



# How to Transform the Energy mix: a transport view

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**“Green Transition in Latin America**

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# Fragmented globalisation & Green transition

- The global order is fractured into two regions competing against each other.
- China is investing heavily in renewable energy notwithstanding its large investment in fossil fuels (oil and natural gas).
- The geopolitical shift between the Russia-China axis and the USA brings opportunities for countries i.e. Mexico to adopt an industrial policy that reduces dependence on fossil fuels (green industrial measures) and on China.
- Biden's industrial policy to reduce dependence on China may benefit Mexico by "nearshoring" industrial capacity towards Mexico away from China.
- Transport and electricity sectors, preferably of the "green" type is key.
- **Transport is highly dependent on fossil fuels in Latinamerica**

# Fragmented globalisation & green transition

- Geopolitics: Ukraine War, Food Crisis, Covid-19,
- New level of emissions in modern history 2021. We are on track for +2.8 degrees Celsius by 2100. Possibility to reduce to +2.6 degrees Celsius by reducing emissions by 50% (worldwide) by 2030. GHG emissions have not decreased.
- Mexico proposes to reduce GHG emissions by 30% on November 7, 2022. **Mexico does not provide a roadmap (sectors) on how to reduce its GHG emissions by this percentage.**
- Transportation is key: the primary sector experiencing an increase and annual GHG growth rate higher than other end-use sectors (residential, industrial, power generation).

# Growth in investment Stock (Mill. 2021 USD)

Source: [https://unctad.org/system/files/official-document/wir2022\\_en.pdf](https://unctad.org/system/files/official-document/wir2022_en.pdf) . Annex table 2.

Stock FDI	2000	2010	2021	Variation 2021/2000
China	27,768	317,211	2,581,800	9297,8%
EU	1,967,112	6,988,984	13,263,759	674,3%
US	2,694,014	4,809,587	9,813,545	364,3%
China/EU+US	0,6%	2,7%	11,2%	

# Great power competition & green transition

- Besides fossil energy, Renewable energy provides geopolitical and economic advantages
- R & D for efficient and sustainable energy technologies are drivers of innovation and economic competitiveness. China leads this field globally. China uses industrial policy.
- We observe a declining role of United States as an energy investor and the expansion of China. The retreat in renewable energy investment by the former within and outside the USA in contrast to China.
- **China has adopted a proactive industrial policy whilst Latinamerica and the USA have not until now...**

# China and Latinamerica/Mexico

## Some questions for formulating industrial policy

- What does Asia produce for the US that is already made in Mexico?
- What does Asia produce for the US that could be produced in Mexico?
- What does Latinamerica import from Asia that can be produced in Mexico and the rest of Latin America?
- Transport technology and policy are inputs for industrial policy

# China's Investment (% total) by sector in Latin America (Dussel, 2021). Trade deficit of renewable energy technology?

			2000-04	2005-09	2010-14	2015-20	2000-20
Metals, minerals and mining-OFDI			81.39	89.25	31.83	25.26	35.72
Energy-OFDI			0	2.01	37.09	45.46	36.69
Telecommunications-OFDI			7.55	0.31	2.87	2.18	2.41
Electronics-OFDI			0	0.83	3.74	1.96	2.45
Autoparts and automobiles-OFDI			0	1.57	2.16	6.26	4.09
Transportation-OFDI			9.7	0	0.49	3.46	2.19
Subtotal			98.64	93.97	78.18	84.58	83.55
Transportation-employment			41.97	0	4.87	50.53	37.94

