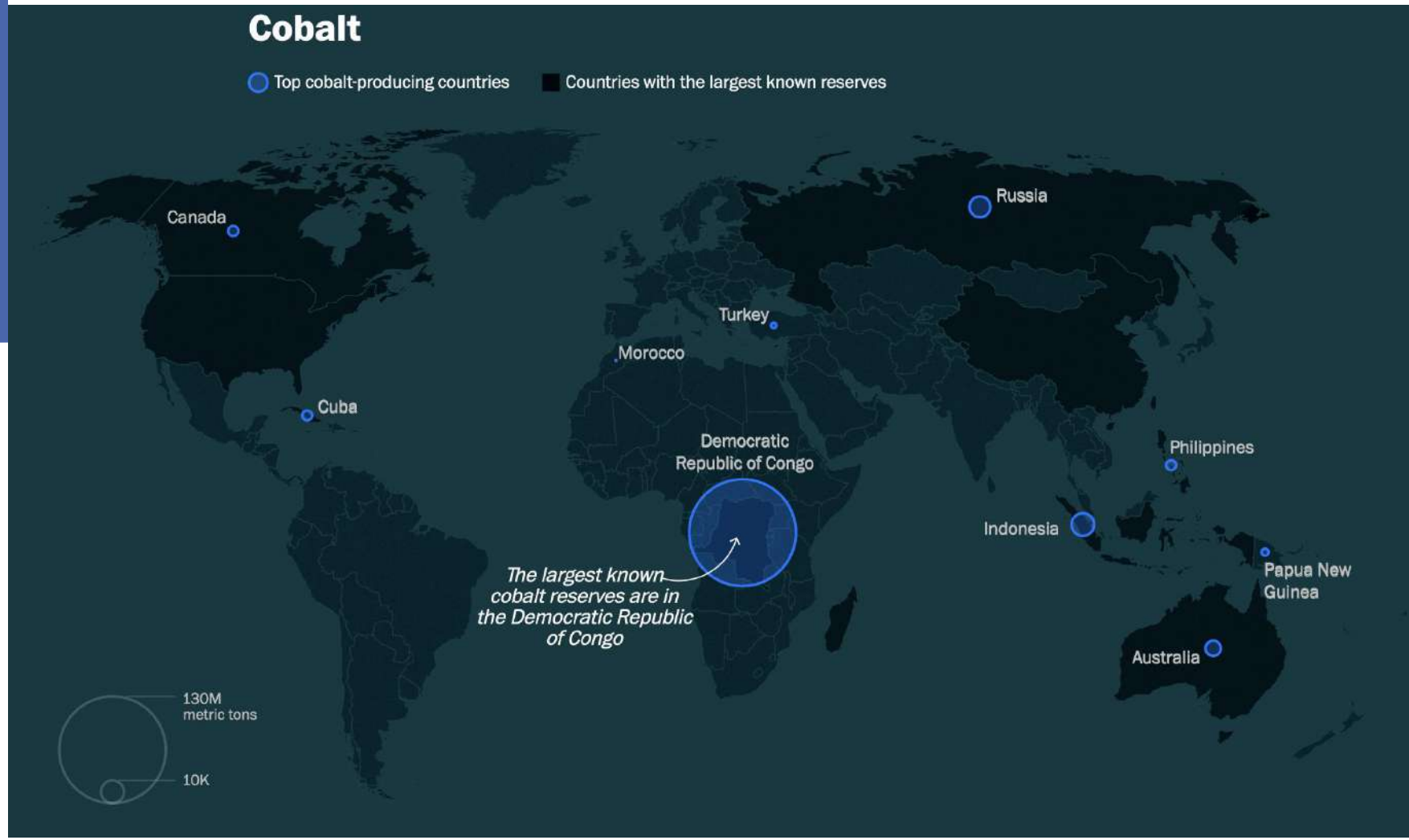

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