The importance of energy literacy

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http://energyeducation.ca

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What I'll talk about

- Why we care about energy
- The world needs and is using more energy
- Creating an energy literate population

Who cares about energy?

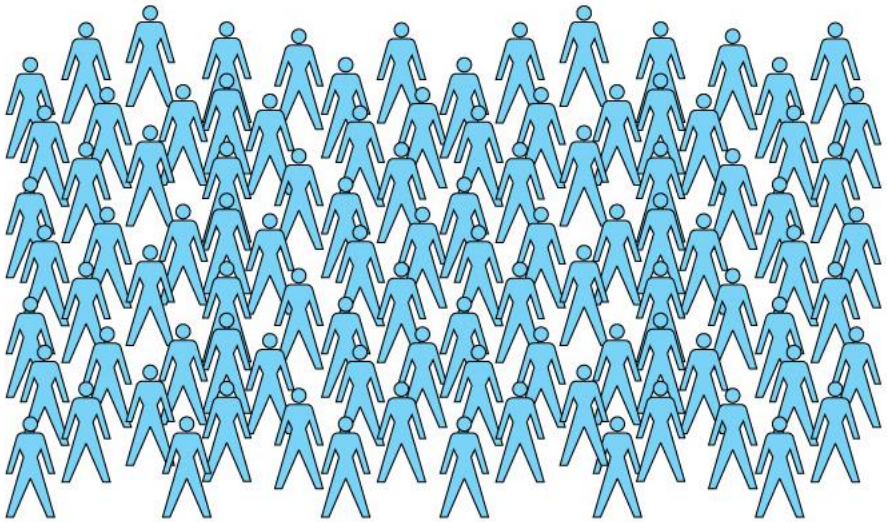
- We don't want
  - Calories
  - Gasoline
  - Electricity
  - Natural gas
- We want
  - Food
  - Travel
  - Entertainment
  - Warm houses

It's what energy gives us!

A person produces ~100 W

- Bend your wrist, ~1 W
- Deep knee bends ~100 W = 1 energy servant
- Canadians use ~110 energy servants
- World average is 20 energy servants

You



Your energy servants

Worldwide demand is increasing

World needs 5-6x for power equality

Power in 2014

16 TW
=
16,000,000,000,000 W

Power in future?

80 TW
=
80,000,000,000,000 W

People often misunderstand the issue

Phrases like:

- "Energy is needed to live the way we want to."
- "Energy dense fuels give a high quality of life."
- "The developing world wants the same energy resources that we have."

don't really say as much as we think

Energy is needed to live the way we want to.

Image taken from:
http://www.oysterworldwide.com/news/melanie-current-oyster-nepal-volunteer-tells-us-just-how-resourceful-nepali-people-are/img_3522/

Energy dense fuels give a high quality of life

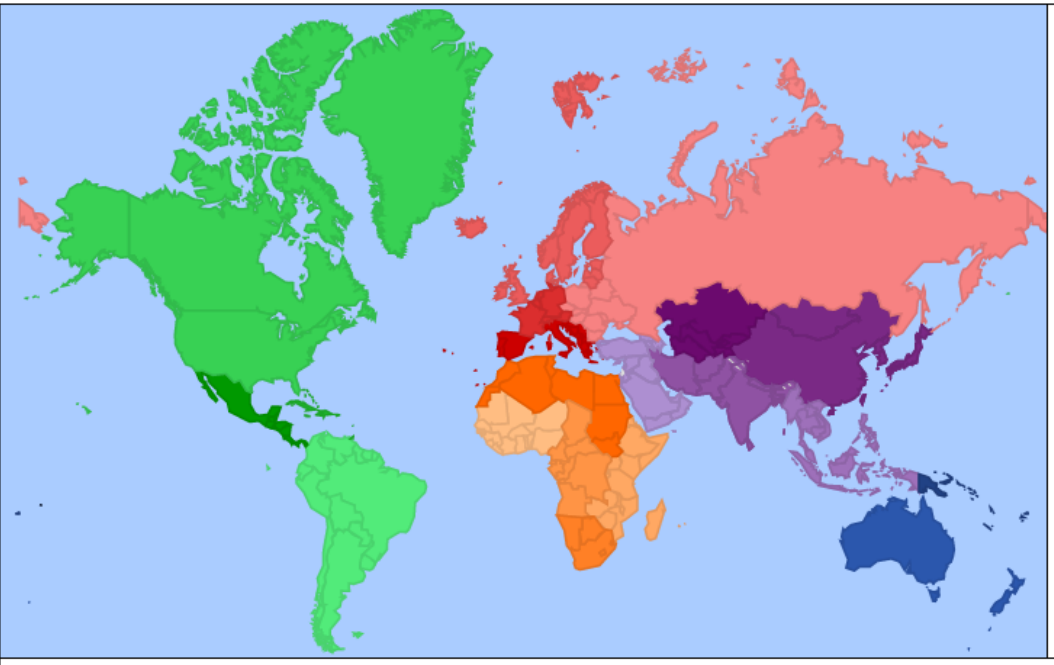
http://practicalaction.org/blog/access-to-services/energy/improved-cooking-stoves-an-issue-of-perception/

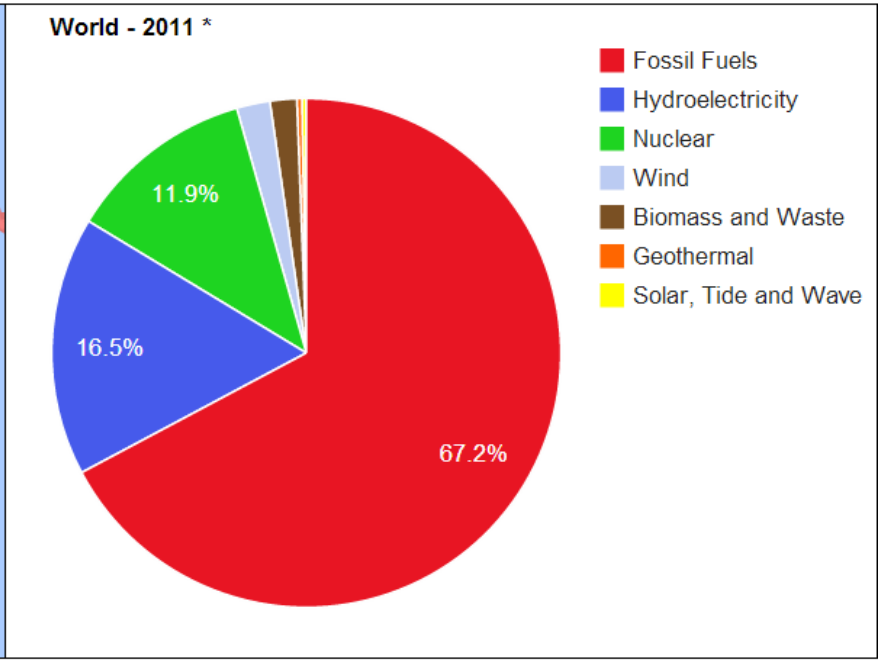
Developing world wants the energy wealth.

