

# Pursuing nuclear power as an option for Namibia

Nortin Titus

The views expressed does not reflect the position, opinion or policy of MME, the Government of Namibia, the Geological Survey, AEB or NCRST



- Most recognisable rock in the Universe!
- Houses 7 billion people
- Created without borders
- 70% of the surface is covered with water
- Iron, oxygen and silicon
- It's tilted by 66 degrees





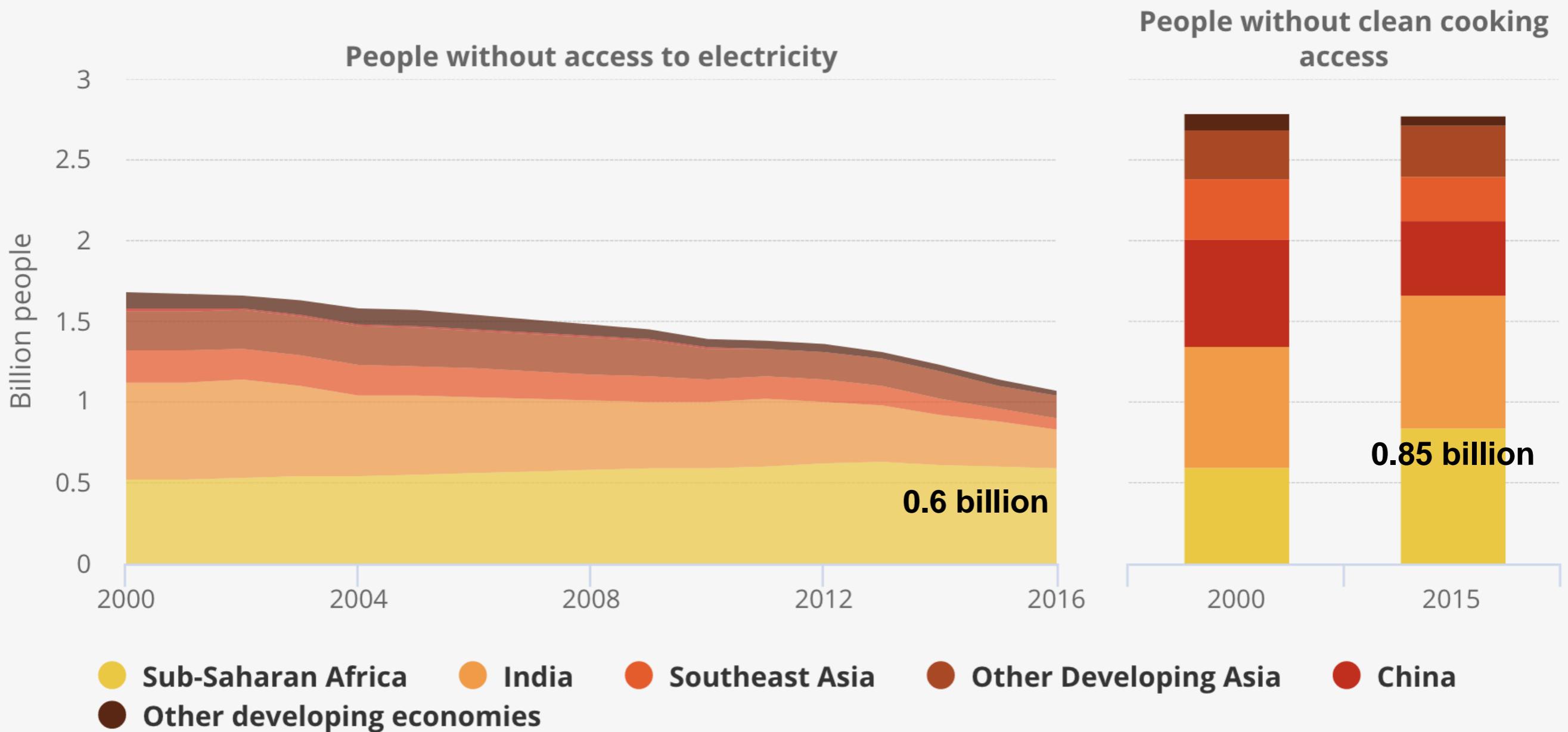
- Shared space
- Shared resources -  
for us & for our  
offspring
- Preserve the  
environment





...electricity - the oil of the future...