# How to cut GHG emissions for transport under **green industrial policy**?

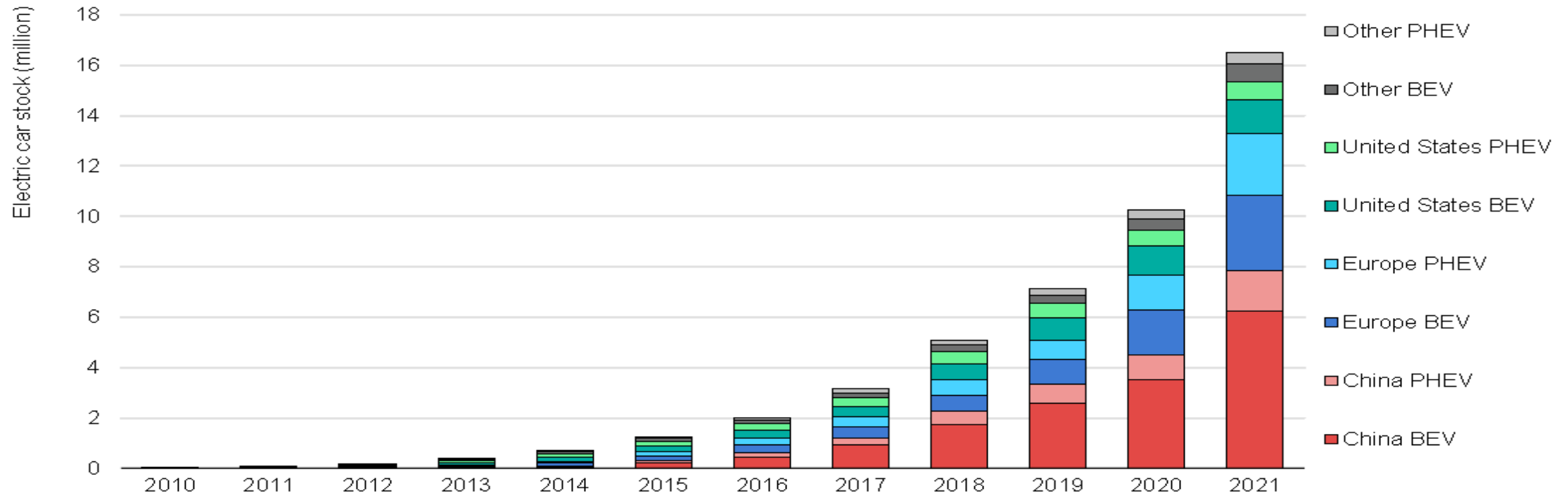
- Expansion of renewable electricity generation
- Mass transit, Public transport is essential
- Create new industries without internal combustion engine i.e EVS, trains, ships