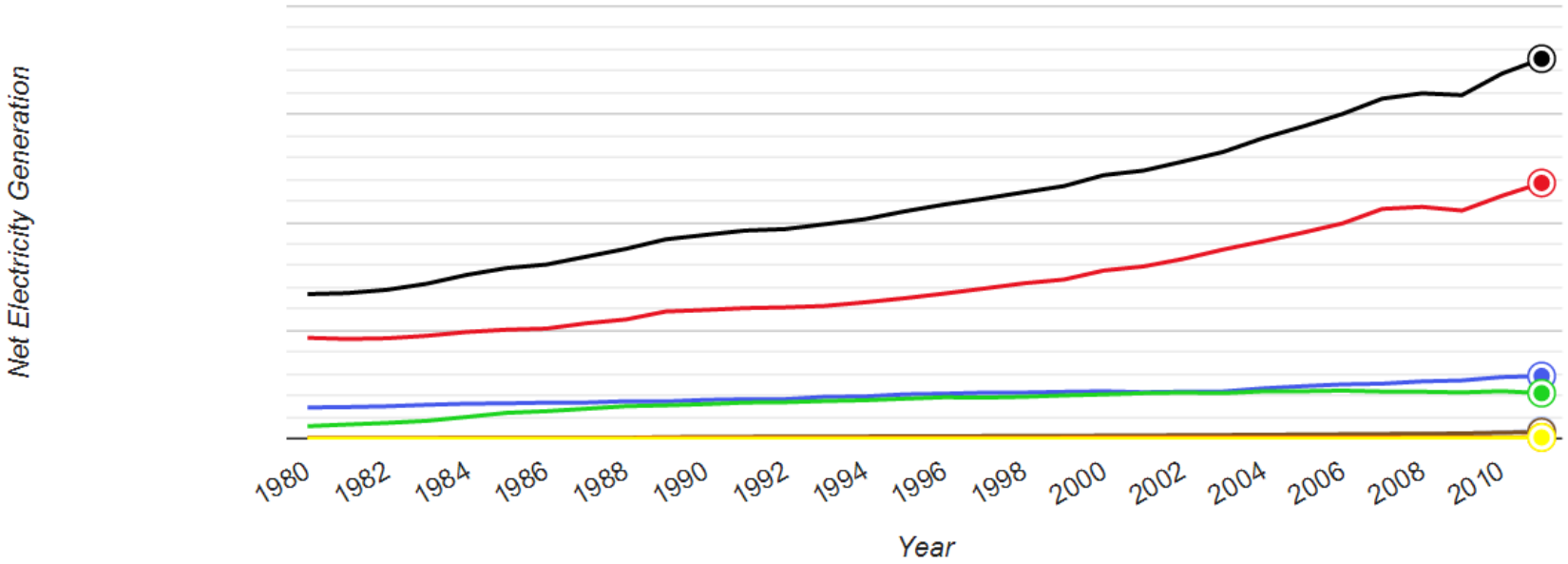
How will they get it?

Electricity generation

Location: World Year: 2011 Submit



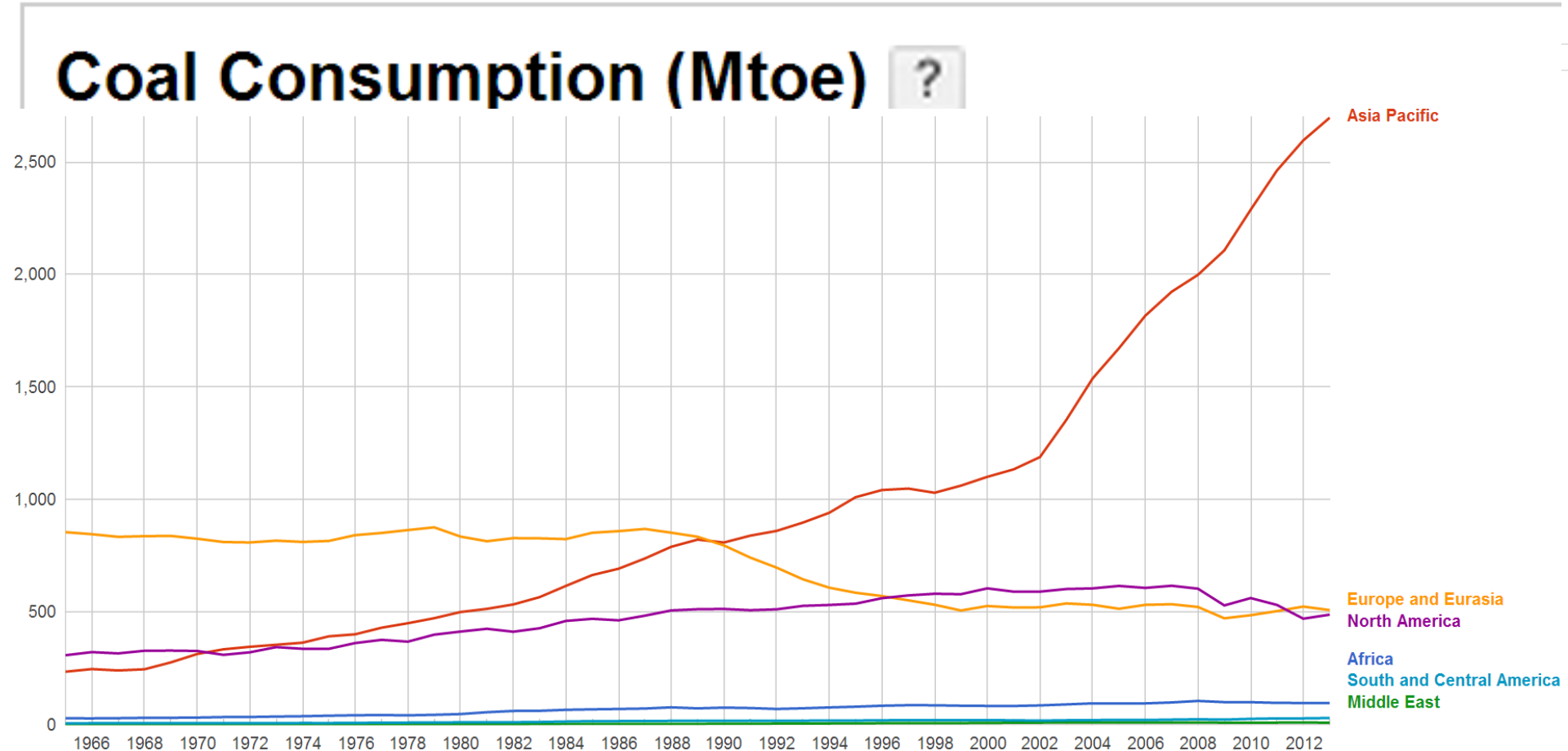




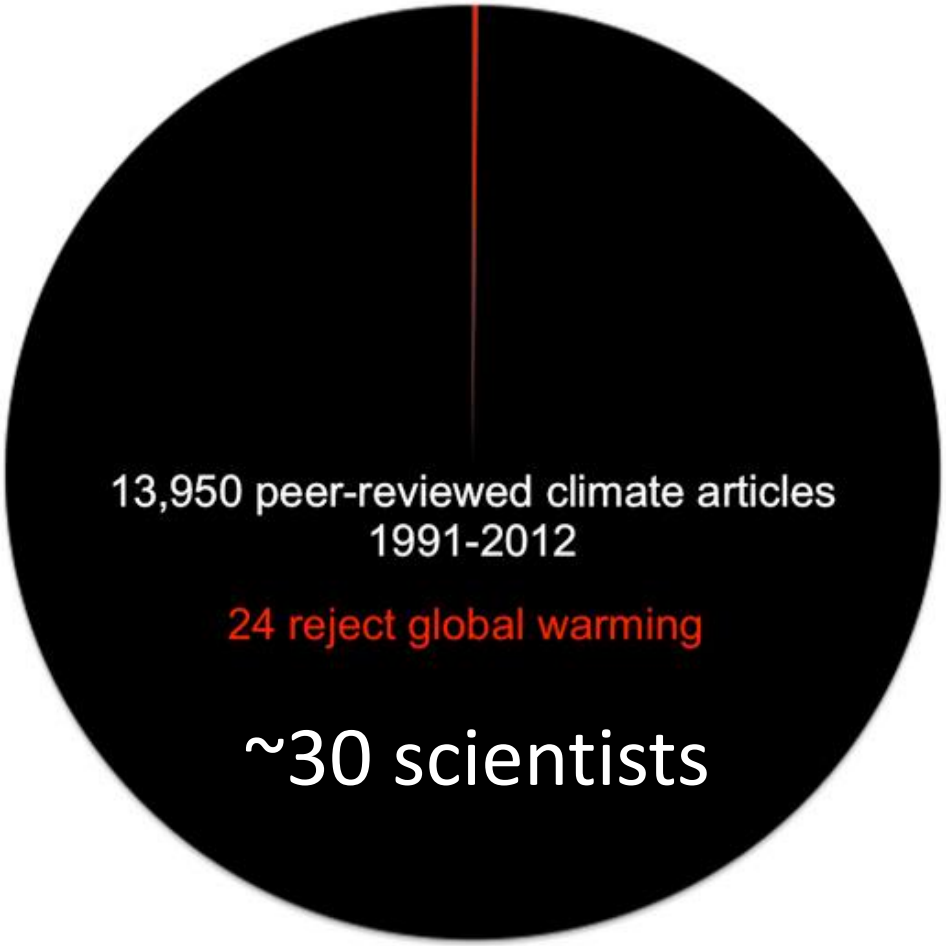
Fastest growing energy source?