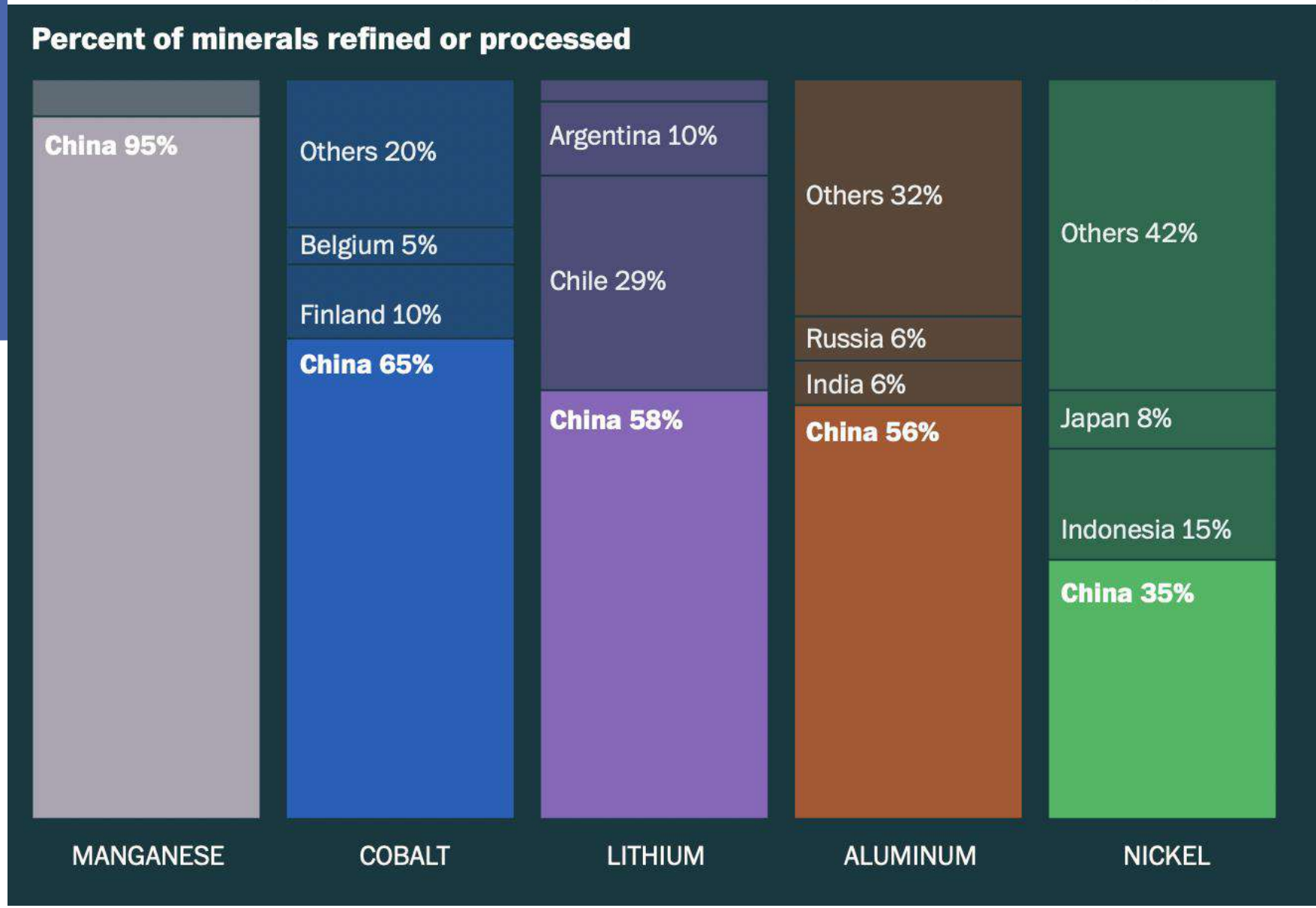