## Over 16.5 million electric cars were on the road in 2021, a tripling in just three years

Global electric car stock, 2010-2021



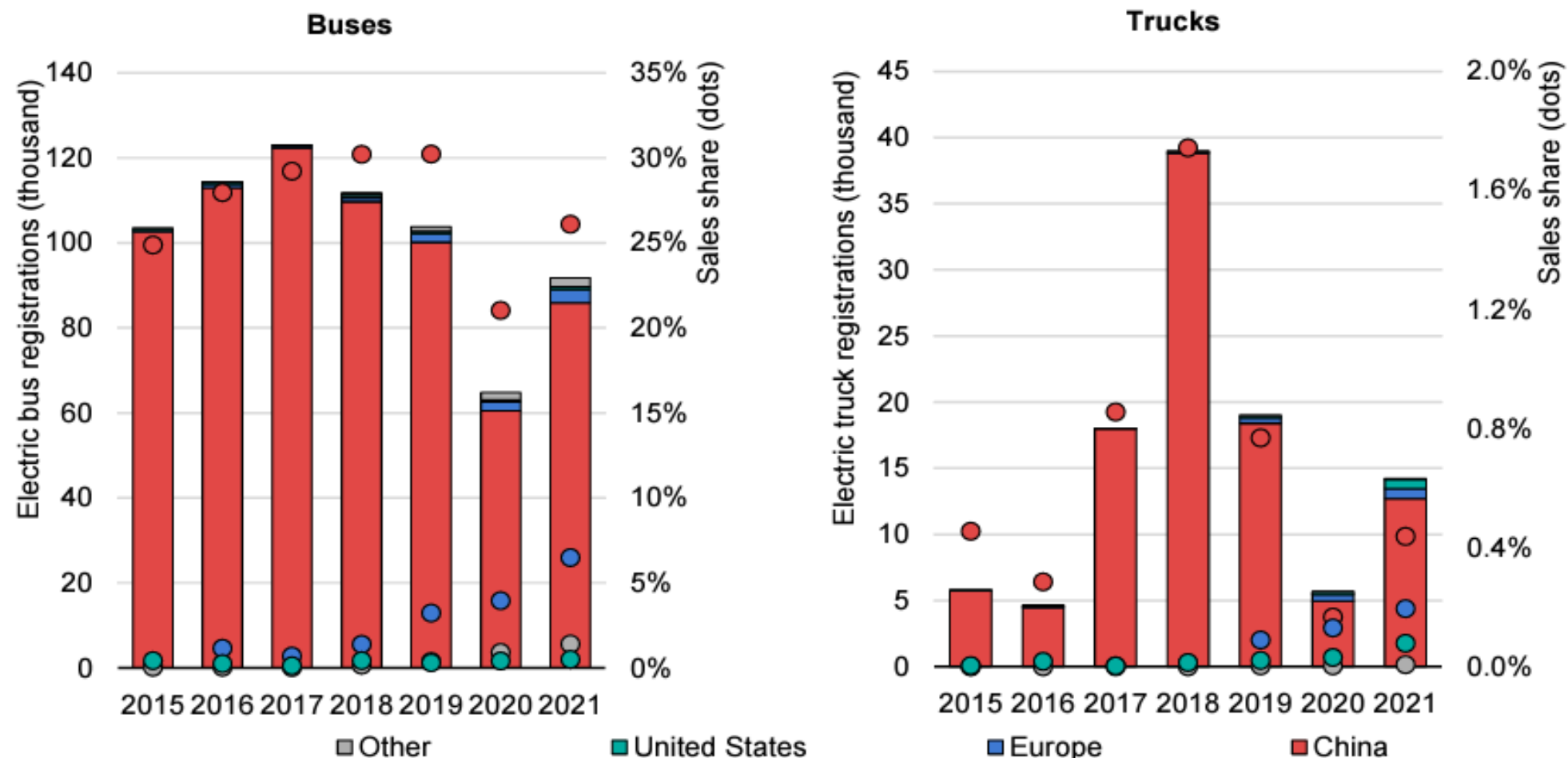
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Notes: BEV = battery electric vehicle; PHEV = plug-in hybrid electric vehicle. Electric car stock in this figure refers to passenger light-duty vehicles.

"Other" includes Australia, Brazil, Canada, Chile, India, Japan, Korea, Malaysia, Mexico, New Zealand, South Africa and Thailand. Europe in this figure includes the EU27, Norway, Iceland, Switzerland and United Kingdom.

Sources: IEA analysis based on country submissions, complemented by [ACEA](#); [CAAM](#); [EAFO](#); [EV Volumes](#); [Marklines](#).

## Electric bus and truck registrations and sales shares by region, 2015-2021



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Notes: Other = Australia, Brazil, Canada, Chile, Korea, India, Indonesia, Japan, Mexico, South Africa, Thailand, Malaysia and New Zealand. Electric bus and truck registrations and stock data can be interactively explored via the [Global EV Data Explorer](#).

Sources: IEA analysis based on country submissions, complemented by [ACEA](#); [EAFO](#); [EV Volumes](#).

# EVs in the World : China & EU need to import oil for transport and so have an incentive for EVs

EVs in the World

Stock: EVs	Registrations 2017 (thousands)	Registrations 2018 (thousands)	% EV sales 2018 of total vehicle sales per country 2022 in brackets
USA	750	1200	6.39 (9)
Mexico	4	25	0.9
China	1,200	2,300	3.90 (30)
European Union	N.A.	1,200	8 (21)
Norway	176	290	46 (88)
United kingdom	135	198	17 (23)
Sweden	43	66	8 (54)
France	121	165	2.2 (21)
Spain	16	28	0.9 (8.9)