## People without access to electricity and clean cooking facilities



# If 500 million people in Africa cooked a hot meal everyday

- Electric range - 3kW
- 2h ; 5 days / week
- 450 TWh / year



# Demand for electricity

- shelter and heating
  - water and sanitation
  - cooking
- ....
- ....
- ....
- economic development

# Demand for baseload electricity

- data collection, data storage, knowledge generation, knowledge deployment
- communication and commerce
- digitisation and automation (incl. agriculture and mining)
- electrification of the transport sector
- global security

# Future of Mining Explore

Real insight into the catalysts and trends changing mining's future

► Exploration

► Sustainability

► Innovation

► Investment

► Have your say

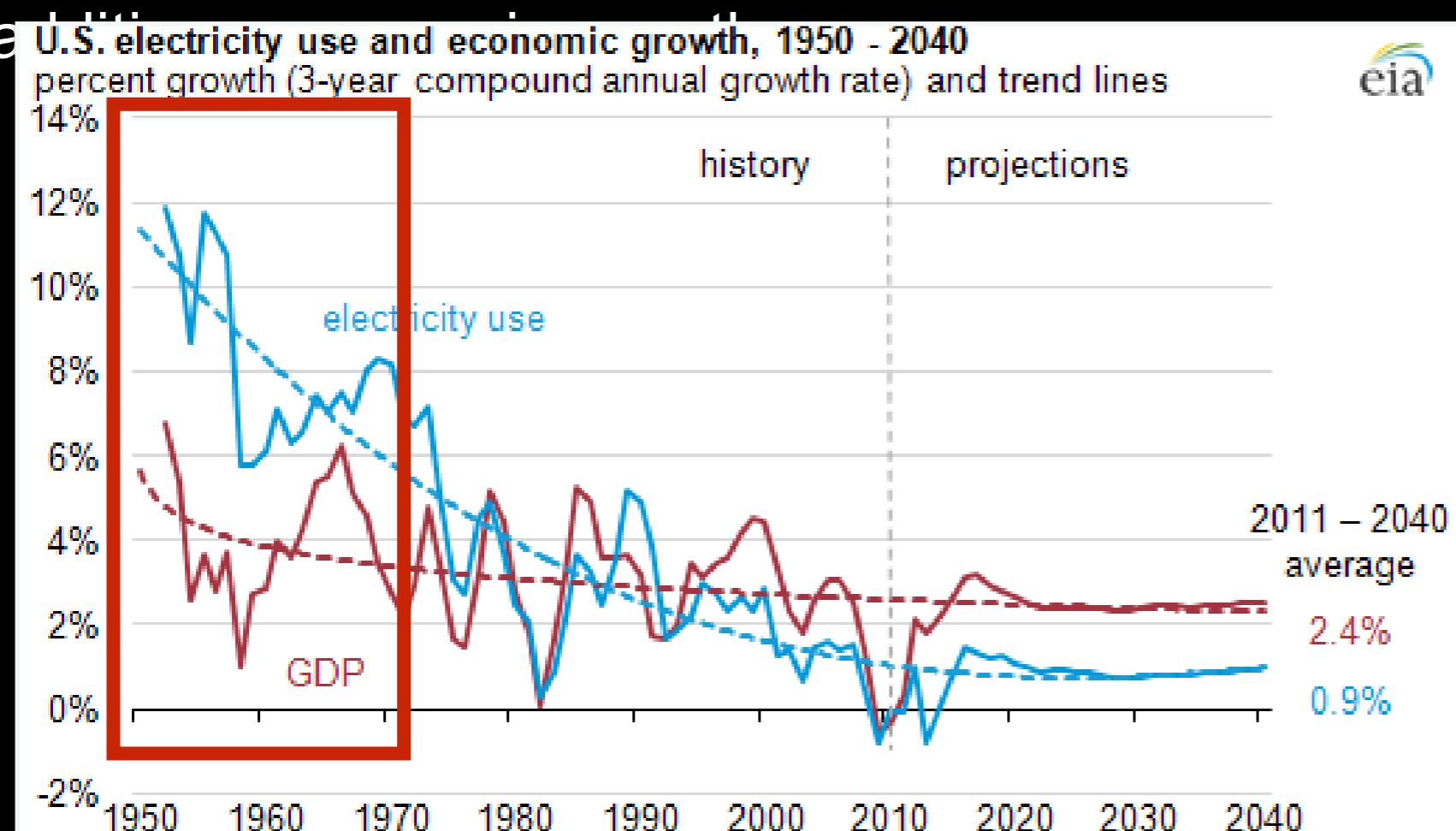
## Electric mine-truck pilot project for Aitik

