Towards Energy Security in ASEAN: Impact of Regional Trade, Renewables and Energy Efficiency

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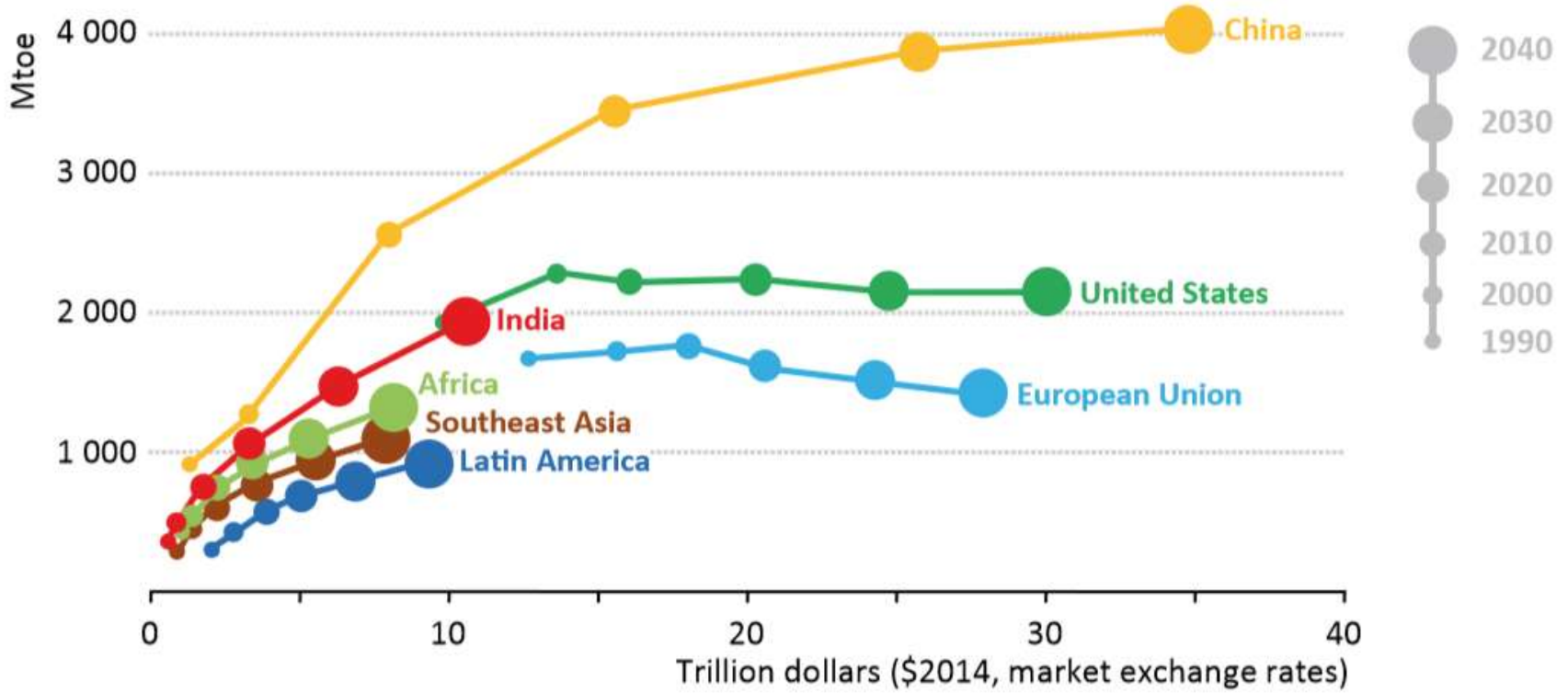
Changing dynamics of global energy demand

Primary energy demand and GDP by selected region in IEA New Policies Scenario (1990-2040)

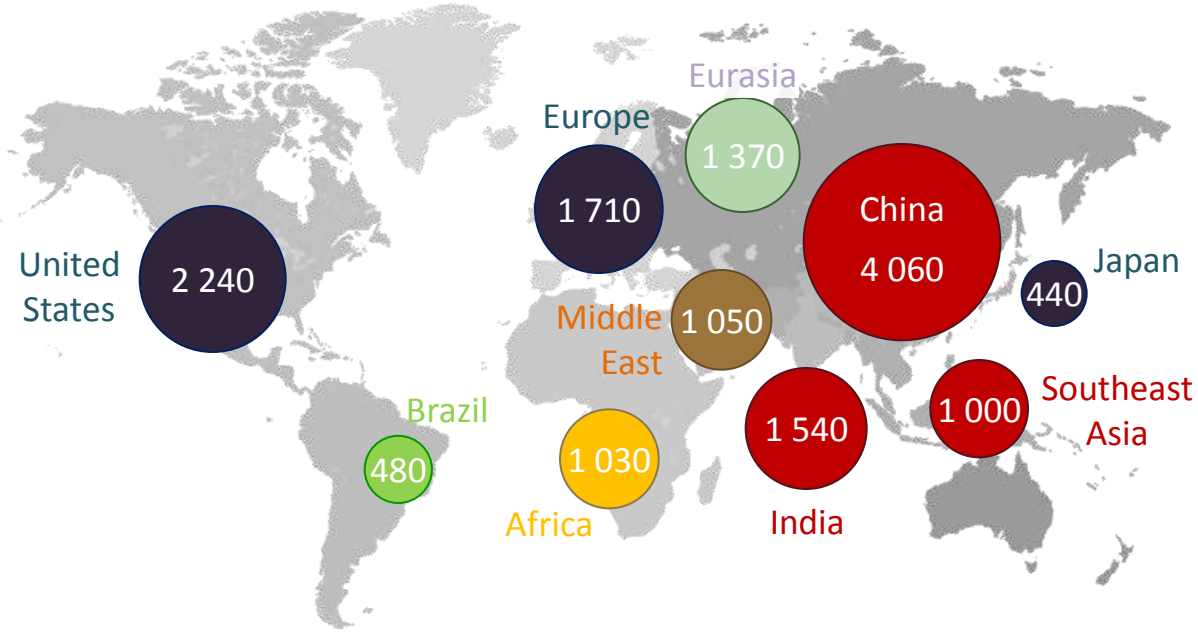


Source: IEA World Energy Outlook (2015)

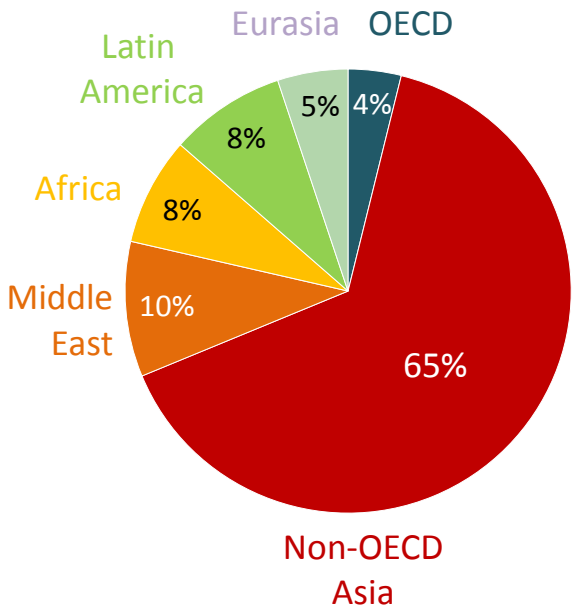
Changing dynamics of global demand

- Global energy demand increases by one-third over the period to 2035. Countries from the OECD make only a marginal contribution to this growth – only 4%.

Primary energy demand, 2035
(Mtoe)