## National Strategy on Electric Mobility & Goals: 2030—2050 (Mexico)

Year	Goals
2030	<ul style="list-style-type: none"><li>• Electrification of transportation would reduce between 3.5 and 5 million tons of CO<sub>2</sub>e emissions, equivalent to the introduction of at least 500,000 light vehicles and 7,000 heavy-duty vehicles, either for cargo or passengers, from 2019 to 2030.</li></ul>
2030	<ul style="list-style-type: none"><li>• 5% of light and heavy vehicle sales will be hybrid and electric.</li></ul>
2030	<ul style="list-style-type: none"><li>• 10 urban areas in the country with high GHG emissions and non CO<sub>2</sub> pollutants will have incorporated electric technology into their public transportation systems.</li></ul>
2040	<ul style="list-style-type: none"><li>• Half of the sales of light and heavy passenger vehicles in the country will be hybrid and electric. (AMBITIOUS TARGET). Current sales level is at 1%.</li></ul>
2050	<ul style="list-style-type: none"><li>• 100% of the sales of light and heavy vehicles will be electric vehicles.</li></ul>



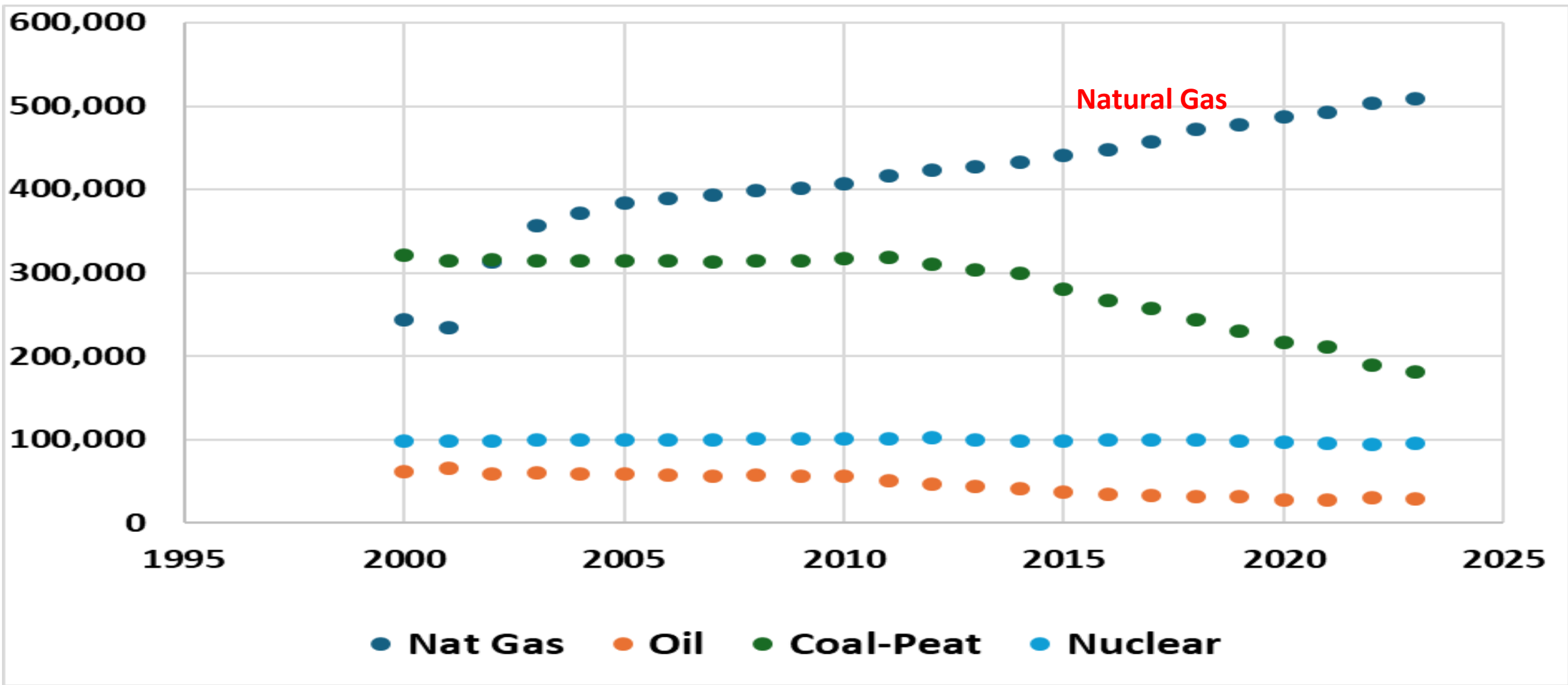
# Transport energy indicators. Need to increase transport electrification & public trans. (SOURCE: Handbook of Transport & Development, Hickman et al, 2015).