Boliden has initiated a pilot and demonstration project for the electrification of in-pit truck transports in Aitik, Sweden's largest open pit copper mine, together with key partners in industry and academia

Staff reporter | 23 Feb 2018 | 13:56 | News |

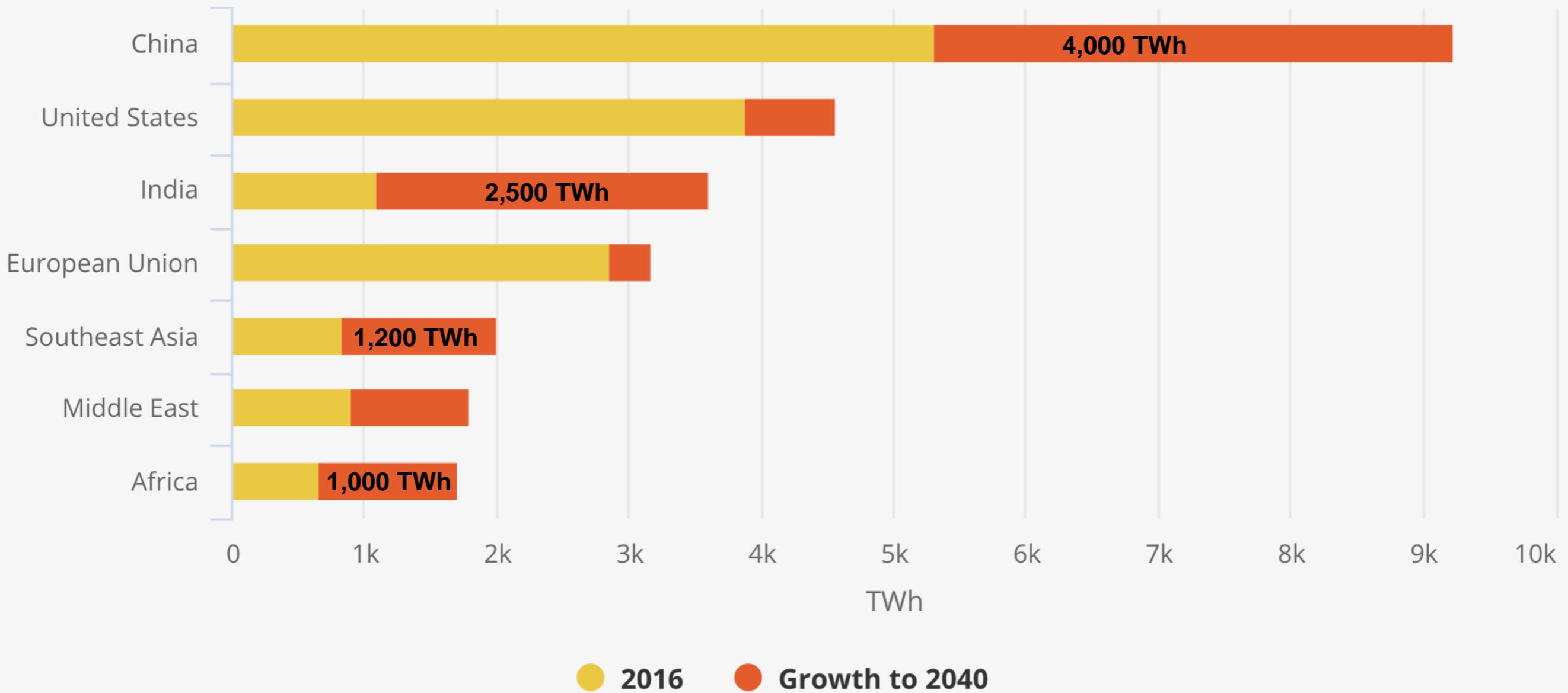
# Demand for electricity

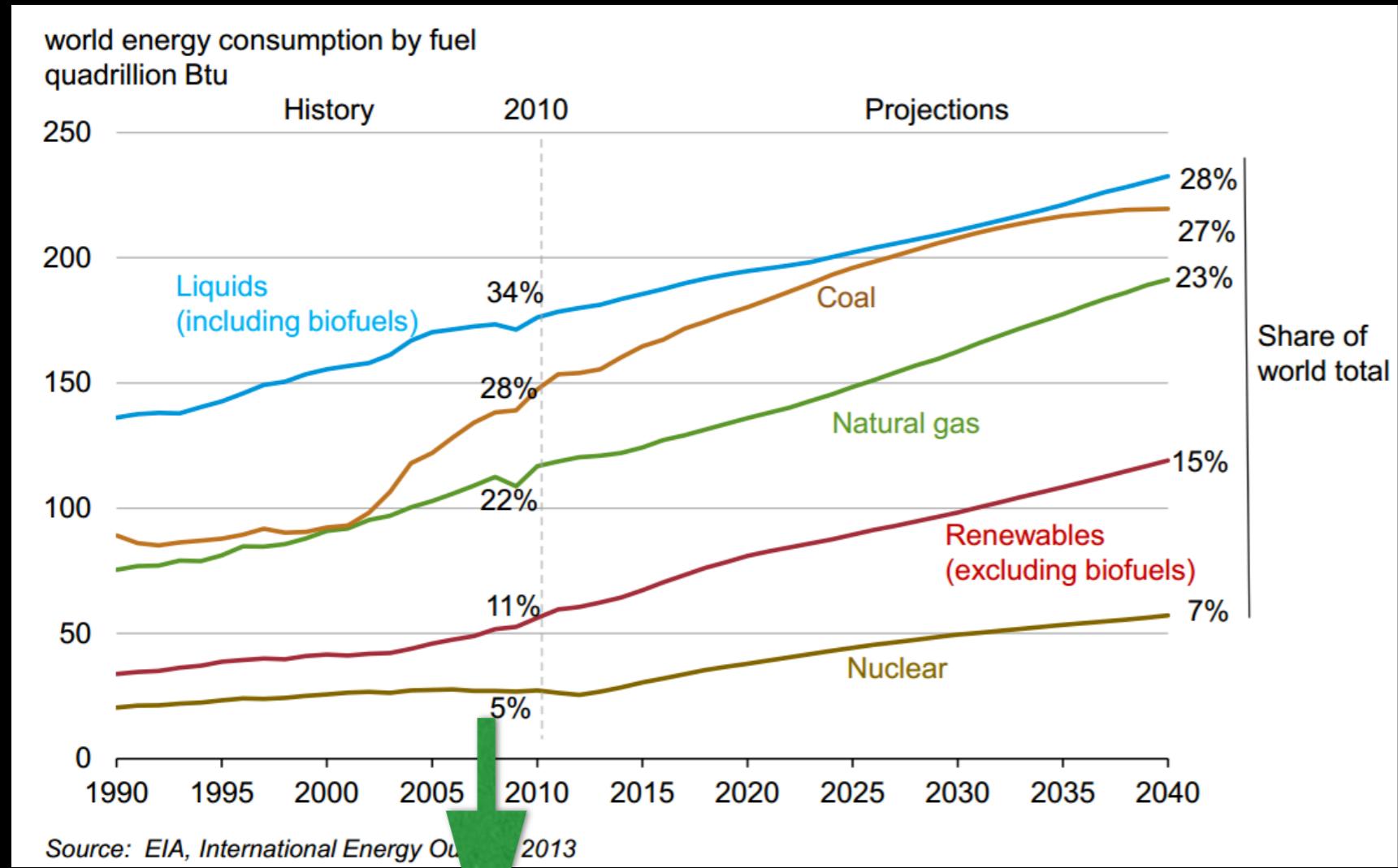
- Traditionally - raw material processing, manufacturing and value