Share of global growth
2012-2035



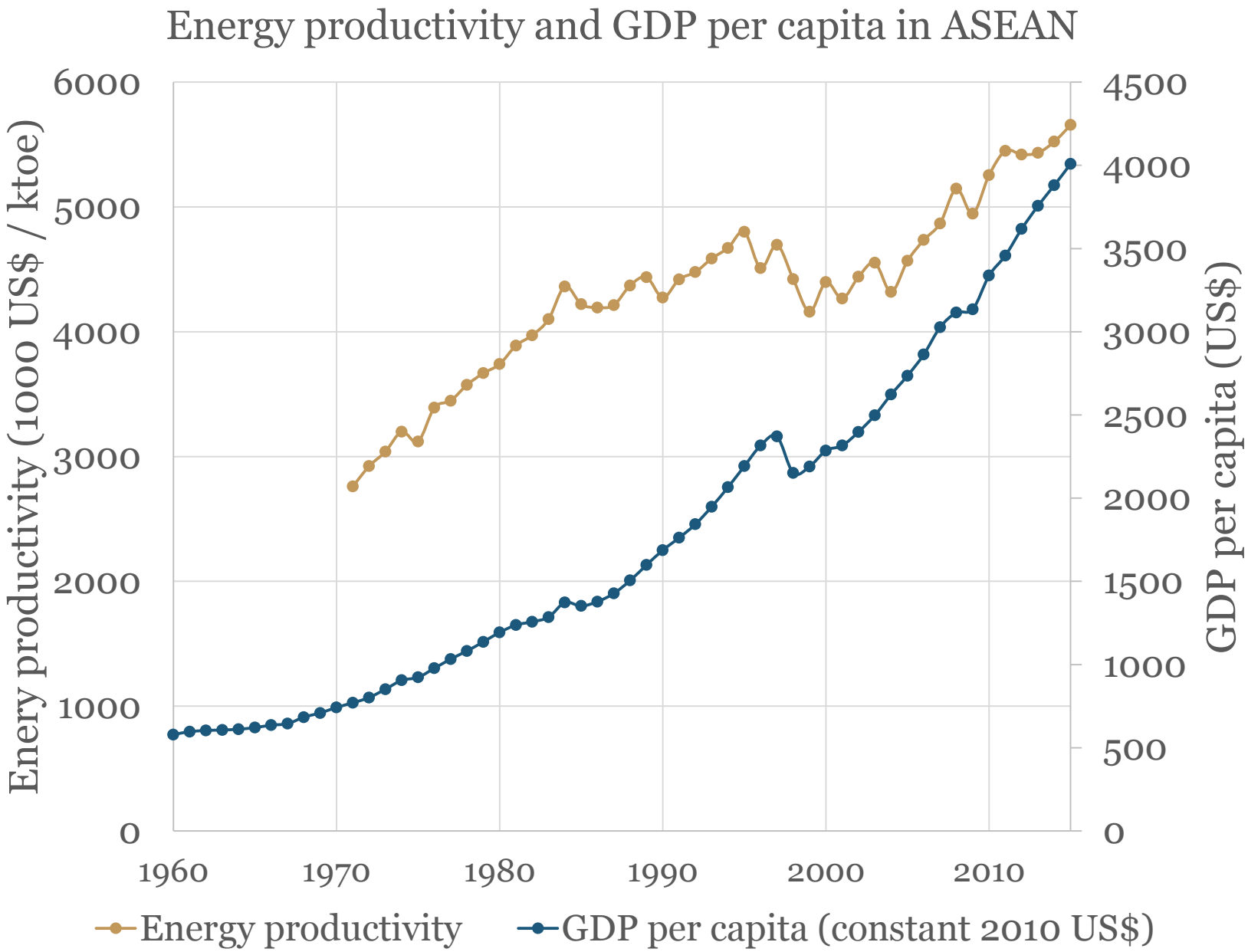
Source: IEA,2013

- ASEAN is 9 times population intensive than Central Asia
- But the latter has much richer energy endowment, in particular natural gas.

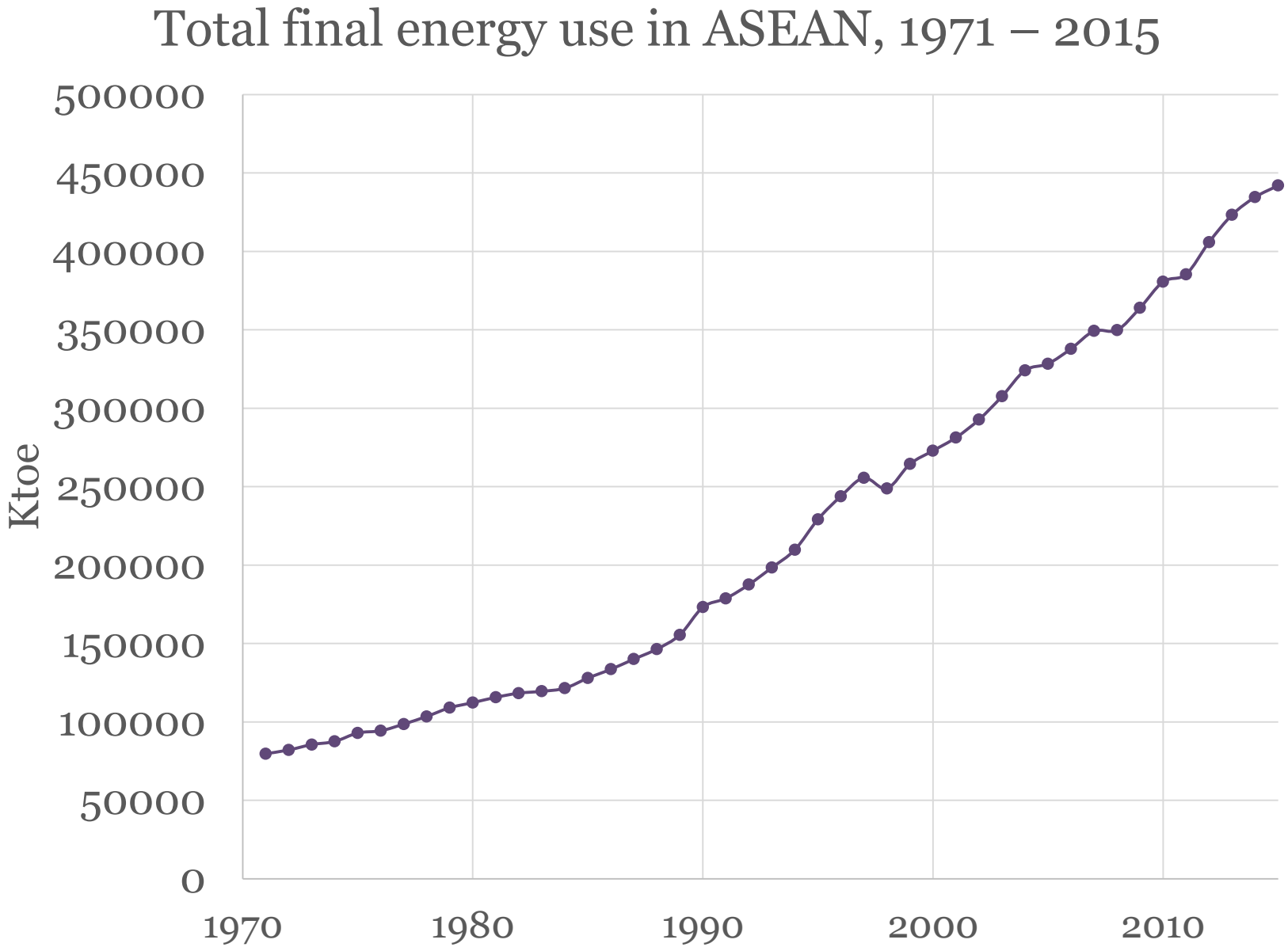
	Central Asia	ASEAN
Countries	Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, & Uzbekistan,	Thailand, Indonesia, Vietnam, Philippines, Malaysia, Singapore, Myanmar (Burma), Cambodia, Laos, Brunei
Population (2016, million)	70	639
GDP, billion USD (2016)	306.8	2595
Reserves (2016)		
Crude oil, billion bbl	31.25	13.39
Natural gas,tln cubic feet	415.4	200.24

Energy productivity in ASEAN over 1971-2015

- Increase in energy use by a factor of 4.5
- Increase in GDP by a factor of 10.36
- Double energy productivity
- Increase in GDP per capita by a factor of 4.2



- Energy productivity growth
  - 105% during 1971 – 2015
- Growth of GDP per capita:
  - 421% during 1971 – 2015