Transport energy indicators (MJ per p-km by mode)	USA	Australia New Zealand	Canada	Western Europe	High Income Asia
Private vehicles	3.25	2.56	3.79	2.49	2.33
Public transport	2.13	0.92	1.14	0.83	0.48
Bus	2.85	1.66	1.50	1.17	0.84
Tram	0.99	0.36	0.31	0.72	0.36
Light rail	0.67	n.a	0.25	0.69	0.34
Metro	1.65	n.a	0.49	0.48	0.19
Suburban rail	1.39	0.53	1.31	0.96	0.24
Overall energy use	3.20	2.43	3.52	5.66	1.40

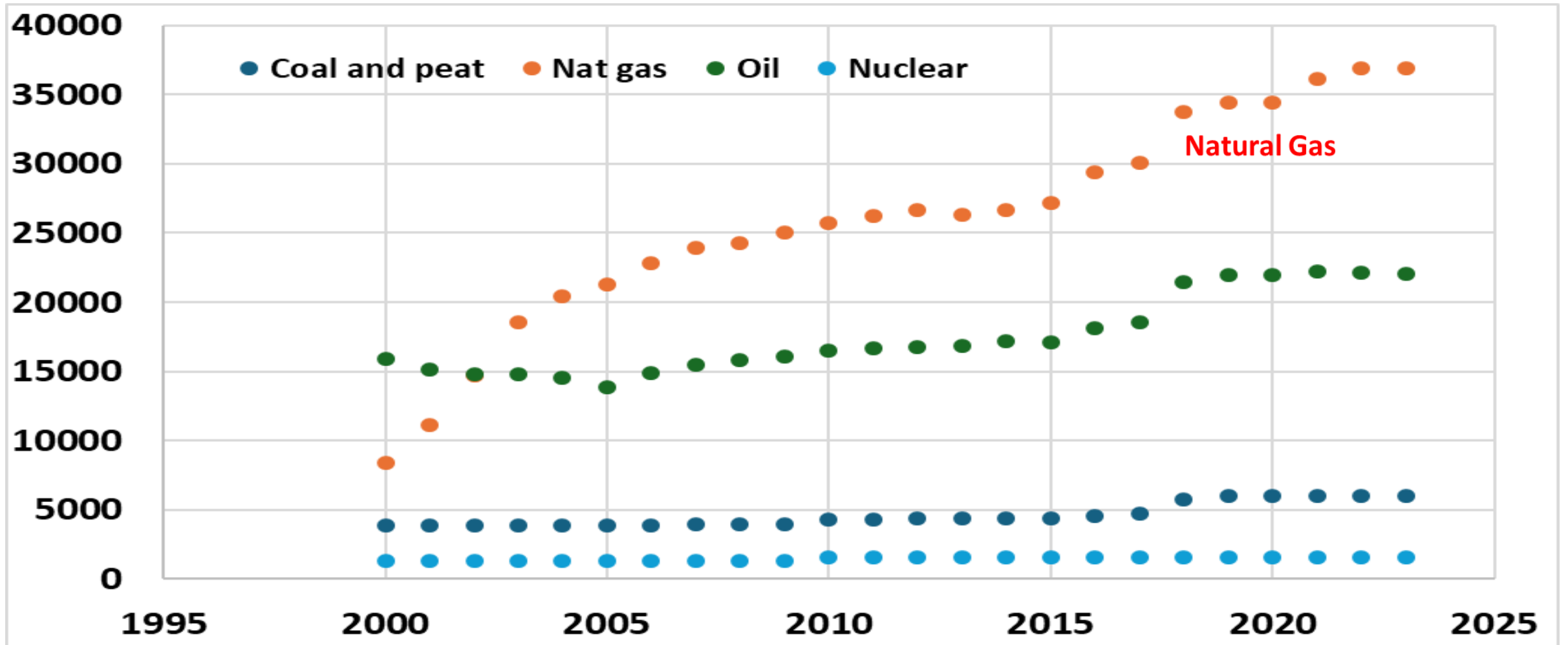
# Transport energy indicators by REGIONS. To transform Energy matrix more public transport capacity is needed. (SOURCE: Handbook of Transport & Development, Hickman et al, 2015).