Graph: Line ▾ Compare By: Region ▾

Y-axis: Coal ▾



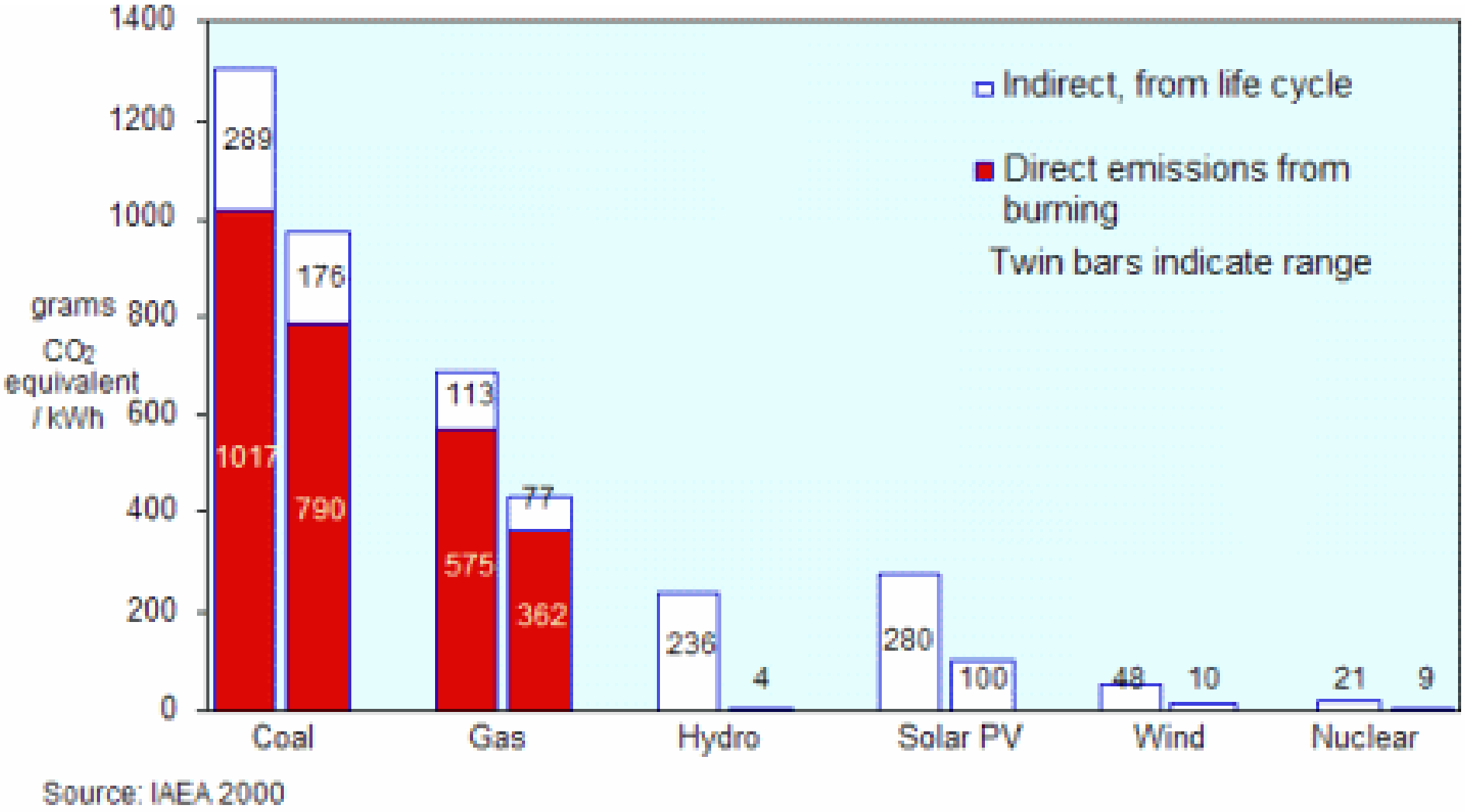
Consensus?



List all of the climate change papers that deny

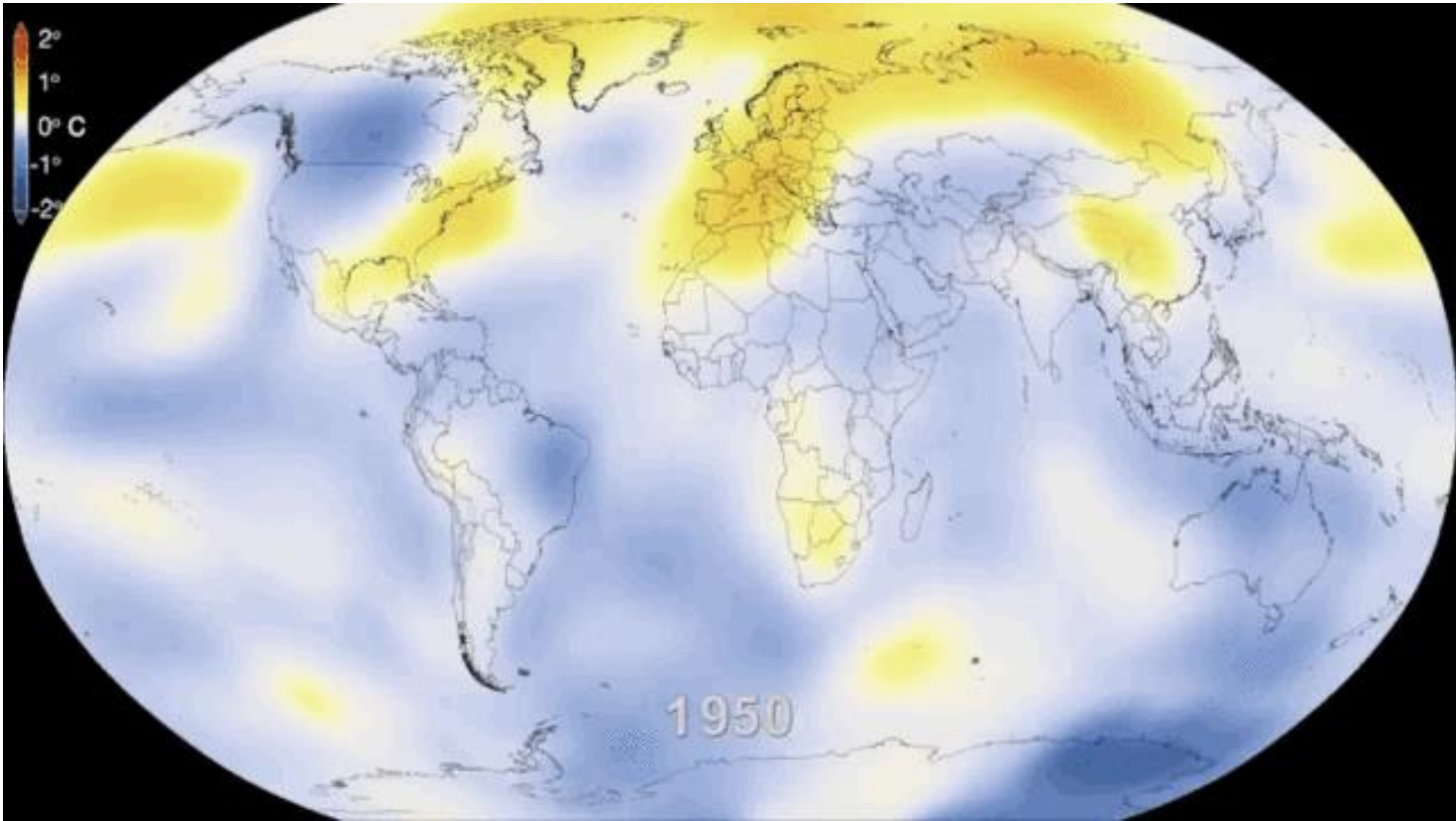
http://www.jamespowell.org/Rejections/index.html