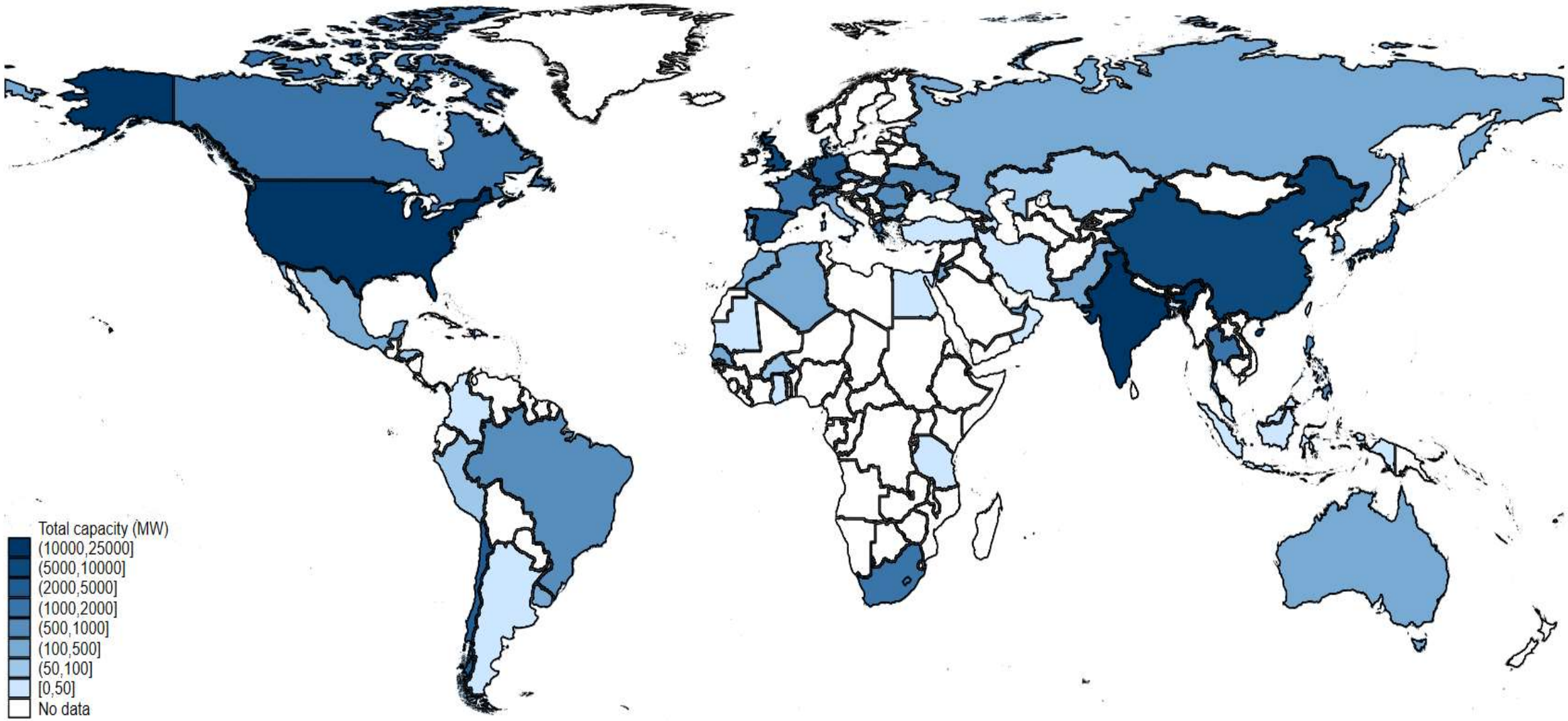


- Growth of total energy use
  - 454% during 1971 – 2015

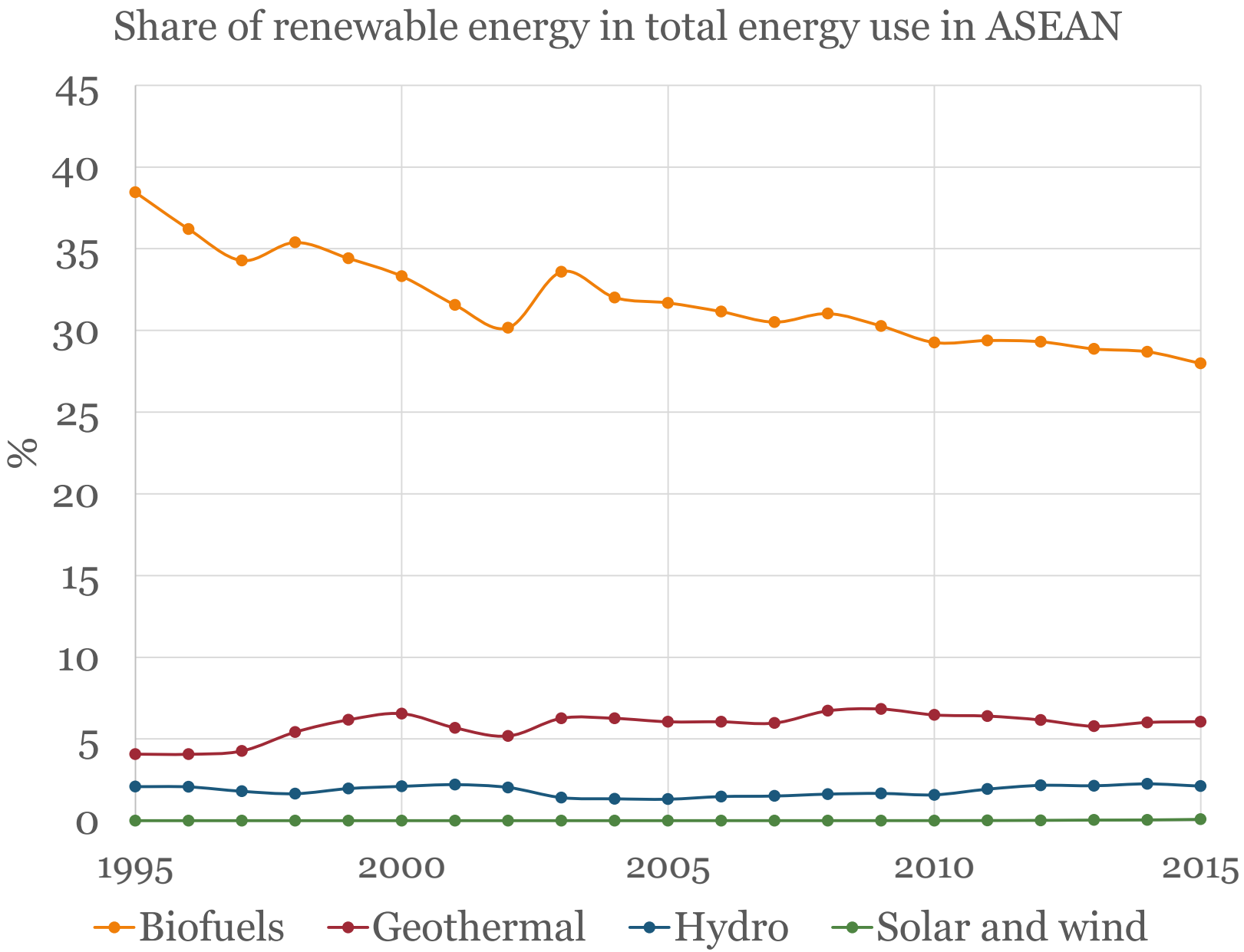
However, challenges remain

- Energy consumption structure
  - High dependence on fossil fuels
  - Limited shares of geothermal, hydro, solar and wind energy
- Energy trade

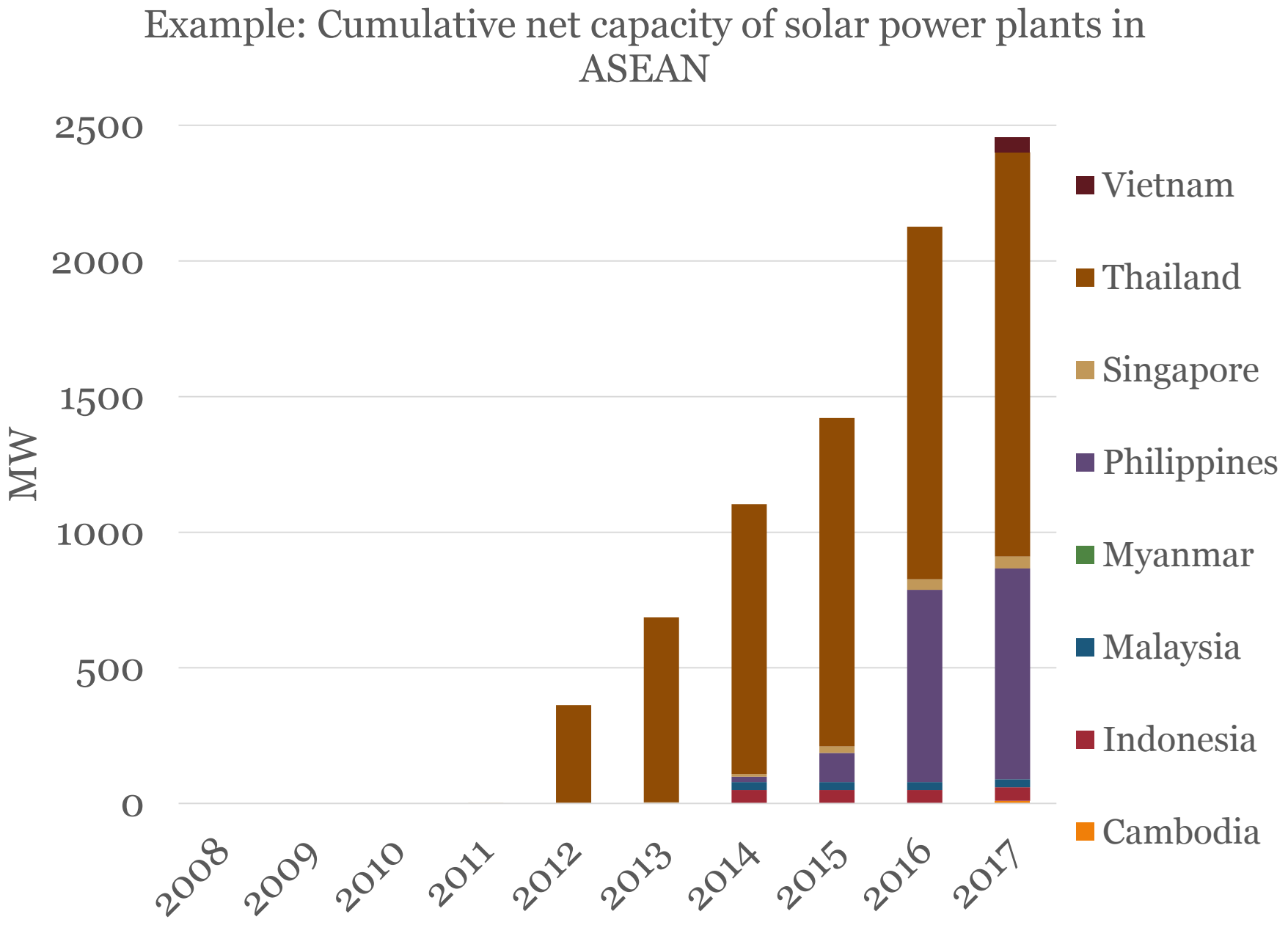
Total capacity of operational solar plants in the world