Transport energy indicators (MJ per p-km by mode)	CHN	LIA	LAM	AFR	MEA	EEU
Private vehicles	0.66	1.78	2.27	1.86	2.56	2.35
Public transport	0.28	0.64	0.76	0.51	0.67	0.4
Bus	0.26	0.66	0.75	0.57	0.74	0.56
Tram	n.a	n.a	n.a	n.a	0.13	0.74
Light rail	n.a	0.05	n.a	n.a	0.2	1.71
Metro	0.05	0.46	0.19	n.a	n.a	0.21
Suburban rail	n.a	0.25	0.15	0.49	0.56	0.18
Overall energy use	0.87	1.20	1.6	1.26	1.99	1.31

# USA: Fossil based electricity capacity (MW). Transport needs capacity additions,



# Mexico: Fossil based electricity capacity (MW). Transport needs extra capacity in future.





# Installed renewable electricity capacity (MW) SOUTHAMERICA-EXCLUDING MEXICO. Brazil is the main leader in renewables excluding hydropower.

## SOUTHAMERICA

<b>Total renewable energy</b>	265819.784
<b>Hydropower</b>	179998.347
<b>Renewable hydropower</b>	179024.347
<b>Pumped storage</b>	974.000
<b>Marine</b>	0.050
<b>Wind</b>	33540.890
<b>Onshore wind energy</b>	33540.890
<b>Offshore wind energy</b>	0.000
<b>Solar</b>	32820.771
<b>Solar photovoltaic</b>	32712.501
<b>Concentrated solar power</b>	108.270
<b>Bioenergy</b>	20382.326
<b>Solid biofuels and renewable</b>	19698.212
<b>Renewable municipal waste</b>	34.539
<b>Bagasse</b>	13377.488
<b>Other solid biofuels</b>	6286.000
<b>Liquid biofuels</b>	17.500
<b>Biogas</b>	666.614
<b>Geothermal</b>	51.400

SOURCE: IRENA

Of which:

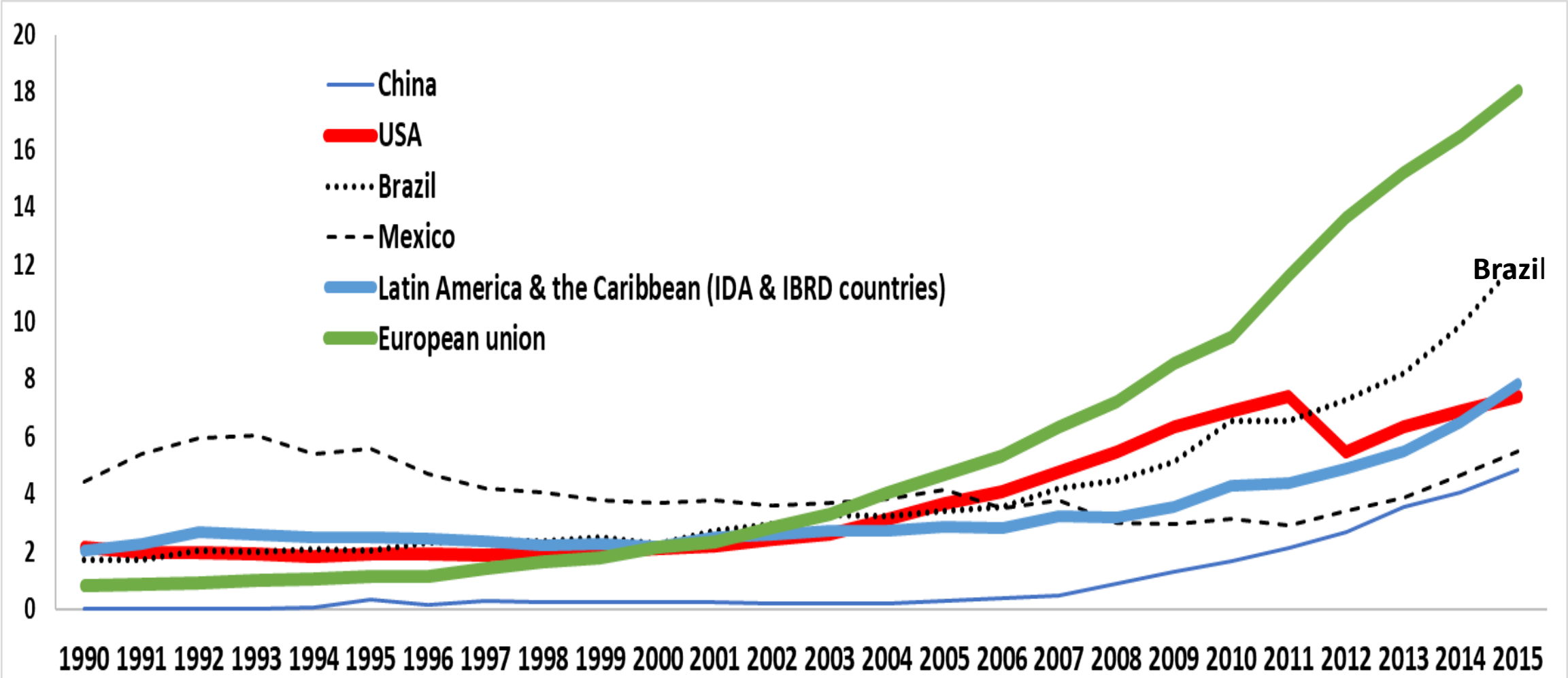
	Brazil	Argentina	Chile	Colombia	Ecuador
<b>Total renewable energy</b>	65.9%	5.7%	7.1%	5.1%	2.0%
<b>Hydropower</b>	61.0%	6.3%	4.0%	7.0%	2.9%
<b>Renewable hydropower</b>	61.3%	5.8%	4.1%	7.0%	2.9%
<b>Pumped storage</b>	0.0%	100.0%	0.0%	0.0%	0.0%
<b>Marine</b>	100.0%	0.0%	0.0%	0.0%	0.0%
<b>Wind</b>	72.0%	9.9%	11.4%	0.1%	0.1%
<b>Onshore wind energy</b>	72.0%	9.9%	11.4%	0.1%	0.1%
<b>Offshore wind energy</b>	#iDIV/0!	#iDIV/0!	#iDIV/0!	#iDIV/0!	#iDIV/0!
<b>Solar</b>	73.4%	3.4%	19.0%	1.5%	0.1%
<b>Solar photovoltaic</b>	73.6%	3.4%	18.8%	1.5%	0.1%
<b>Concentrated solar power</b>	0.0%	0.0%	100.0%	0.0%	0.0%
<b>Bioenergy</b>	84.4%	1.4%	6.8%	1.9%	0.7%
<b>Solid biofuels and renewable</b>	84.8%	1.1%	6.7%	2.0%	0.7%
<b>Renewable municipal waste</b>	100.0%	0.0%	0.0%	0.0%	0.0%
<b>Bagasse</b>	91.8%	0.4%	0.0%	2.9%	1.1%
<b>Other solid biofuels</b>	69.8%	2.5%	20.9%	0.0%	0.0%
<b>Liquid biofuels</b>	100.0%	0.0%	0.0%	0.0%	0.0%
<b>Biogas</b>	72.9%	10.9%	9.6%	1.4%	1.2%
<b>Geothermal</b>	0.0%	0.0%	100.0%	0.0%	0.0%

SOURCE: IRENA

# Installed renewable electricity capacity (MW) REGIONS. Need to increase renewable energy capacity for transport electrification (SOURCE: IRENA)