GHG from electricity, g/kWh



Source: IAEA 2000

The Climate is Changing, the World is warming
It's mostly CO_2, which makes it human driven
(image from NASA: 6 decades of warming Earth)



Numbers are hard to imagine

- AB uses 4 GWyr of coal power

  ~ 32 million tonnes of coal/year

- 1 GW of solar ~ 400 km^2

- 1 GW of wind ~10 000 km^2

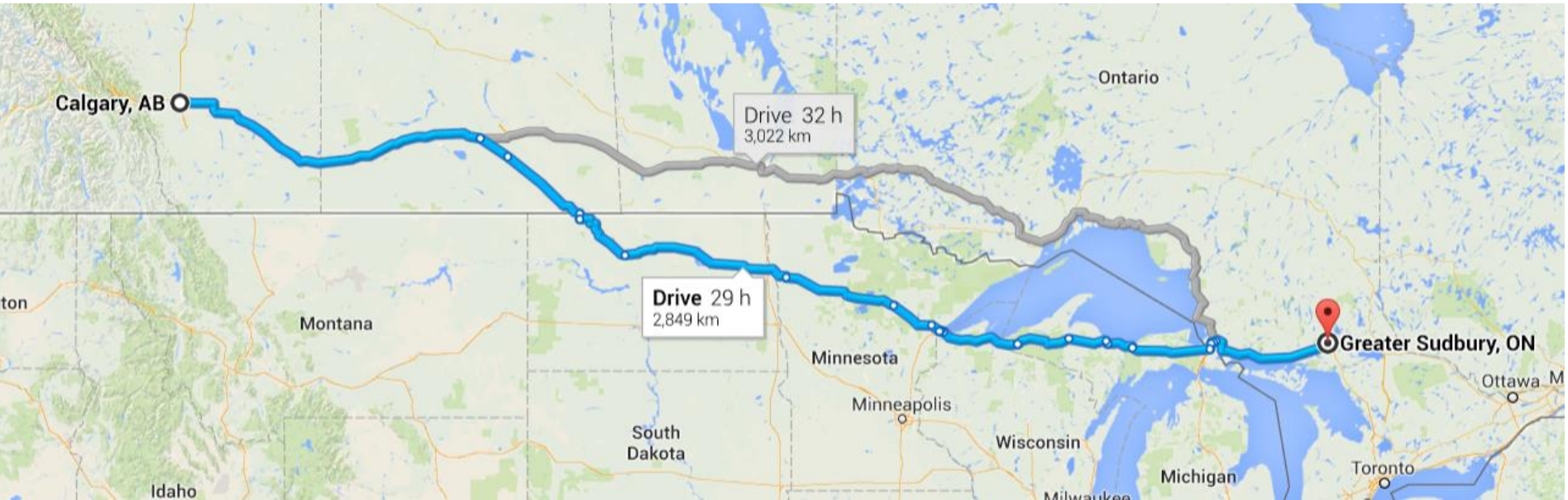
AB coal use in 1 year

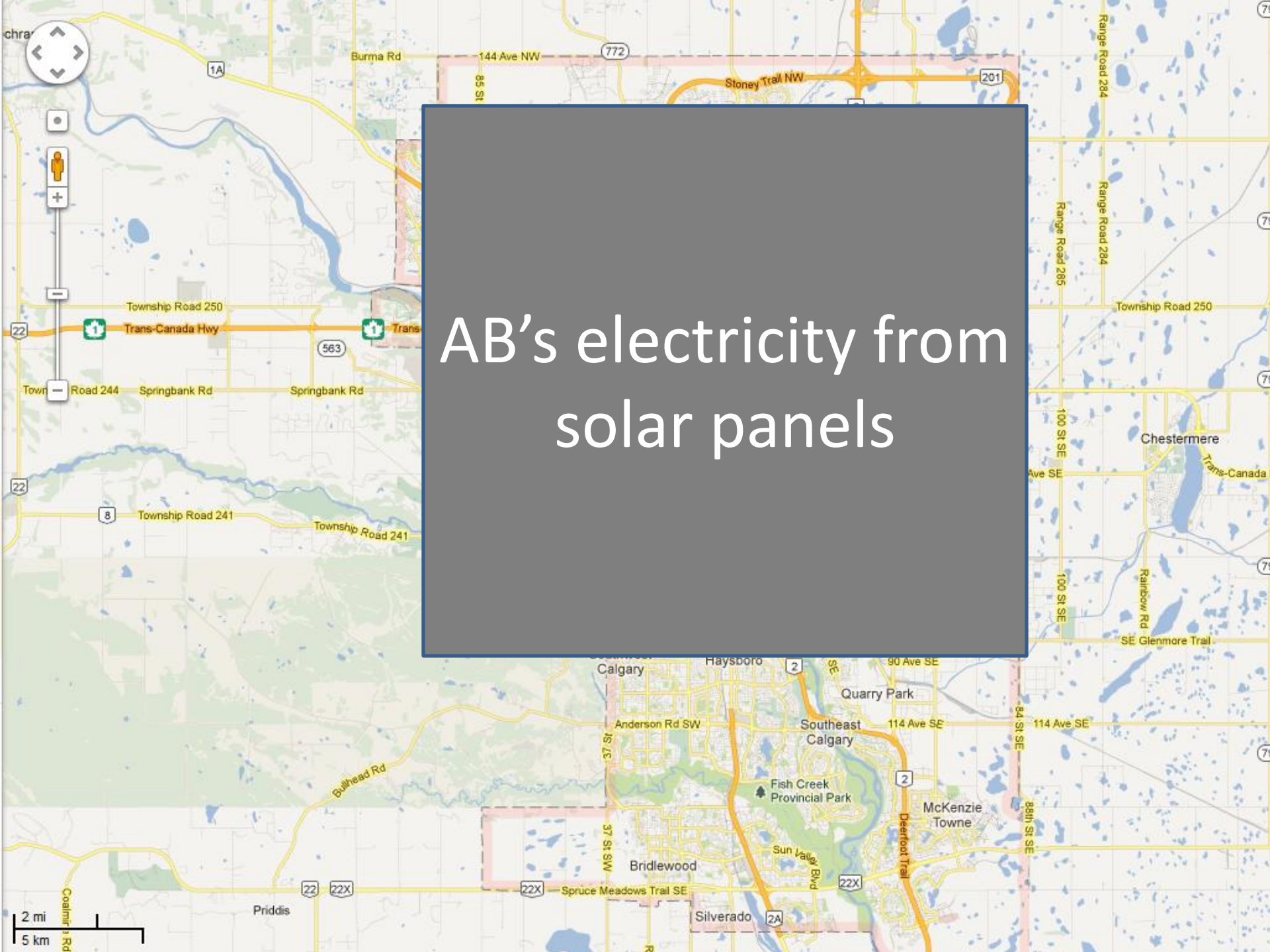
For 1 year, 1440 trains

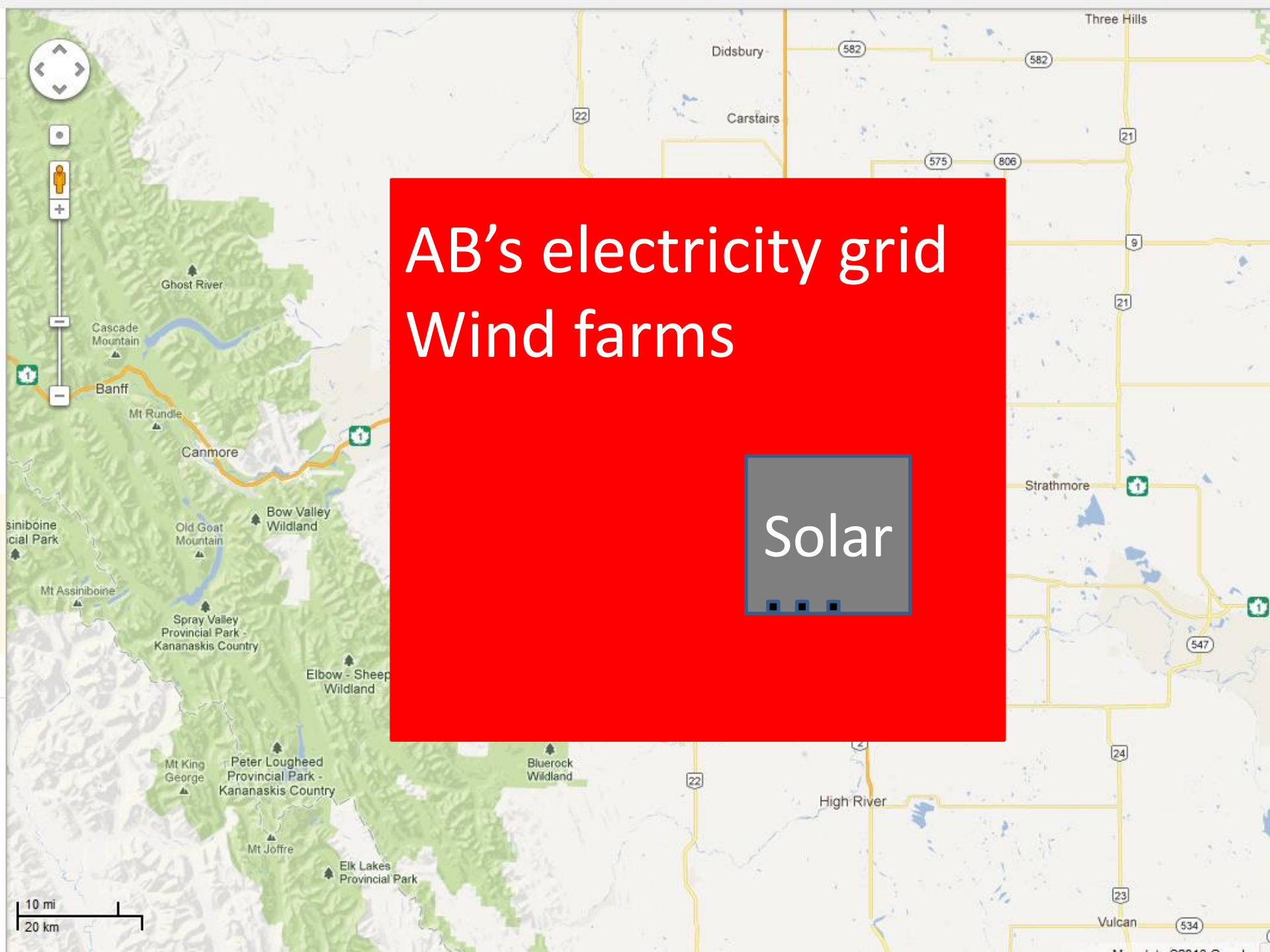
total train length = 2880 km

Calgary to Sudbury

Or ~4 trucks of Uranium




AB’s electricity from solar panels
Burma Rd
144 Ave NW
772
Stoney Trail NW
201
Township Road 250
Trans-Canada Hwy
563
Springbank Rd
Township Road 241
Range Road 284
Range Road 285
Chestermere
Trans-Canada
100 St SE
Rainbow Rd
SE Glenmore Trail
Calgary
Haysboro
90 Ave SE
Quarry Park
Anderson Rd SW
Southeast Calgary
114 Ave SE
84 St SE
Bullhead Rd
37 St SW
Fish Creek Provincial Park
McKenzie Towne
88th St SE
Deerfoot Trail
Sun Valley Blvd
Bridlewood
Spruce Meadows Trail SE
Priddis
Silverado
2 mi
5 km

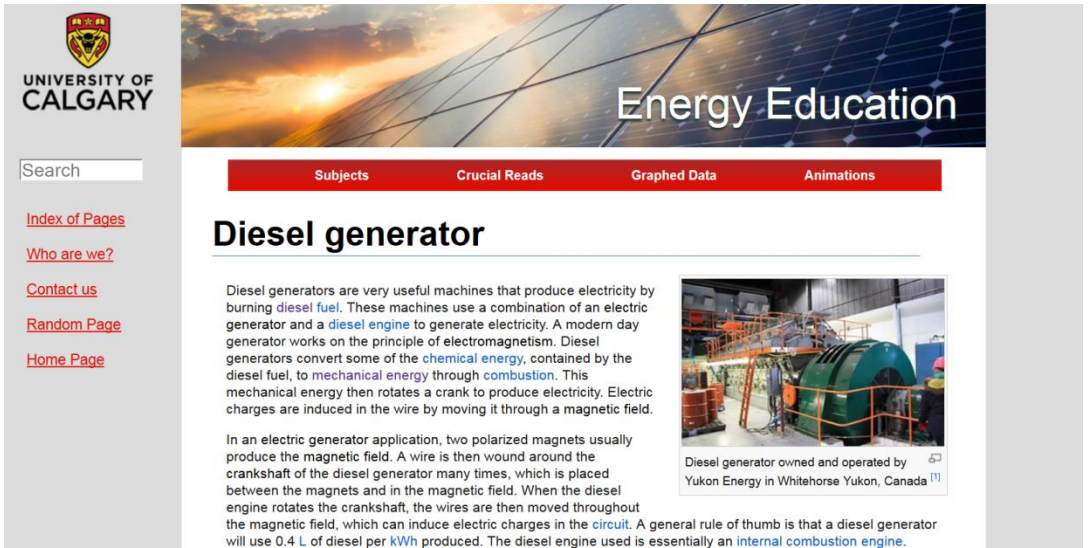

AB's electricity grid
Wind farms
Solar
Three Hills
Didsbury
Carstairs
Ghost River
Cascade Mountain
Banff
Mt Rundle
Canmore
Bow Valley Wildland
Old Goat Mountain
Mt Assiniboine
Spray Valley Provincial Park - Kananaskis Country
Elbow - Sheep Wildland
Mt King George
Peter Lougheed Provincial Park - Kananaskis Country