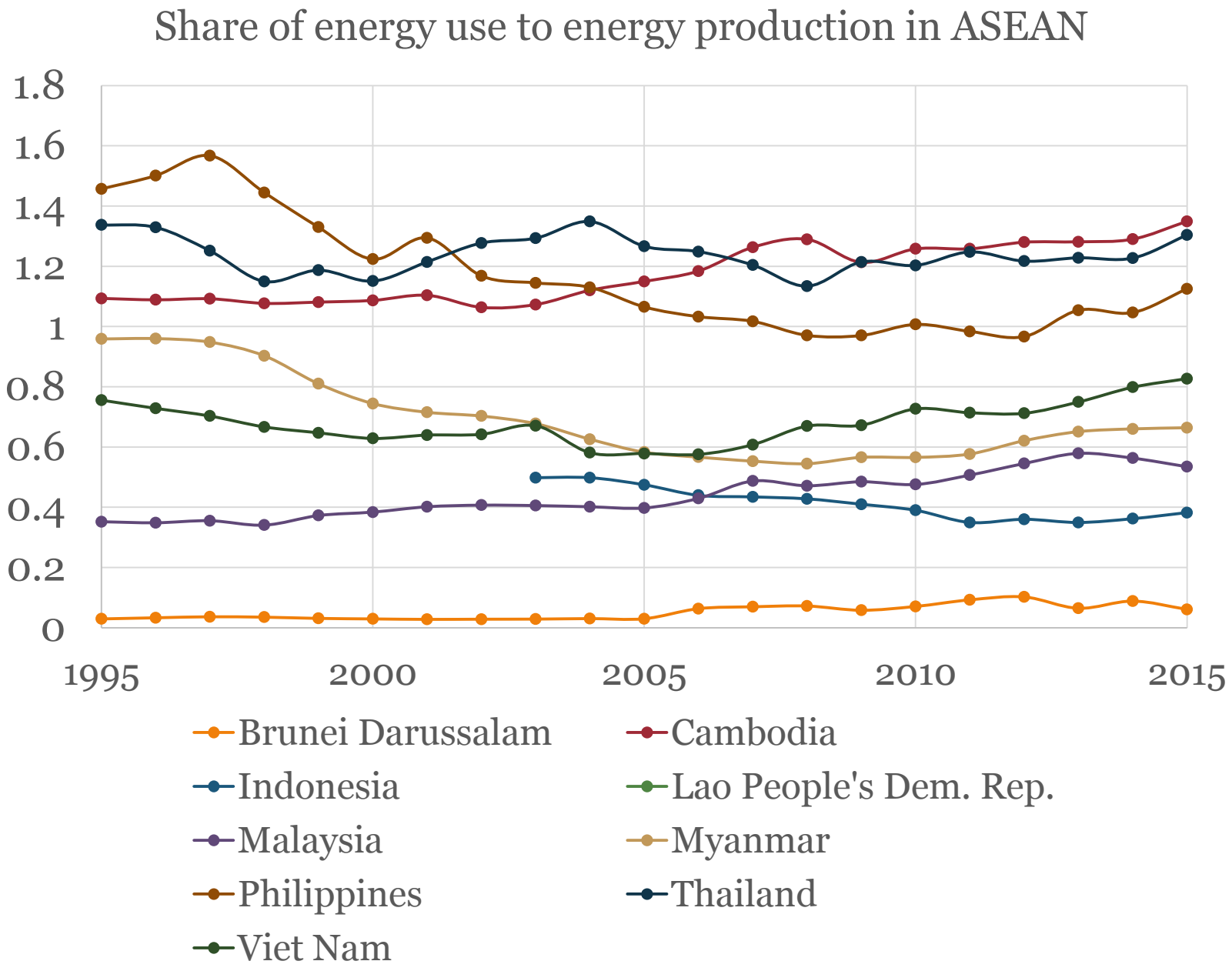
Source: Own elaboration.



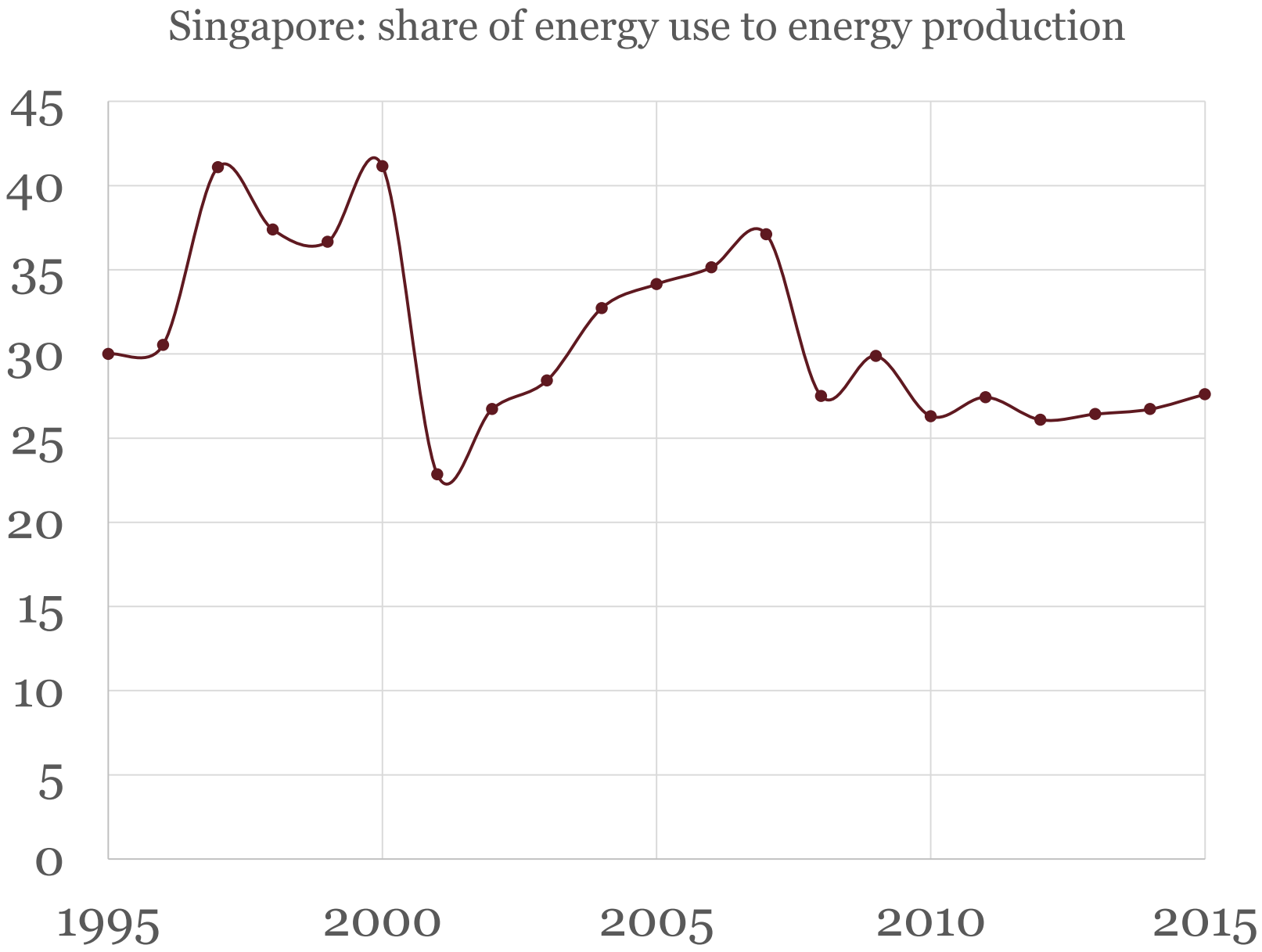
- Renewable energy structure
  - Geothermal: around 5%
  - Hydro, solar and wind energy: below 5%
  - Biofuels:
    - Provided directly by forestry and agriculture e.g., firewood, wood chips



- Major active countries in renewable energy production in ASEAN
  - Geothermal energy: Philippines and Indonesia
  - Hydro energy: Viet Nam, Indonesia and Malaysia
  - Biofuels energy: Indonesia, Thailand and Viet Nam
  - Solar and wind energy: Thailand and Philippines