Material consumption Nikel mine

Material consumption Lithium mine

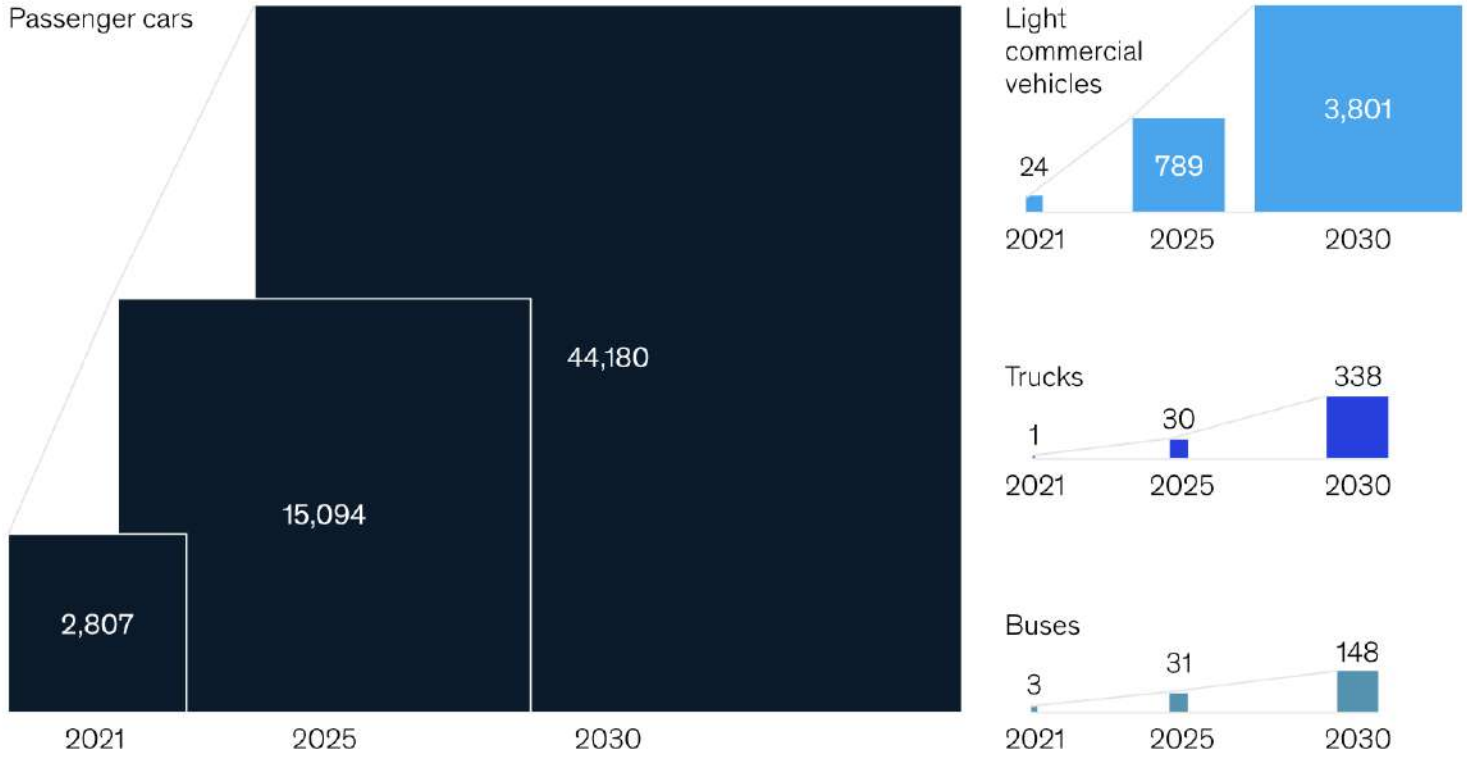
Material consumption Cobalt mine

Charging EV

UNECE

If federal zero-emission vehicle sales targets are met, the United States could have more than 48 million electric vehicles on the road in 2030.