Bluerock Wildland
Mt Joffre
Elk Lakes Provincial Park
Strathmore
High River
Vulcan
10 mi
20 km


Boeing 747-400
Source: NREL


No scale makes size hard to tell

Energyeducation.ca

- Comprehensive
- Science behind entire energy sector
- Technologically and politically neutral
- Visually driven



Proposal

- An energy literate population is:
  - Pro energy
  - Pro wealth
  - Understands climate change

- Informed people have different conversations
- Meaningful visuals not numbers
- Need an energy 101 course and encyclopedia

Need all energy sources
BUT understand pros & cons

Thanks to my team!

Worked on project:

- Ellen Lloyd
- Braden Heffernan
- Jacqueline Williams
- James Jenden
- Jasdeep Toor

Volunteered for project:

- Yuen-ying Carpenter
- Gokul Dharan
- Shining Chen
- Isaac Faubert
- Karen Street

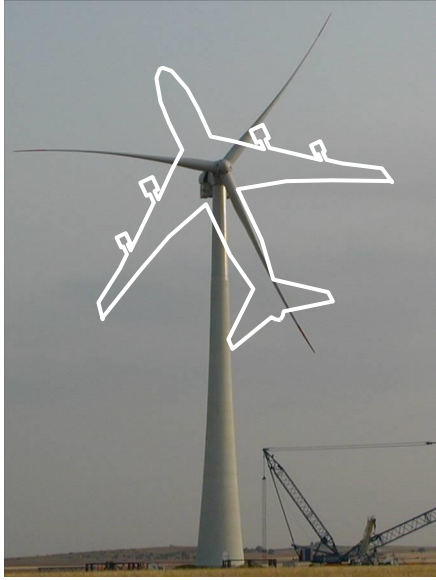
The 529 and 507 students who contributed their senior projects to energyeducation.ca

Websites to open

- http://energyeducation.ca/simulations/charts/mapchart.html
- http://energyeducation.ca/simulations/dsplfinal.html?coal_consumption
- http://energyeducation.ca/simulations/dsplfinal.html

Bonus slides for questions

Wind



- Expensive to build,
- Need huge areas
- Only gives power when the wind blows

- Cheap to operate
- Minimal environmental impact, no CO_2
- People like it

Solar

- Even more expensive than wind
- Need almost as much area as wind
- Only gives power when the sun shines