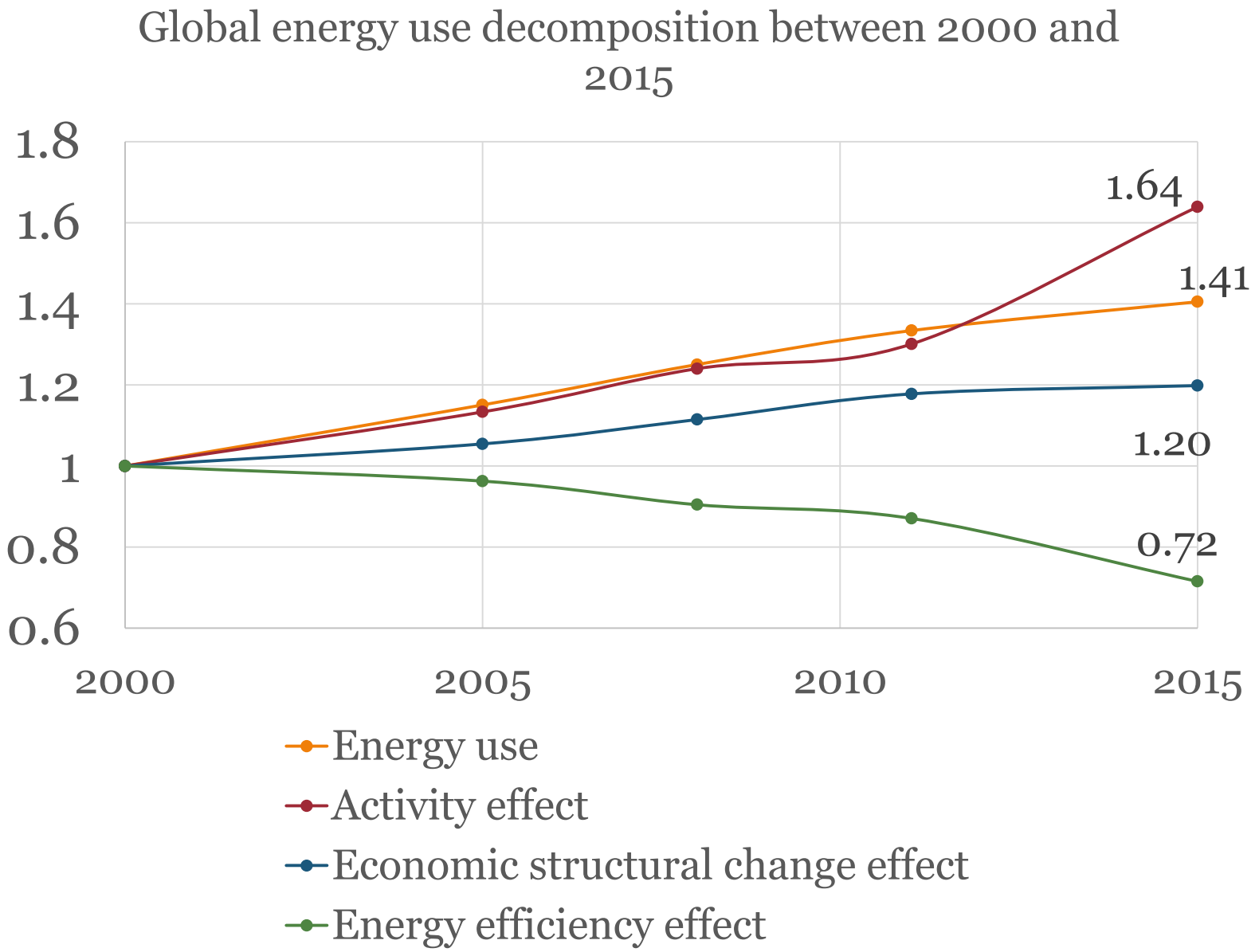


- **Energy use > energy production**
  - Cambodia
  - Thailand
  - Philippines
- **Energy use < energy production**
  - Brunei Darussalam
  - Indonesia
  - Laos
  - Malaysia
  - Myanmar
  - Viet Nam

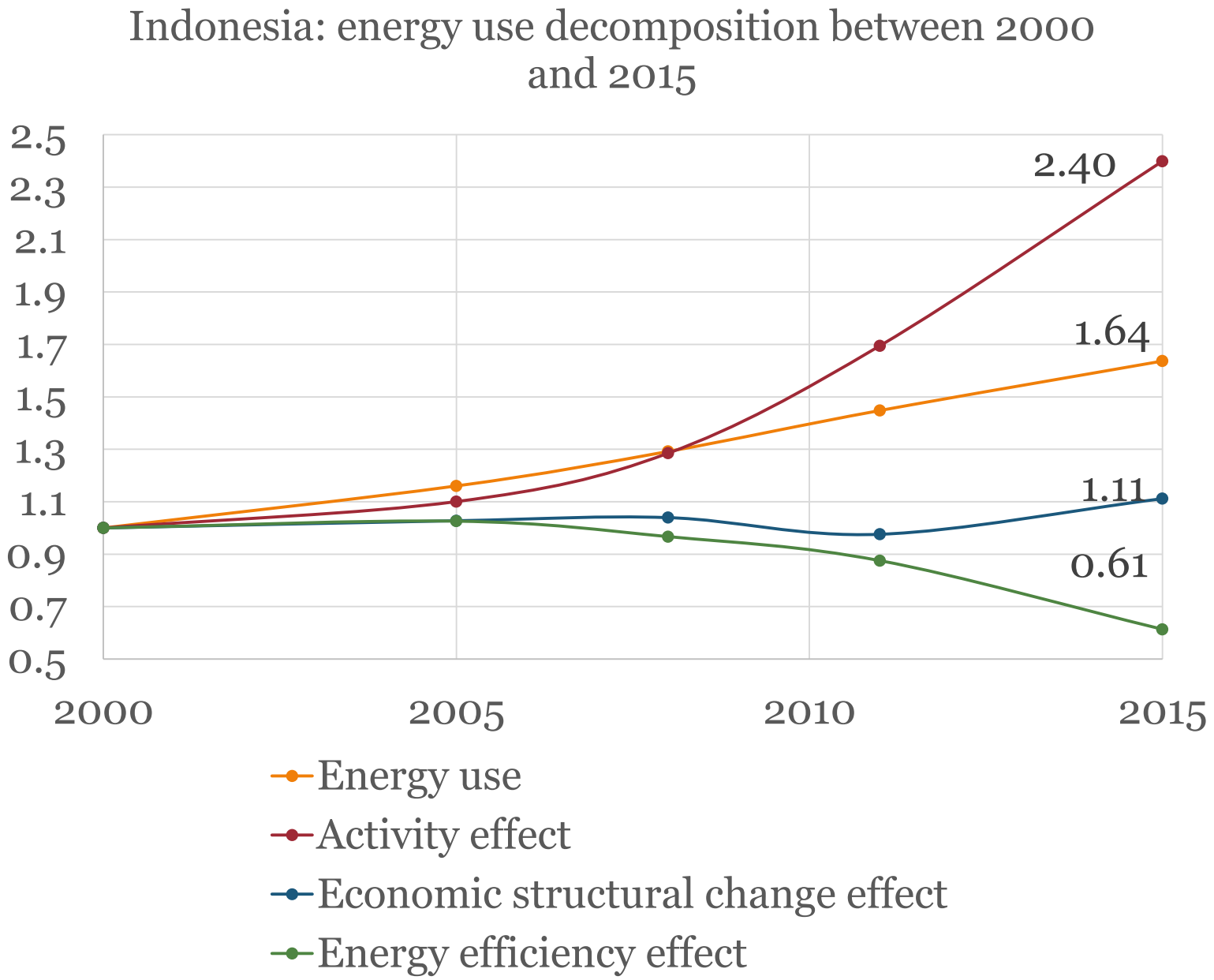


- Example of Singapore:
  - Energy use is more than 20 times energy production

- What drives growth in energy use?
- With latest data from IEA and ADB Input-Output tables, we decompose increase in global energy use into three factors:
  - Activity effect : 64%
  - Economic structural change effect: 20%
  - Energy efficiency effect: 28%



- Example of Indonesia



What drives growth in energy use?