- 2-3x electricity use for 1% economic growth

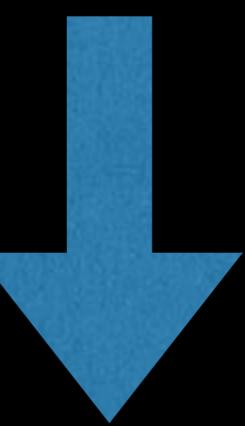
## Electricity demand by selected region





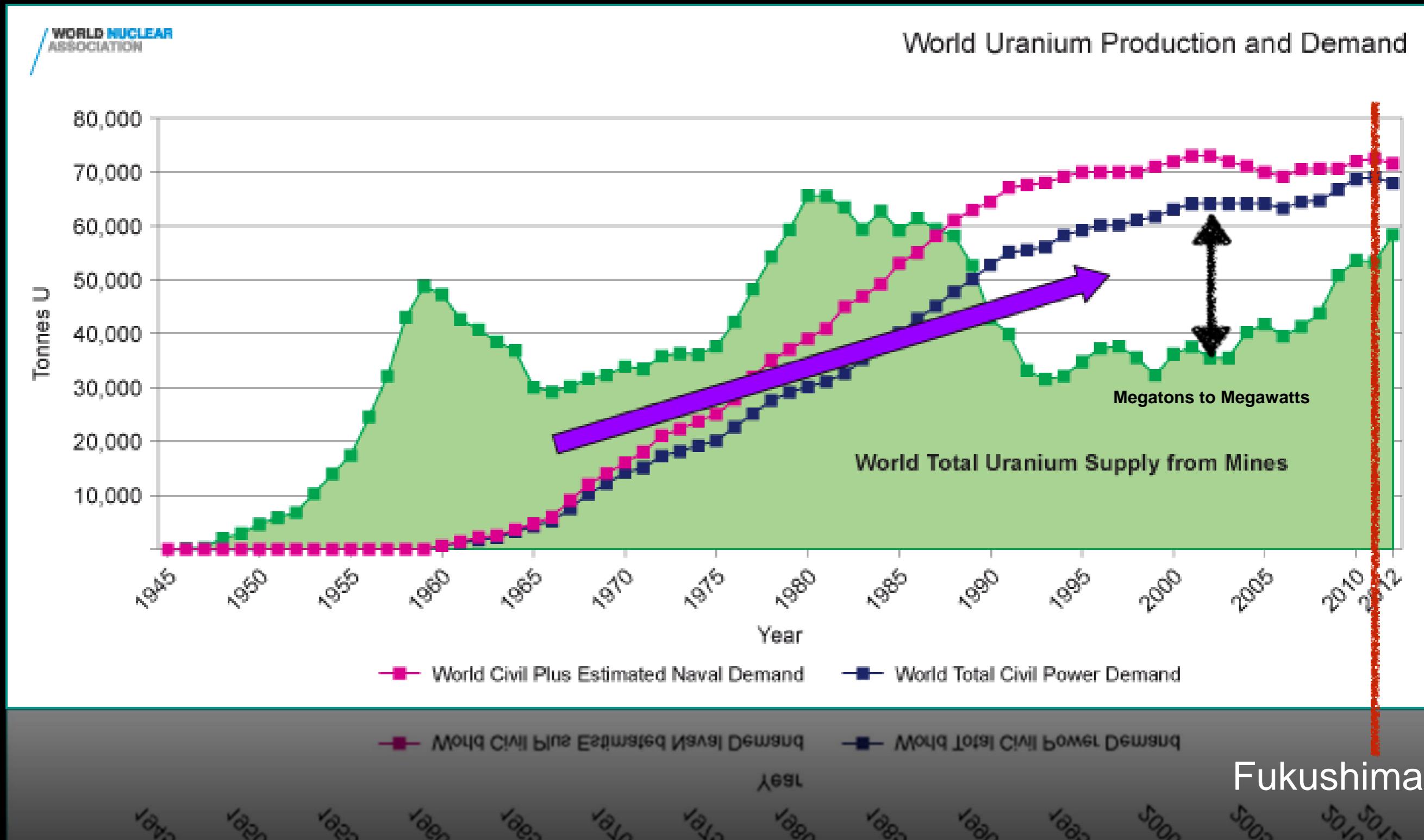
U

C



Si, Li, Co, As,  
Ga, I, Se, Pb

# Supplied nuclear fuel for civil applications



# Post Fukushima era

- 2000 - 2010: 38 new nuclear power reactors connected to the electrical grid
- 2011 - present: 45 new nuclear power reactors connected to the grid.
- 2000 - present: 83 new reactors ~ 80 GWe (~700 TWh)
- Total of 450 reactors operating globally
- 56 reactors currently under construction

## Namibia seeks to use its own reserves

16 January 2007