- Cheap to operate
- Minimal environmental impact, no CO_2
- People like it

Nuclear

- Expensive to build
- Takes a long time to build
- People hate it

- Safe, clean, reliable, affordable
- Densest energy
- Easiest waste to manage of any power source
- no CO_2

Natural Gas

- Lots of CO_2
- Fluctuating cost → fluctuating price

- Quick to build
- Very flexible fuel (probably most)
- Abundant, dense energy

Oil

- Will eventually run out
- Huge environmental changes due to global warming

- Cheap, easy to use
- Only real transportation fuel right now (LNG will come)
- Led to modern world
- dense energy

Coal

- Very dirty
  - acid raid (NOx and SOx)
  - Mercury
  - Particulate matter
- Abundant, cheap, dense energy
- Got us the industrial revolution
- Leading cause of climate change

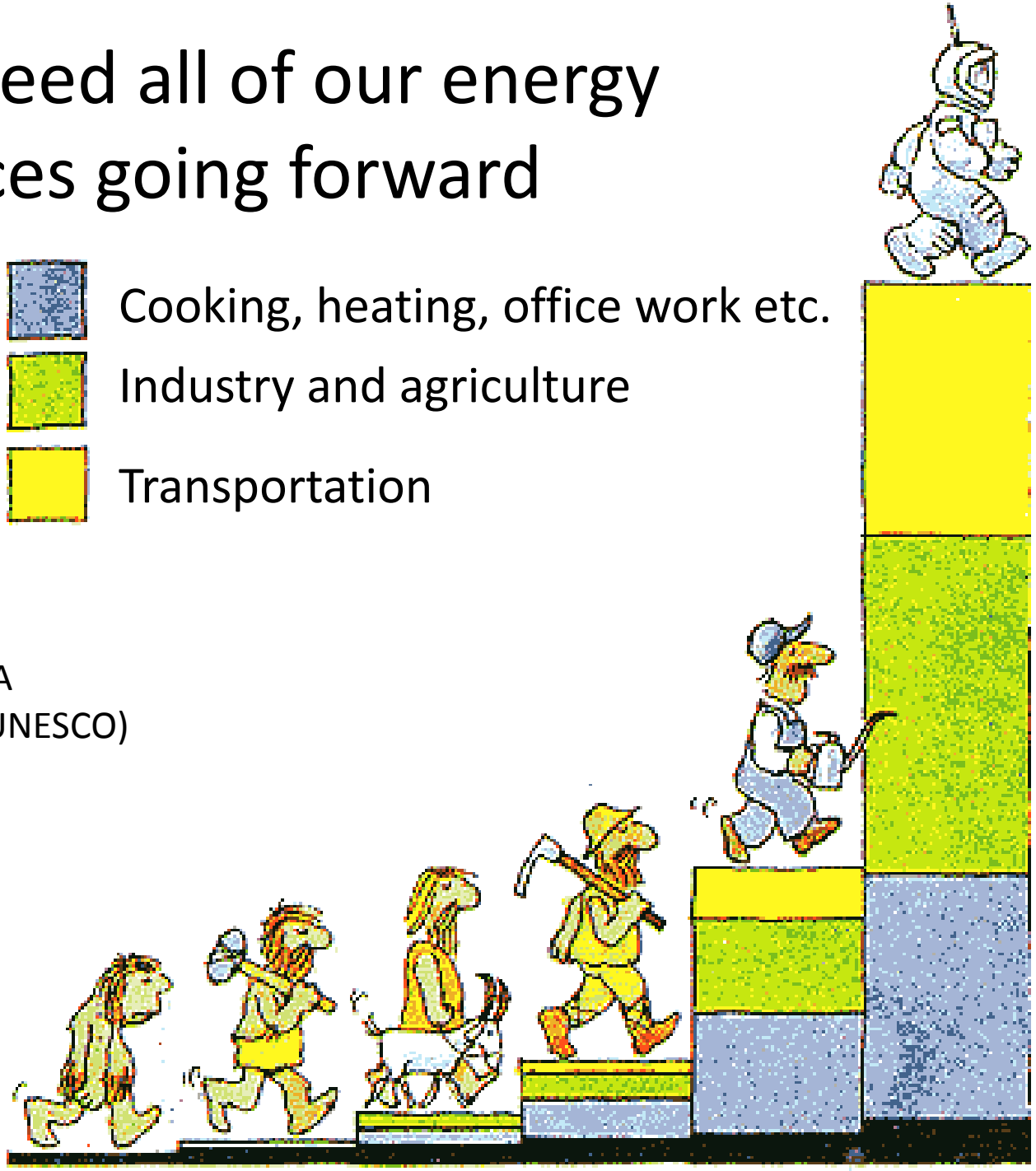
We need all of our energy sources going forward

Cooking, heating, office work etc.

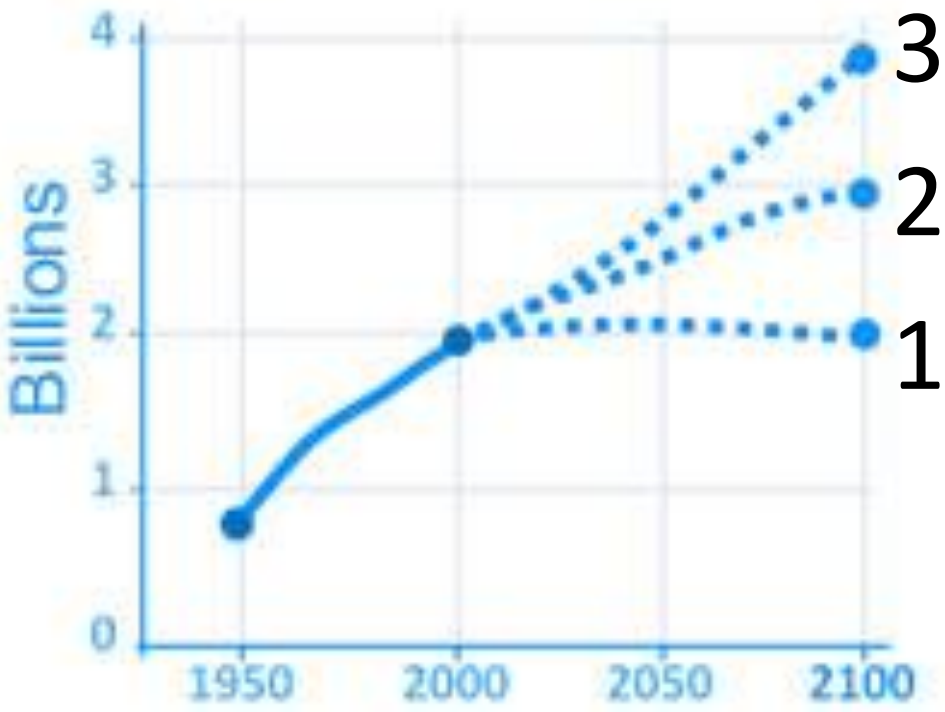
Industry and agriculture

Transportation

Taken from WNA
(got data from UNESCO)