- Decompositions of energy use in selected economies between 2000 and 2015

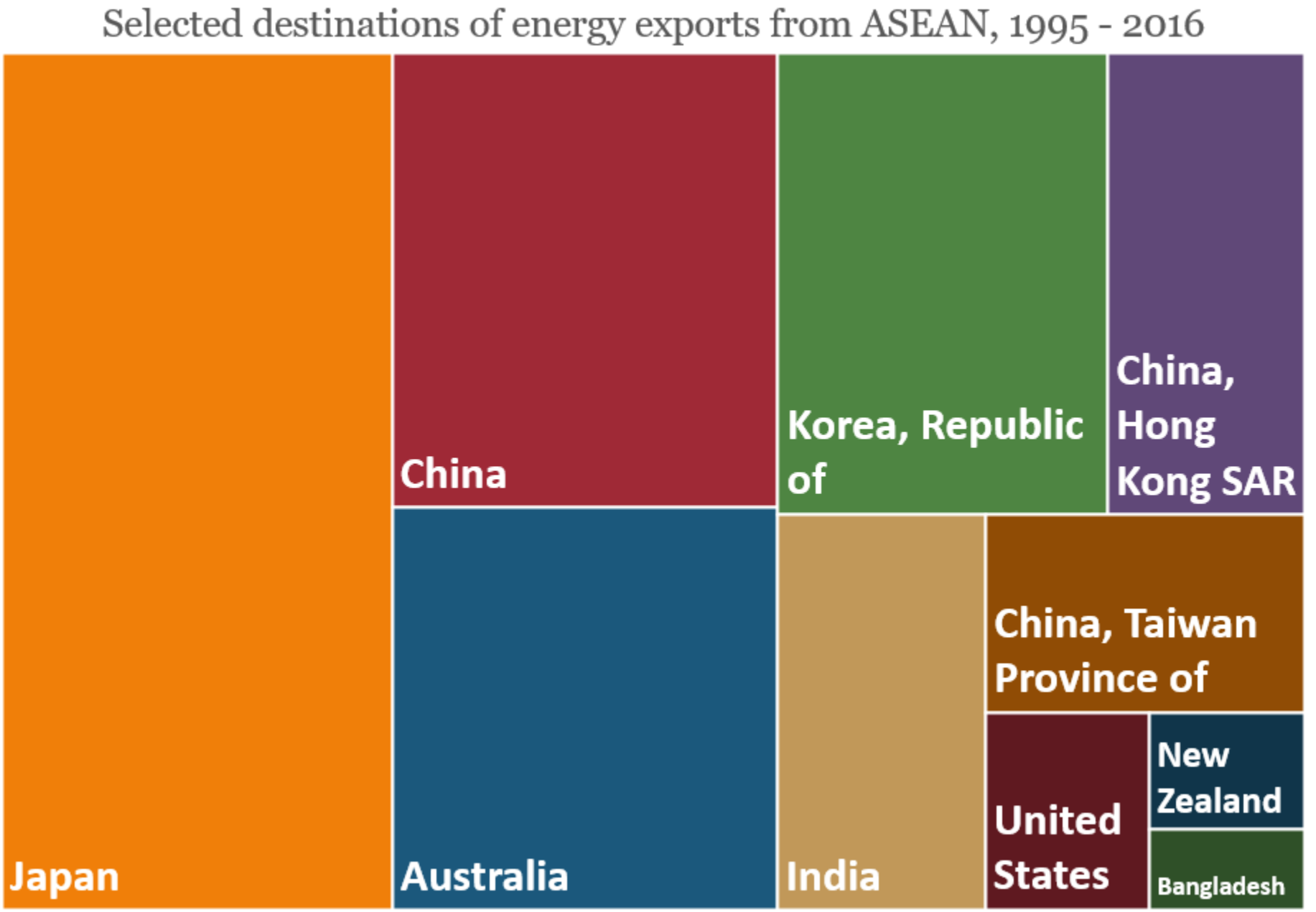
	Energy use	Activity effect	Energy efficiency effect	Economic structural change effect
Philippines	1.41	1.98	0.65	1.10
Thailand	1.69	1.67	0.79	1.28
Malaysia	1.67	2.41	0.90	0.77
Indonesia	1.64	2.40	0.61	1.11
Viet Nam	2.83	2.06	1.03	1.34
Russia	1.06	1.57	0.71	0.94
Mongolia	2.07	4.39	0.52	0.90
China	3.23	4.86	0.64	1.05
India	2.33	2.67	0.65	1.33

Energy trade

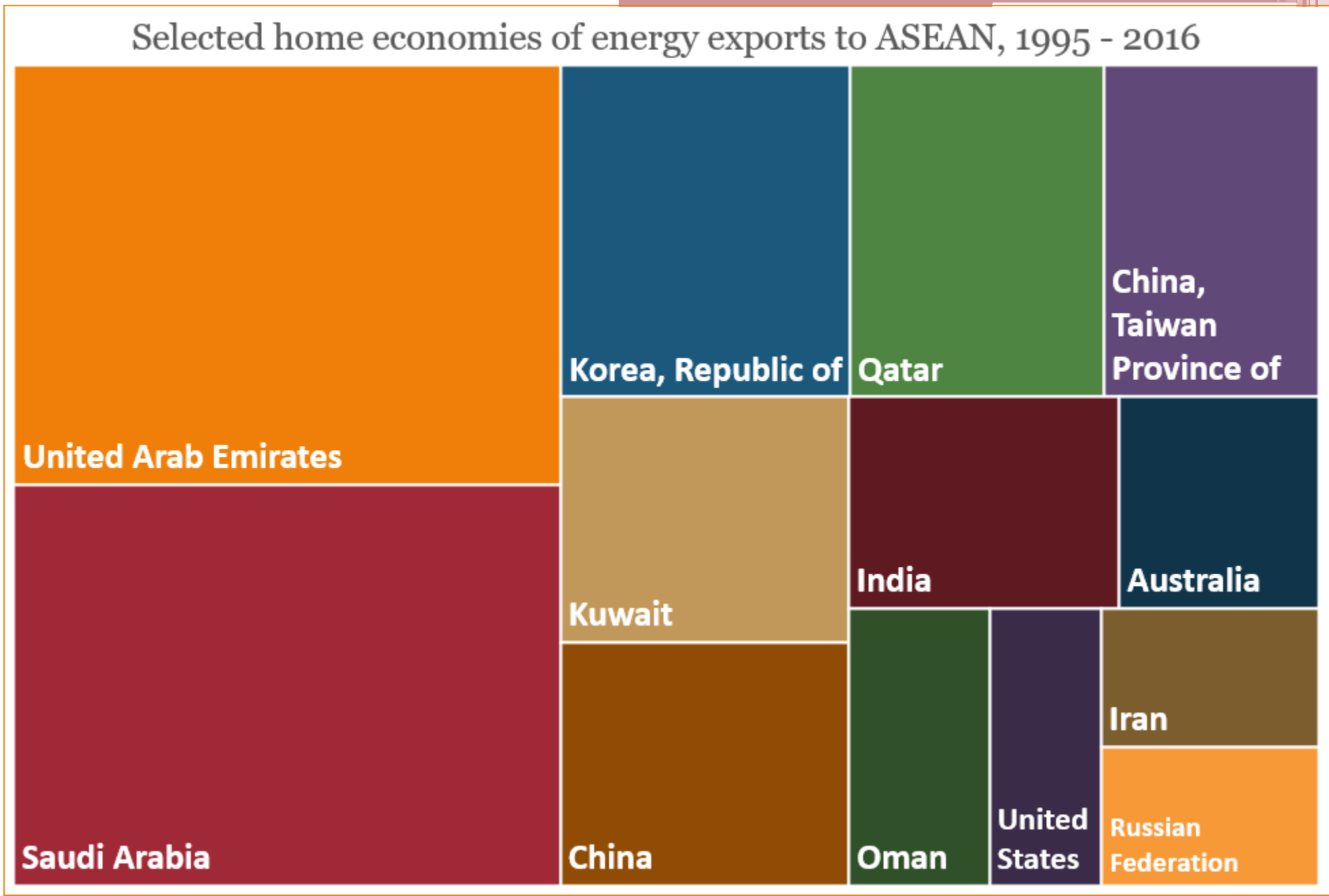
- Data: UNCTAD
- Trade of mineral fuels, lubricants and related materials (SITC 3) in thousands of US dollars, including:
  - Coal, coke and briquettes
  - Petroleum, petroleum products and related materials
  - Gas, natural and manufactured
  - Electric current
- Regional concentration of energy trade
  - Destinations of energy exports from ASEAN: mostly Asia-Pacific region
  - Home economies of energy exports to ASEAN: Middle East & Asia-Pacific region

Energy trade

- Who buys energy products from ASEAN?
  - Japan
  - China
  - Australia
  - South Korea
  - Hong Kong
  - India
  - Taiwan
  - United States
  - New Zealand
  - Bangladesh



- Who sells energy products to ASEAN?
  - United Arab Emirates
  - Saudi Arabia
  - South Korea
  - Qatar
  - Taiwan
  - Kuwait
  - China
  - India
  - Australia
  - Oman
  - United States
  - Iran
  - Russia