Electric-vehicle parc, by segment[1] growth, thousands of vehicles[2]

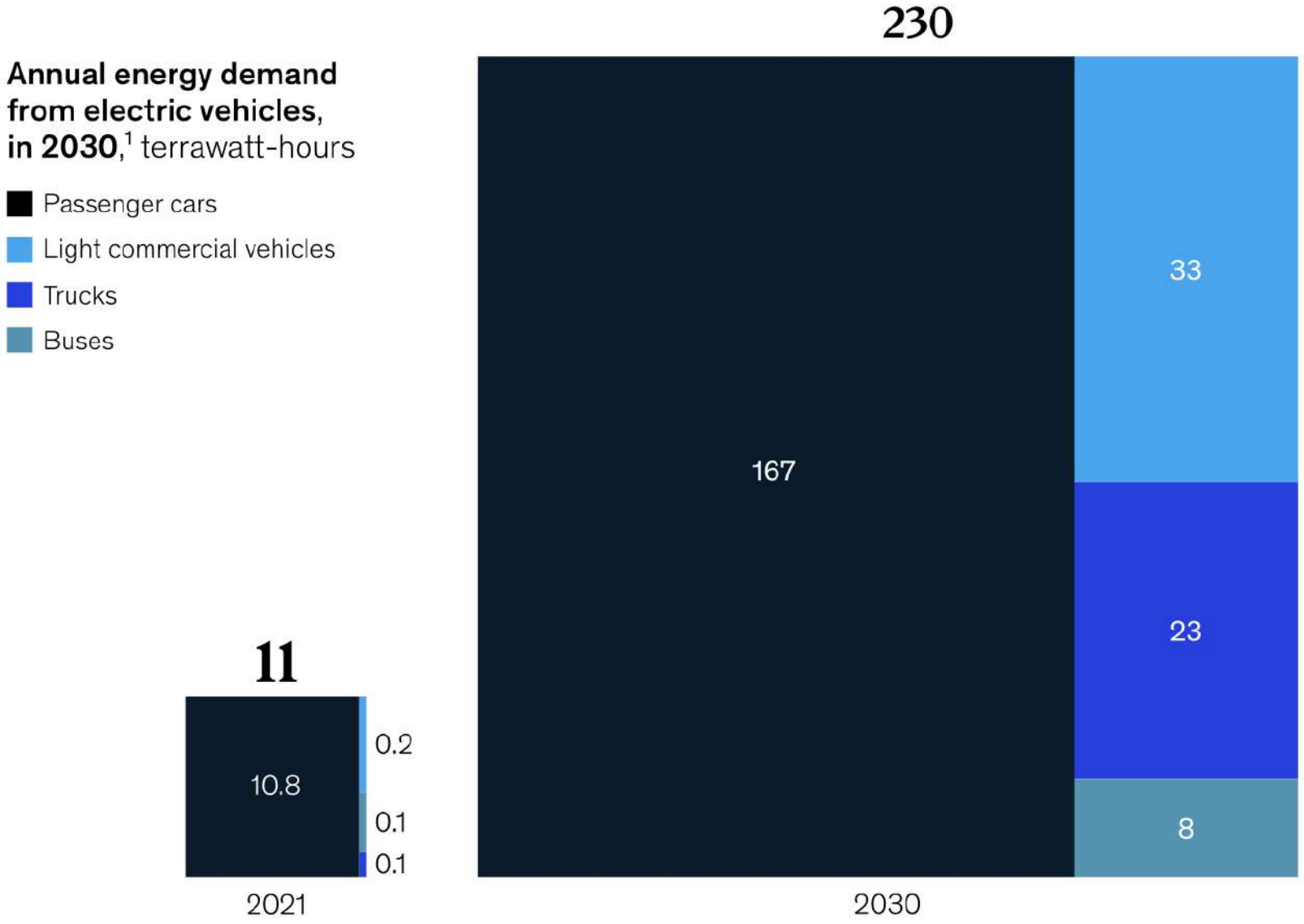


[1] Based on a scenario where zero-emissions vehicles (battery-electric vehicles, plug-in hybrid electric vehicles, fuel-cell electric vehicles) account for half the vehicles sold in the United States in 2030, in line with a federal target.
[2] Battery-electric vehicles and plug-in hybrid electric vehicles.
Source: McKinsey Center for Future Mobility