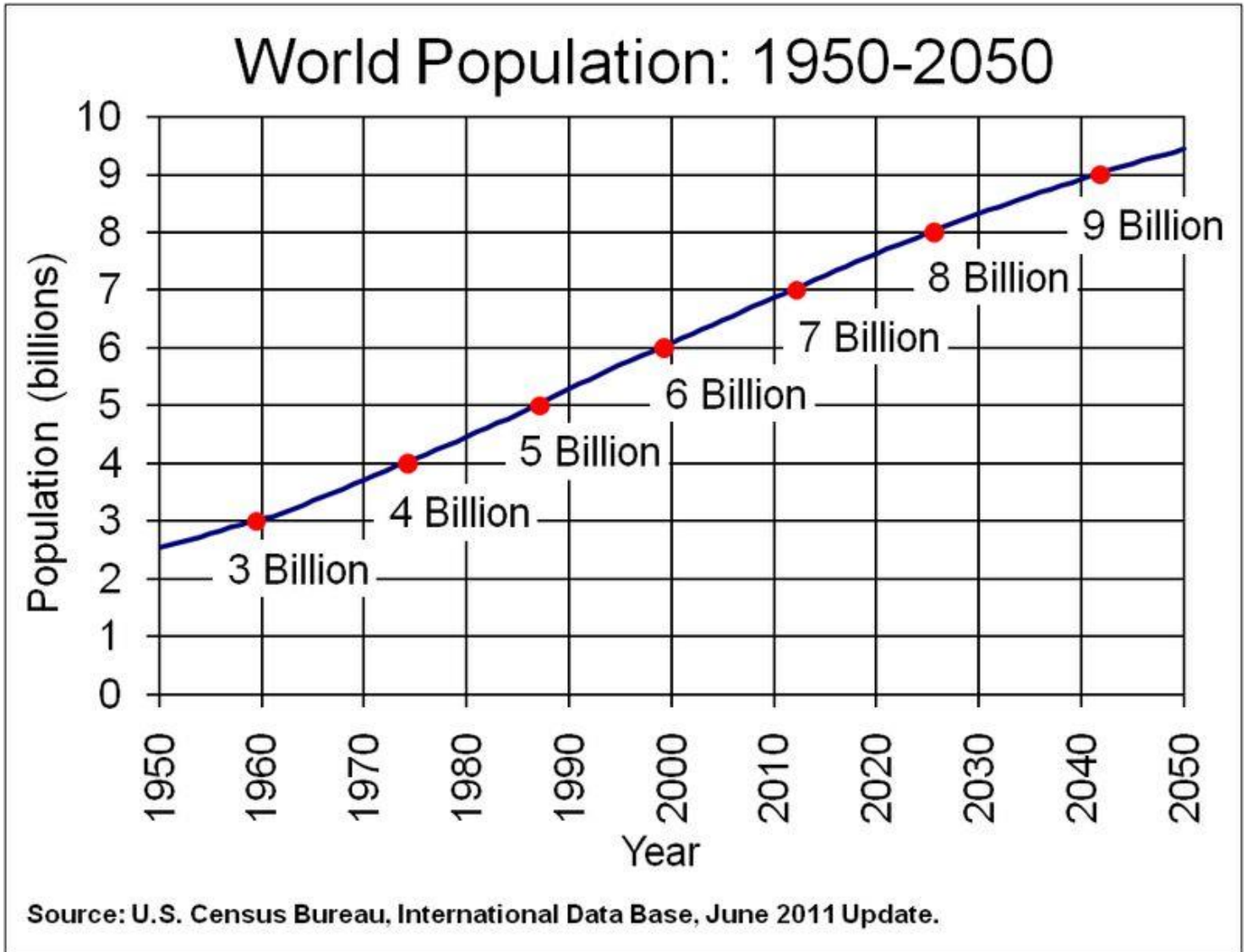


Which path shows the UN prediction of Number of children being born in world?

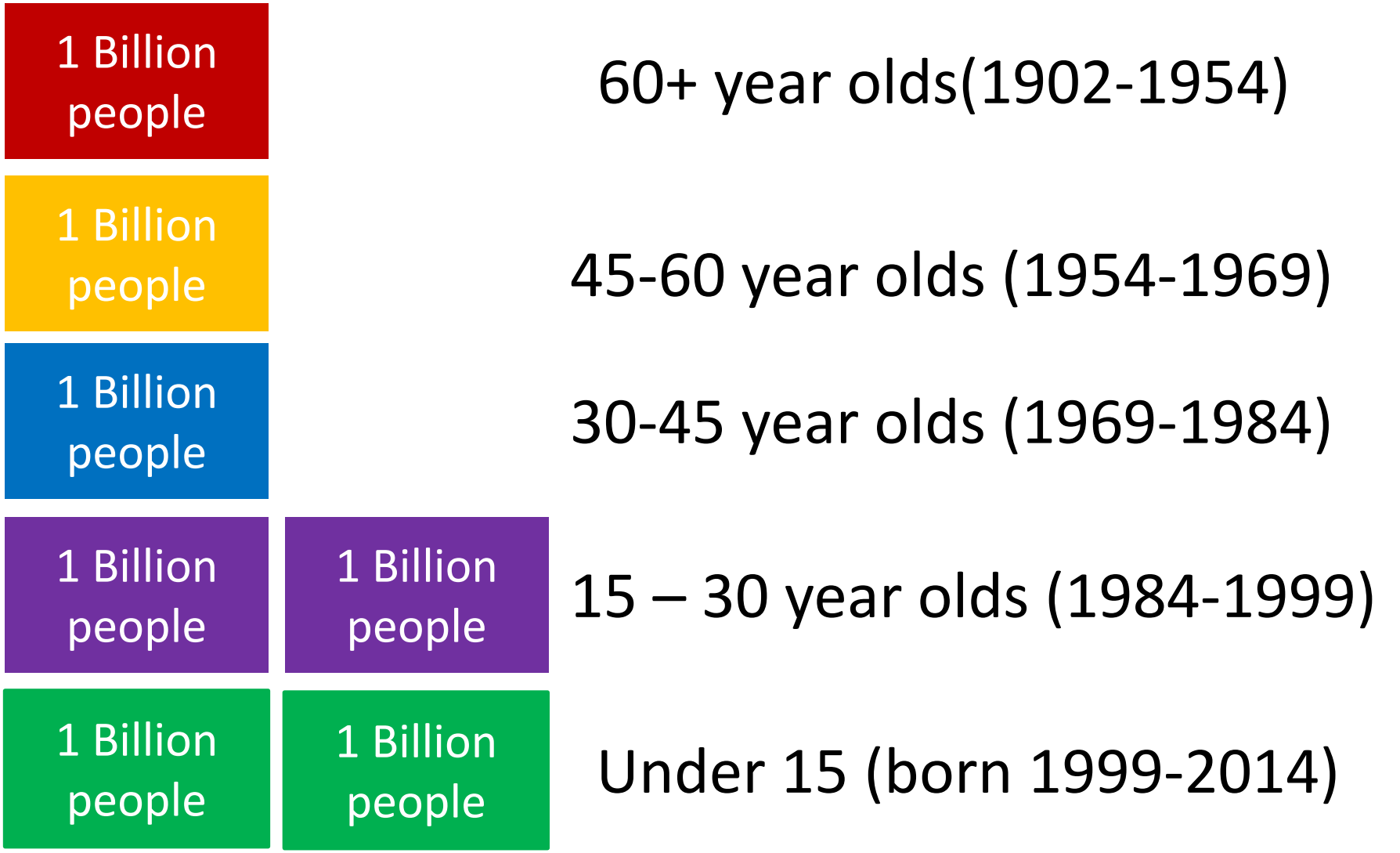


Note that this starts at 2000.

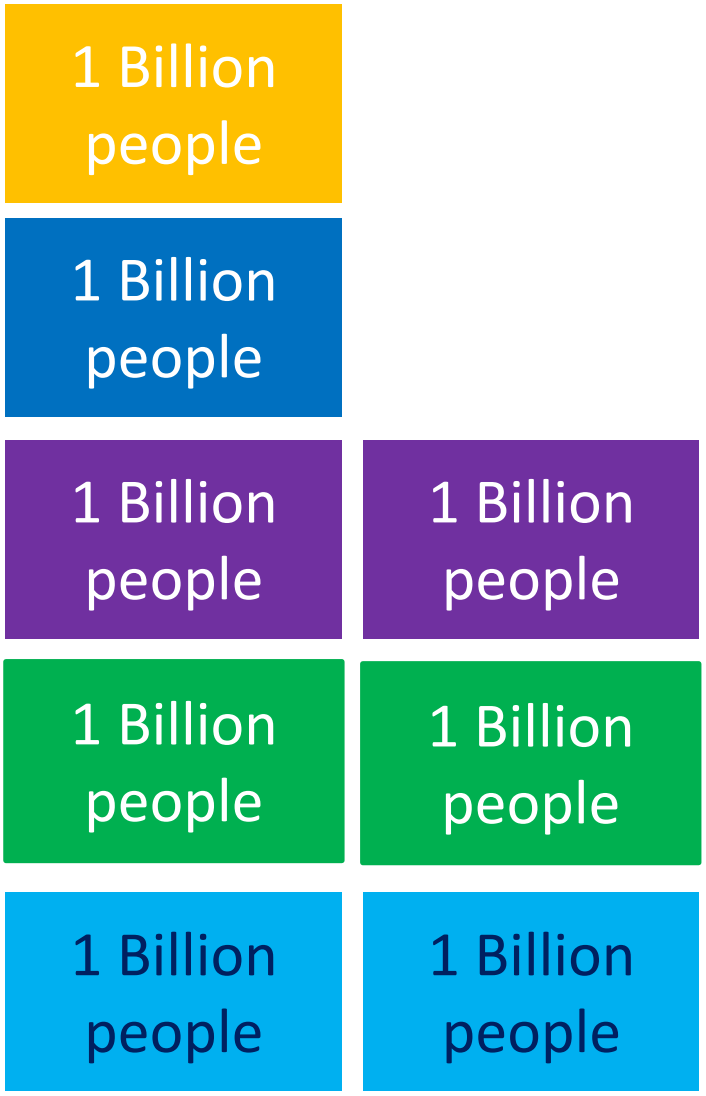
Couples replace themselves with children but population rises (not change in life expectancy!)