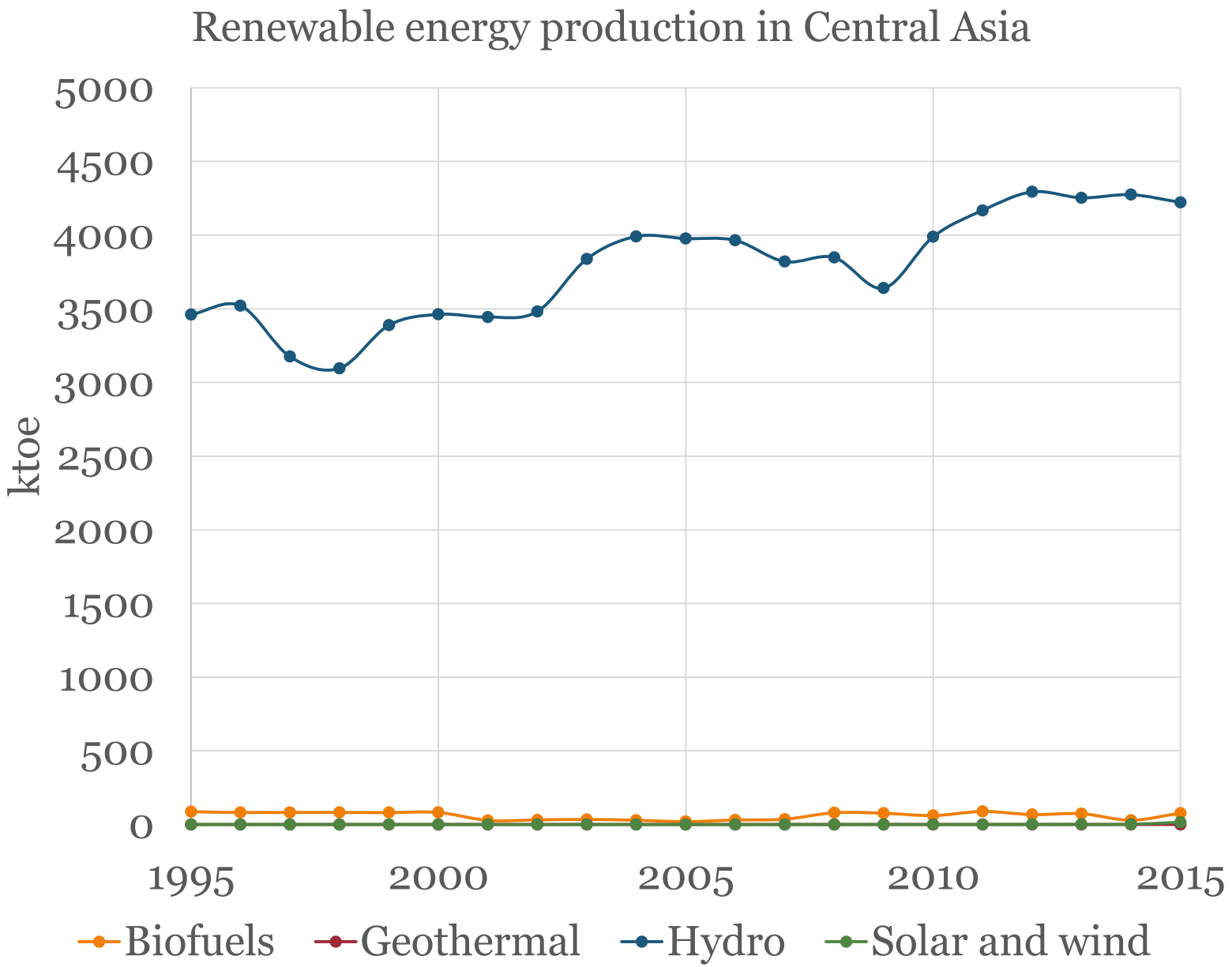


Determinants of energy trade 1995 – 2016

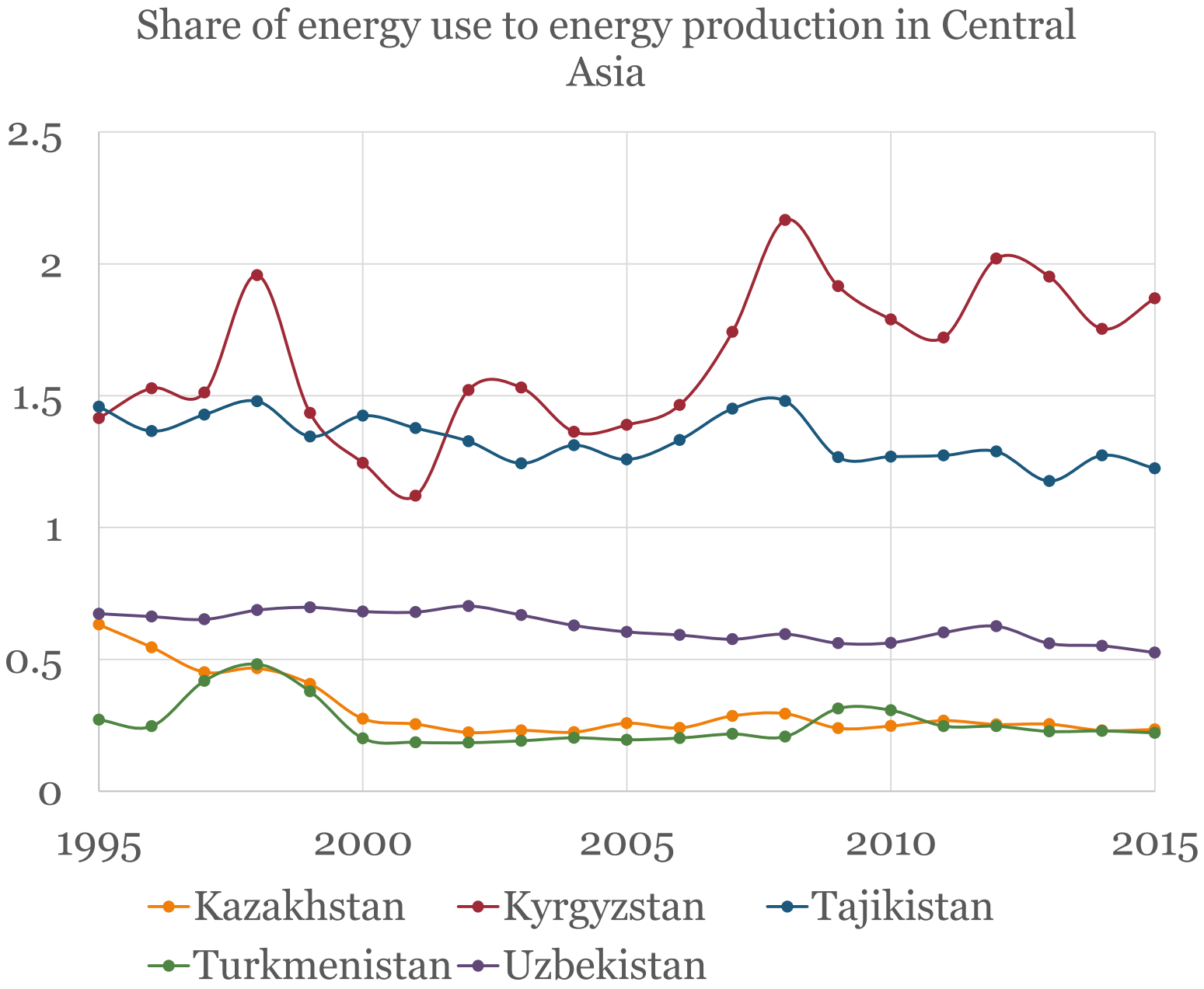
- Findings based on trade gravity model:
  - Distance matters: Longer distance lowers energy exports
  - Economic size
    - Larger GDP producer tends to have more energy trade
  - Energy intensity
    - Higher energy intensity in an exporter tends to reduce its energy exports
    - Higher energy intensity in an importer tends to increase its energy imports
  - Share of renewables in energy mix
    - Economies with larger share of renewables tend to import more energy
  - Regional trade agreement: correlated with increasing energy trade
  - Oil reserves
    - Exporters with more oil reserves tend to export more energy
    - Importers with more oil reserves tend to import less energy
- Energy trade within Central Asia is 2 times larger than the trade within ASEAN

Determinants of energy trade (* p<.05, ** p<.01, *** p<.001)

	Model 1	Model 2	Model 3	Model 4	Model 5
Distance	-1.501***	-1.629***	-1.717***	-2.083***	-2.012***
	(0.0308)	(0.0388)	(0.0409)	(0.0609)	(0.0602)
GDP of exporters	0.947***	1.075***	1.086***	0.874***	0.879***
	(0.0147)	(0.0228)	(0.0228)	(0.0397)	(0.0396)
GDP of importers	0.764***	1.025***	0.935***	1.348***	1.353***
	(0.0136)	(0.0226)	(0.0227)	(0.0379)	(0.0378)
Energy intensity of exporters		-0.0673	-0.0863	-0.345***	-0.375***
		(0.0569)	(0.0581)	(0.0948)	(0.0945)
Energy intensity of importers		-0.0213	-0.167**	0.210*	0.181*
		(0.0515)	(0.0523)	(0.0847)	(0.0845)
Regional trade agreement		0.481***	0.450***	0.403***	0.375***
		(0.052)	(0.0564)	(0.0865)	(0.0869)
Share of renewables in exporters			0.0202	-0.0359	-0.0434
			(0.0151)	(0.0241)	(0.0238)
Share of renewables in importers			0.0795***	0.186***	0.178***
			(0.0157)	(0.0263)	(0.0261)
Oil reserves of exporters				0.308***	0.305***
				(0.0194)	(0.0193)
Oil reserves of importers				-0.0635**	-0.0669***
				(0.0201)	(0.0201)
Exporters and importers within Central Asia					5.538***
					(0.451)
Exporters and importers within ASEAN					2.073***
					(0.417)
Constant	-25.41***	-35.98***	-35.60***	-35.46***	-37.36***
	(0.571)	(1.06)	(1.165)	(1.81)	(1.81)
Number of observations	162943	125827	103133	51711	51711