	<b>SOUTHAMERIC</b>	<b>CHINA</b>	<b>BRAZIL</b>	<b>MEXICO</b>	<b>USA</b>	<b>CENTRAL AMERICA</b>	<b>European Union</b>
<b>Total renewable energy</b>	265,819.784	1,160,798.9	175,261.9	31,954.0	866,274.0	18,106.6	566,063.1
<b>Hydropower</b>	179,998.347	413,500.0	109,814.2	13,303.0	103,139.0	8,374.1	152,600.7
<b>Renewable hydropower</b>	179,024.347	367,710.0	109,814.2	13,303.0	83,851.0	8,374.1	129,946.3
<b>Pumped storage</b>	974.000	45,790.0	0.0	0.0	20,618.0	0.0	22,654.4
<b>Marine</b>	0.050	4.8	0.1	0.0		0.0	218.2
<b>Wind</b>	33,540.890	365,964.2	24,163.1	7,312.7	140,862.0	2,101.2	203,539.1
<b>Onshore wind energy</b>	33,540.890	335,504.2	24,163.1	7,312.7	140,820.0	2,101.2	187,438.5
<b>Offshore wind energy</b>	0.000	30,460.0	0.0	0.0	41.0	0.0	16,100.6
<b>Solar</b>	32,820.771	393,031.8	24,078.9	9,356.2	113,015.0	3,946.9	197,629.5
<b>Solar photovoltaic</b>	32,712.501	392,435.8	24,078.9	9,339.2	111,535.0	3,946.9	195,308.4
<b>Concentrated solar power</b>	108.270	596.0	0.0	17.0	1,480.0	0.0	2,321.1
<b>Bioenergy</b>	20,382.326	34,088.2	17,205.7	983.7	11,296.0	2,949.2	33,838.5
<b>Solid biofuels and renewable</b>	19,698.212	32,160.6	16,702.0	917.5	9,205.0	2,890.0	20,236.6
<b>Renewable municipal waste</b>	34.539	13,406.0	34.5	99.5	1,025.0	4.3	4,120.6
<b>Bagasse</b>	13,377.488	0.0	12,277.2	816.0	828.0	2,773.7	110.6
<b>Other solid biofuels</b>	6,286.000	18,755.0	4,390.0	2.0	8,009.0	112.0	15,807.0
<b>Liquid biofuels</b>	17.500	0.0	17.5	0.0	62.0	0.0	2,119.8
<b>Biogas</b>	666.614	1,927.6	486.2	66.2	2,029.0	59.2	11,482.2
<b>Geothermal</b>	51.400	0.0	0.0	998.5	2,653.0	735.2	891.5

# Installed renewable electricity capacity (% total power gen) REGions. Excludes Hydropower electricity(SOURCE: World Bank, 2024), What role has industrial policy played?



# Possible measures to mitigate GHG Emissions in Latinamerica's transport sector (mainly cars and trucks)

- **Greater electrification of the transportation system needs investment in renewable power**
- **Update emissions standards for trailers and new cars, boats, etc. and energy efficiency**
- **Accelerate city densification programs and actions to adopt integrated transportation systems.**
- **Increase public transportation in Latin America.**
- **Carry out the modal change of cargo transportation. i.e More trains**
- **Publish an emissions and energy efficiency standard for new heavy vehicles.**
- **Restrict the importation of used vehicles. These use more gasoline per km traveled.**
- **Build intercity passenger trains.**
- **Accelerate the use of clean and efficient energy in motor transport.**
- **Apply technology programs for public transport vehicles favouring Electricity.**

# Conclusions

- In Latinamerica Transport is highly dependent on fossil fuels and electrification is key
- In the renewable energy field the USA is lagging behind China and the EU. Latinamerica matches the USA.
- Biden´s adoption of the anti-inflation programme provides opportunities for Mexico to adopt a green industrial policy;
- The most recent investments of China focus on renewables and electrical generation sectors in latinamerica
- This pattern that is observed in the world is not observed in Mexico, which has little investment from China and very little in energy.
- In Mexico, since 2018, there has been an increase in sales of passenger and private vehicles of Chinese origin.
- Public transport and EVS provide opportunities where a Green industrial policy has a role to play.
- Mexico imports a large fraction of renewable energy technology from China and other countries. **The country needs to manufacture its own buses, Evs, solar panels, wind power turbines, high speed rail, etc. Therefore there is a role for new industrial policy.**