**Namibia holds about 7% of the world's uranium reserves, which are mined to fuel nuclear power stations around the world. Now the country is taking steps to use the nuclear fuel for its own development.**



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## Namibia works on nuclear energy policy

02 December 2010

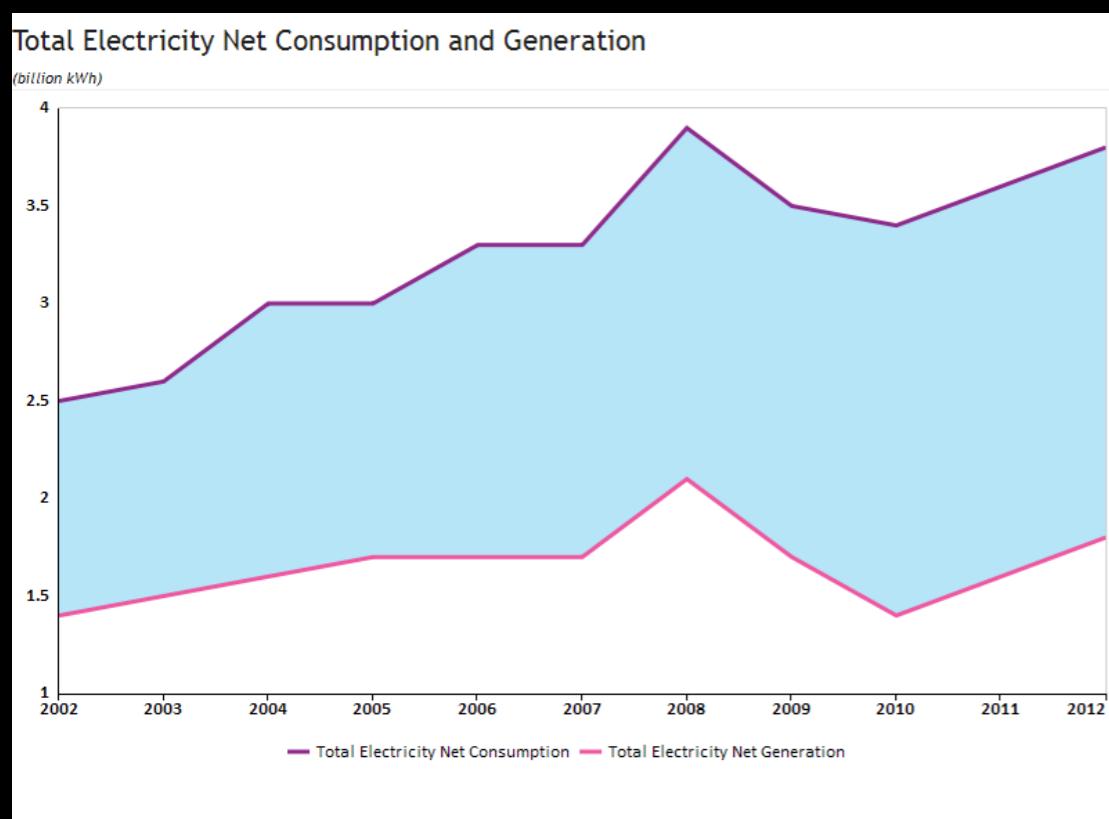
Namibia is seeking to develop a nuclear energy program in order to make use of its uranium resources, *AfricaNews* reported. "It is the expressed decision of the Namibian government to seriously consider the development of nuclear power in order to complete the national energy mix and provide sufficient energy for our development," mines and energy minister Tsak Katali said during the country's first-ever stakeholder