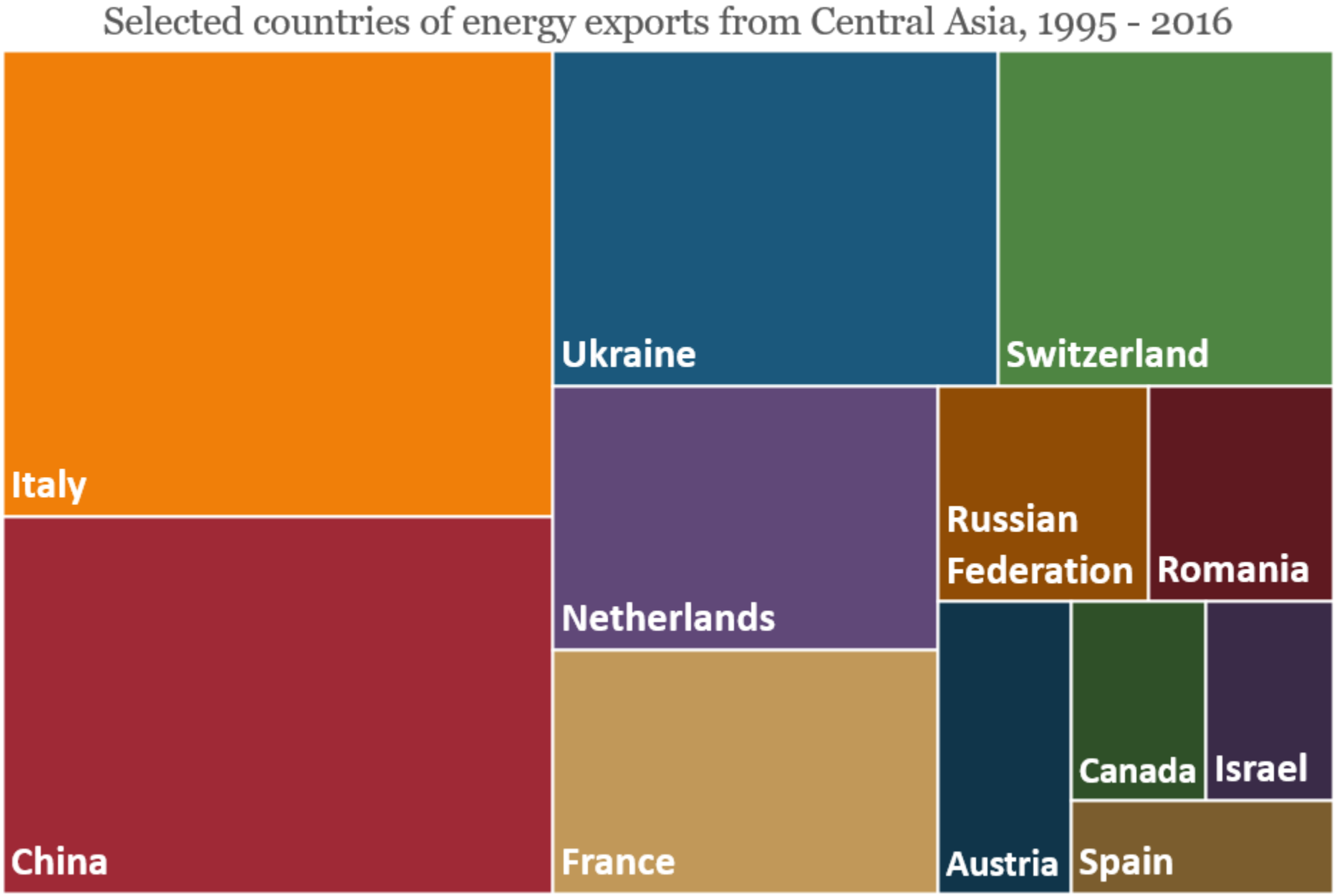
- Renewable energy structure
  - Hydro energy is the major renewable source in Central Asia, in particular Tajikistan.



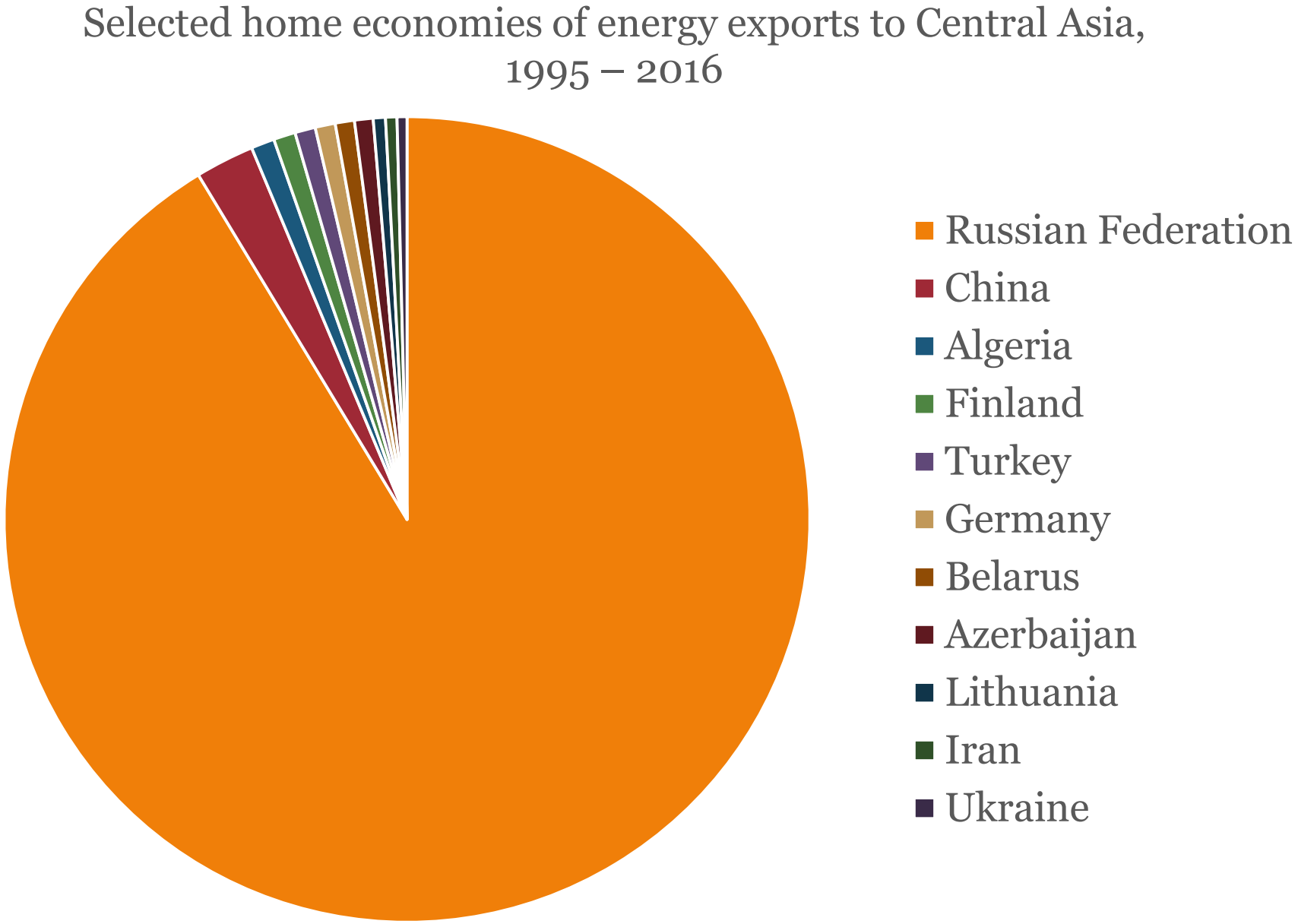
- Energy use> energy production
  - Kyrgyzstan
  - Tajikistan
- Energy use< energy production
  - Kazakhstan
  - Turkmenistan
  - Uzbekistan

Energy trade

- Who buys energy products from Central Asia?
  - Italy
  - China
  - Ukraine
  - Switzerland
  - Netherlands
  - France
  - Russia
  - Romania
  - Austria
  - Canada
  - Israel
  - Spain



- Who sells energy products to Central Asia?
  - Most from Russia



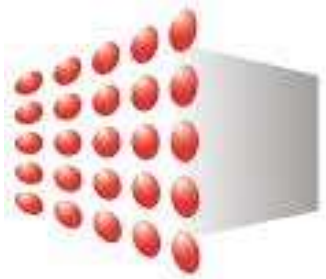
Conclusions

- Development in renewables has not significantly contributed to improving energy security so far
- Progress in energy intensity tends to reduce reliance on energy imports
- Energy efficiency progress contributed to reducing energy demand, but largely offset by economic structural change in part of ASEAN countries
- Regional economic integration has a significant role in promoting energy trade

Policy implications

- Countries need to enhance the role of renewables in long term energy strategy
- Energy saving gains must be enabled by technological change and economic structure change
- Regional trade help improve energy security
- Central Asia faces serious infrastructure bottleneck to realize energy bonus due to lack of maritime transport facilities

Thank you!



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