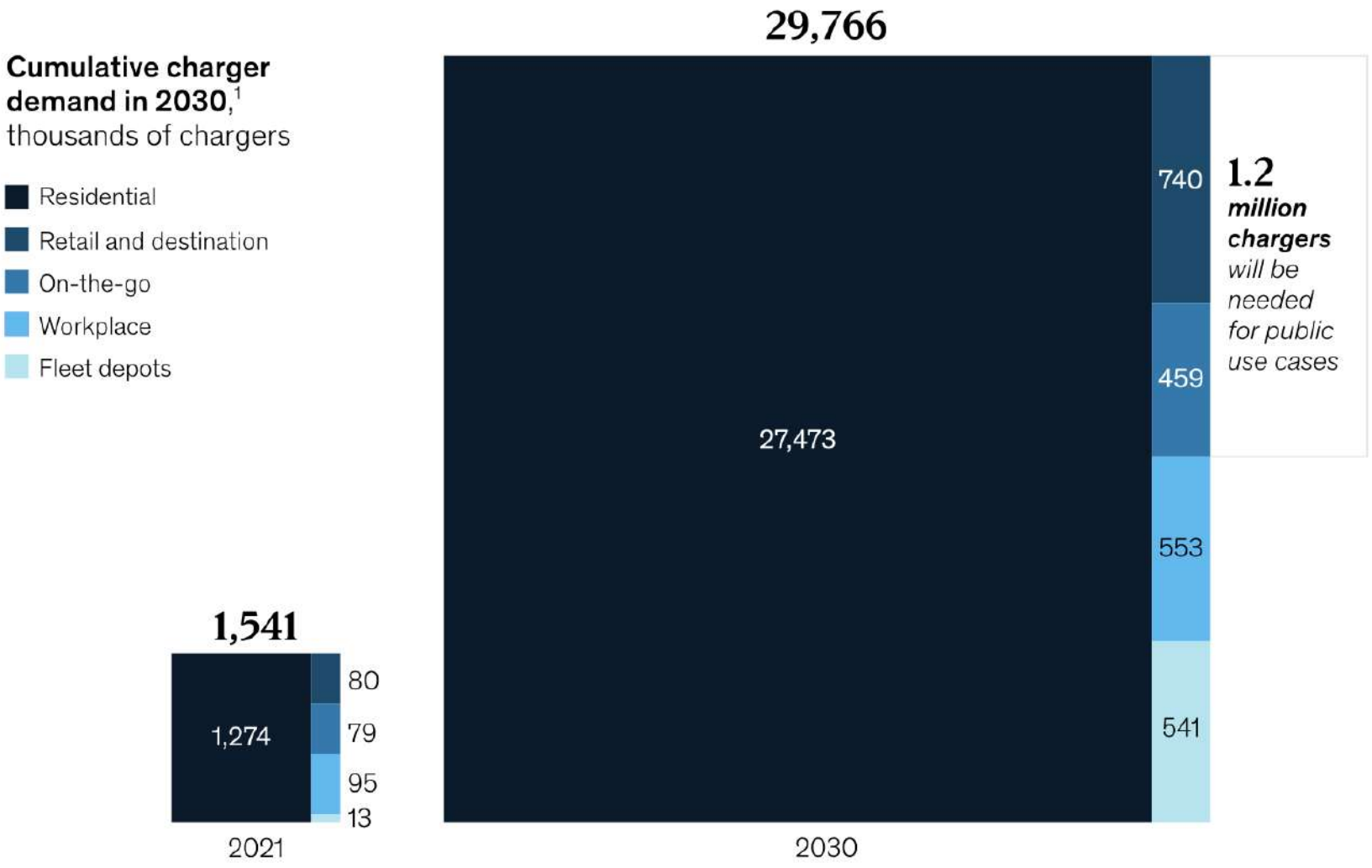
McKinsey & Company

Demand of TWh for EVs

While most electric-vehicle chargers would be in homes, about 1.2 million would be public chargers.



Charger demand



Note: Figures may not sum, because of rounding.
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Thank you for your attention