### Related Stories

- Namibia regulating uranium,



- Consume 3,7 TWh electrical energy
- Generate 1,5 TWh of electrical energy
- A single 120MW baseload power station
- Independent Namibia has not had a baseload power plant connected to the grid
- To close the demand gap will require 3 additional 120 MW Van Eck power stations.



- We import 100% of the coal required for Van Eck
- We import yearly on average 60% of our electrical supply
- Neither our fuel or electricity need is 100% secured.

25 April 2018 13h00

<u>System Load (MW)</u>	Total: 503.42
	Skorpion: 3.93
<u>Generation (MW)</u>	Ruacana: 339.65 (300.10 m3/s) Gen 1: 87.10 Gen 2: 86.20 Gen 3: 80.95 Gen 4: 85.40 (77.75 m3/s) (76.60 m3/s) (69.35 m3/s) (76.40 m3/s) Head Bay (m): 896.40 Weir (m): 902.51 Van Eck: 11.17 Gen 1: -0.40 Gen 2: 0.00 Gen 3: 11.76 Gen 4: 0.00 Paratus: 0.00 Anixas: 0.00 Gen 1: 0.00 Gen 2: 0.00 Gen 3: 0.00 Renewables: 32.29 Solar: 30.84 Wind: 1.45
<u>Imports/Exports (MW)</u>	ESKOM: 114.60 Aggeneis - Harib 220KV - Line 1: 31.69 Line 2: 29.99 Aries - Kokerboom 400KV: 56.85 ZESCO: 7.05
<u>Cross-Border Supplies (MW)</u>	Efundja - Ondjiva 132KV: 6.66 Omaere - Ghanzi 132KV: 3.79

25 April 2018 19h00

<u>System Load (MW)</u>	Total: 602.21
	Skorpion: 3.93
<u>Generation (MW)</u>	Ruacana: 344.30 (303.80 m3/s) Gen 1: 87.20 Gen 2: 86.20 Gen 3: 85.80 Gen 4: 85.10 (76.05 m3/s) (76.10 m3/s) (74.15 m3/s) (77.50 m3/s) Head Bay (m): 896.20 Weir (m): 902.51 Van Eck: 12.01 Gen 1: -0.53 Gen 2: 0.00 Gen 3: 12.50 Gen 4: 0.00 Paratus: 0.00 Anixas: 0.00 Gen 1: 0.00 Gen 2: 0.00 Gen 3: 0.00 Renewables: 0.96 Solar: 0.04 Wind: 0.92
<u>Imports/Exports (MW)</u>	ESKOM: 236.68 Aggeneis - Harib 220KV - Line 1: 47.04 Line 2: 44.91 Aries - Kokerboom 400KV: 146.96 ZESCO: 8.85
<u>Cross-Border Supplies (MW)</u>	Efundja - Ondjiva 132KV: 6.08 Omaere - Ghanzi 132KV: 4.22

19h00 - We need an additional 100MW and lost 30MW  
We need 130 MW more @ dinner time



# Namibian uranium

- Supplies currently ~ 5% of world demand of nuclear source material (can supply ~10%)
- Rio Tinto produced 1,850t of uranium oxide in 2016 (down from ~2,600t in 2012)
- ±2,000t supplies ca. 8 nuclear power reactors with fresh fuel per year
- Namibian nuclear fuel generate more than 3,000 MW ~ 26 TWh electrical energy in 2016.
- At 70% of full capacity, Van Eck burns 2,000t of coal within 1 and a half days.



# Implications of our uranium fuel exports

- ~3000t exported yearly
- Fuel for 4 new reactors ~ 30 TWh (3,500 MWe)
- Yearly supply of fresh fuel for ~12 existing reactors (28 TWh electrical energy to other nations)
- Zero need for our own fuel, but rely on 80% imports to supply our electricity need.

# Implications of our uranium fuel exports

Koeberg nuclear power plant



- ~500t needed
- Generate 14 TWh/year
- Own consumption of 4 TWh - 10 TWh baseload ready for export
- 2,500t available for global supply
- Occupy 0.5 km<sup>2</sup> - 72 km<sup>2</sup> (solar) / 1,300 km<sup>2</sup> (wind)

*..is this politics of the belly...?*

# It Does Not Add Up

...the debate on nuclear power generation must start for the sake of the next generation...

# ...we are not maximising our uranium resource...

- We are already exploiting it
- Handing over our competitive advantage
- Compromising our future security of energy supply
- We remain energy starved
- Our future generations will remain starved as well

Home > Future of Mining: Sustainability > Nuclear power on a micro scale

## ⌚ Future of Mining Explore

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## Nuclear power on a micro scale

All miners should be keeping an eye on the development of small modular reactors. Hatch's Brian Gihms explains why

## SMRs a future alternative for remote generation

A SYDNEY business group heard recently that there was real potential for off-grid nuclear power generation courtesy of small modular reactors in the decades to come, revolutionising the cost competitiveness of remote mining and infrastructure projects in vast and remote terrains such as Australia.



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## Small modular reactors: the future of nuclear

By Brian Gihm | June 17, 2016

It's been said that the best way to predict the future is to invent it. In nuclear energy, the future we've predicted—and invented—is inching closer all the time. Small modular reactors, commonly referred to as SMRs, have the potential to change the way the world thinks about electricity production.



IAN MARTIN

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## Think Small: Could SMRs Be Nuclear Power's Next Big Thing?

January 25, 2018 / in Electrical, Engineering, Industry, Nuclear, Power & Energy / by Lee Nixon

SMRs, or small modular reactors, have been creating buzz in the nuclear industry for some time now. That buzz got noticeably louder in 2017 when Canadian Nuclear Laboratories (CNL), Canada's premier nuclear science and technology organization, set the ambitious goal of establishing an SMR on its Chalk River site by 2026.

# Nuclear power landscape

- Countries are continuing with their nuclear power programs
- The development of small modular reactors (SMR) is gaining momentum (more in the East than the West)
  - 10 MW - 300 MW
  - After 2030, SMRs may be the key baseload power producers for small economies, communities and remote operations

# Preparing Namibia for the future

- We must prepare for an electrical future that includes nuclear energy
- Improve our policy, legislation and regulations to make provision for nuclear power generation
- As a mineral rich country, the mining sector will increase usage of machines to mine at greater depths
- Must try to regain our competitive advantage!



Thank you