Distribution of ages in (2014) stolen from Hans Rosling



2 Billion born! (2029)
stolen from Hans Rosling



60+ year olds(1920-1969)

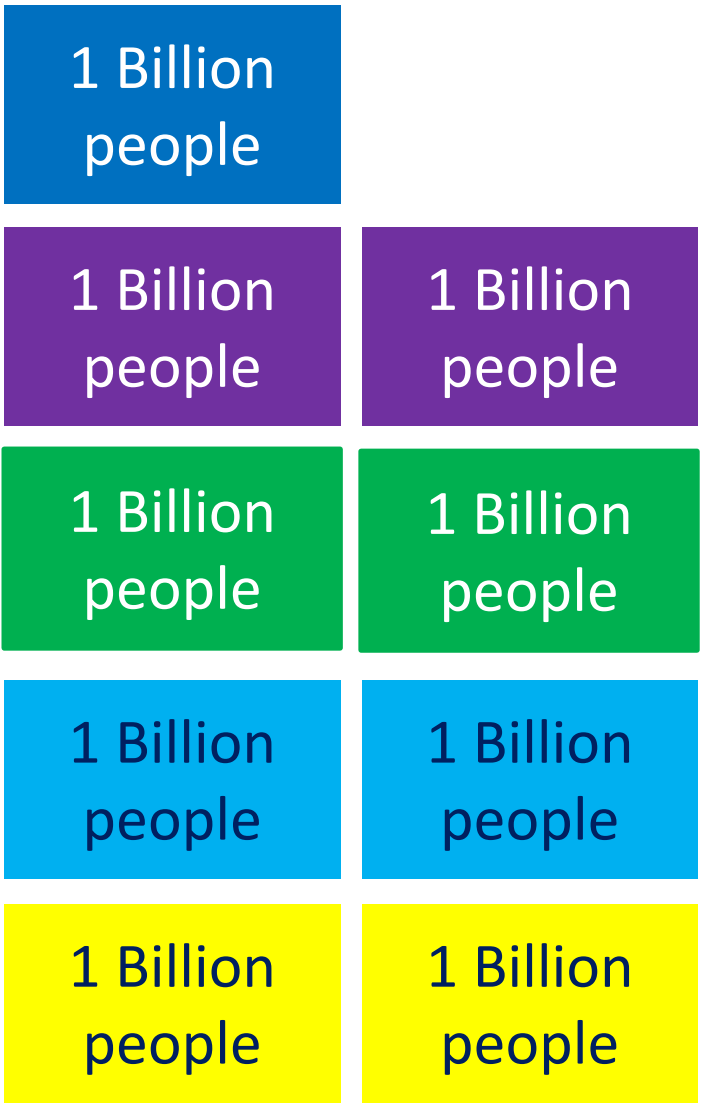
45-60 year olds (1969-1984)

30-45 year olds (1984-1999)

15 – 30 year olds (1999-2014)

Under 15 (born 2014-2029)

2 Billion born! (2044)
stolen from Hans Rosling



60+ year olds(1930-1984)

45-60 year olds (1984-1999)

30-45 year olds (1999-2014)

15 – 30 year olds (2014-2029)

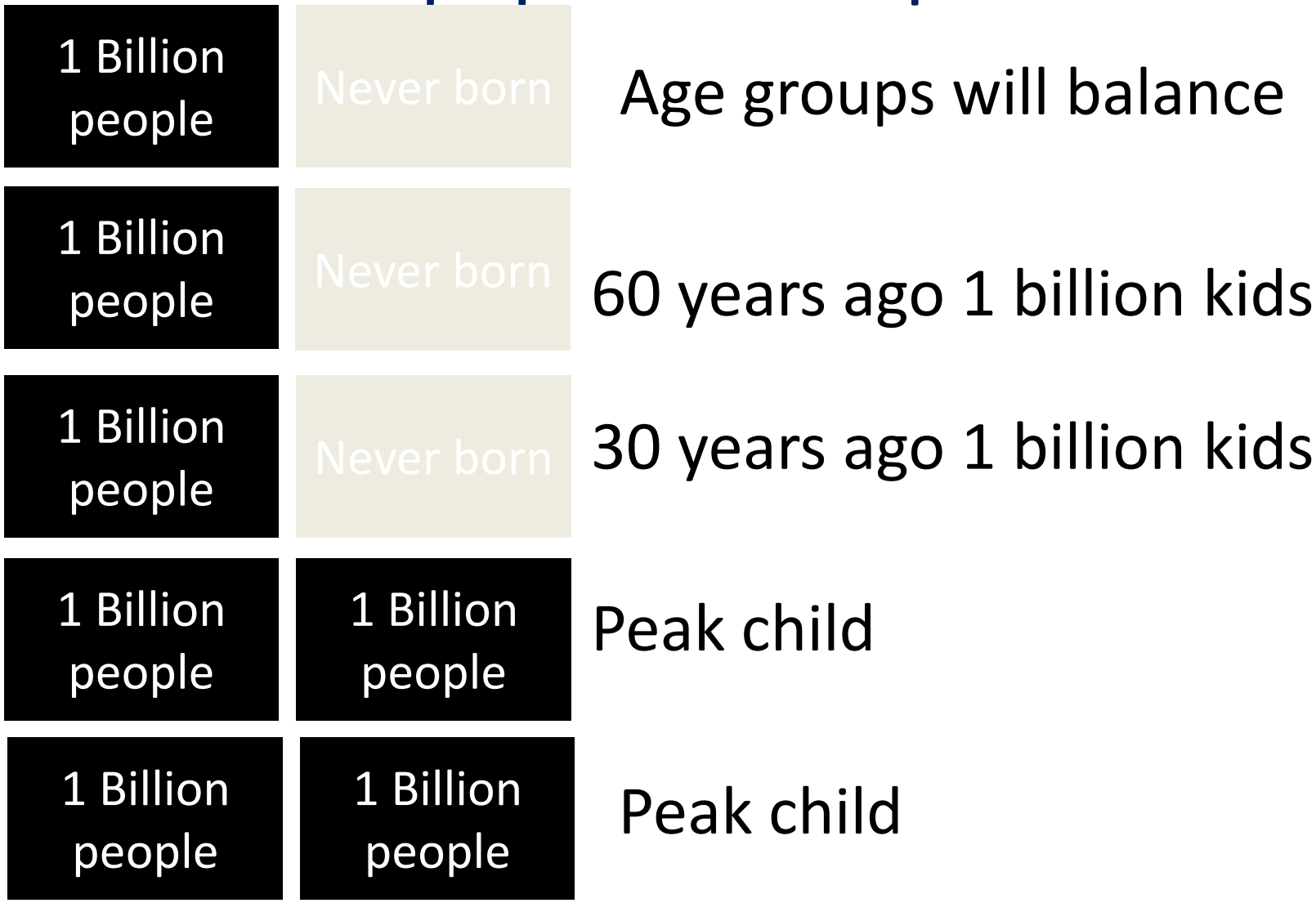
Under 15 (born 2029-2044)

2 Billion born! (2059)

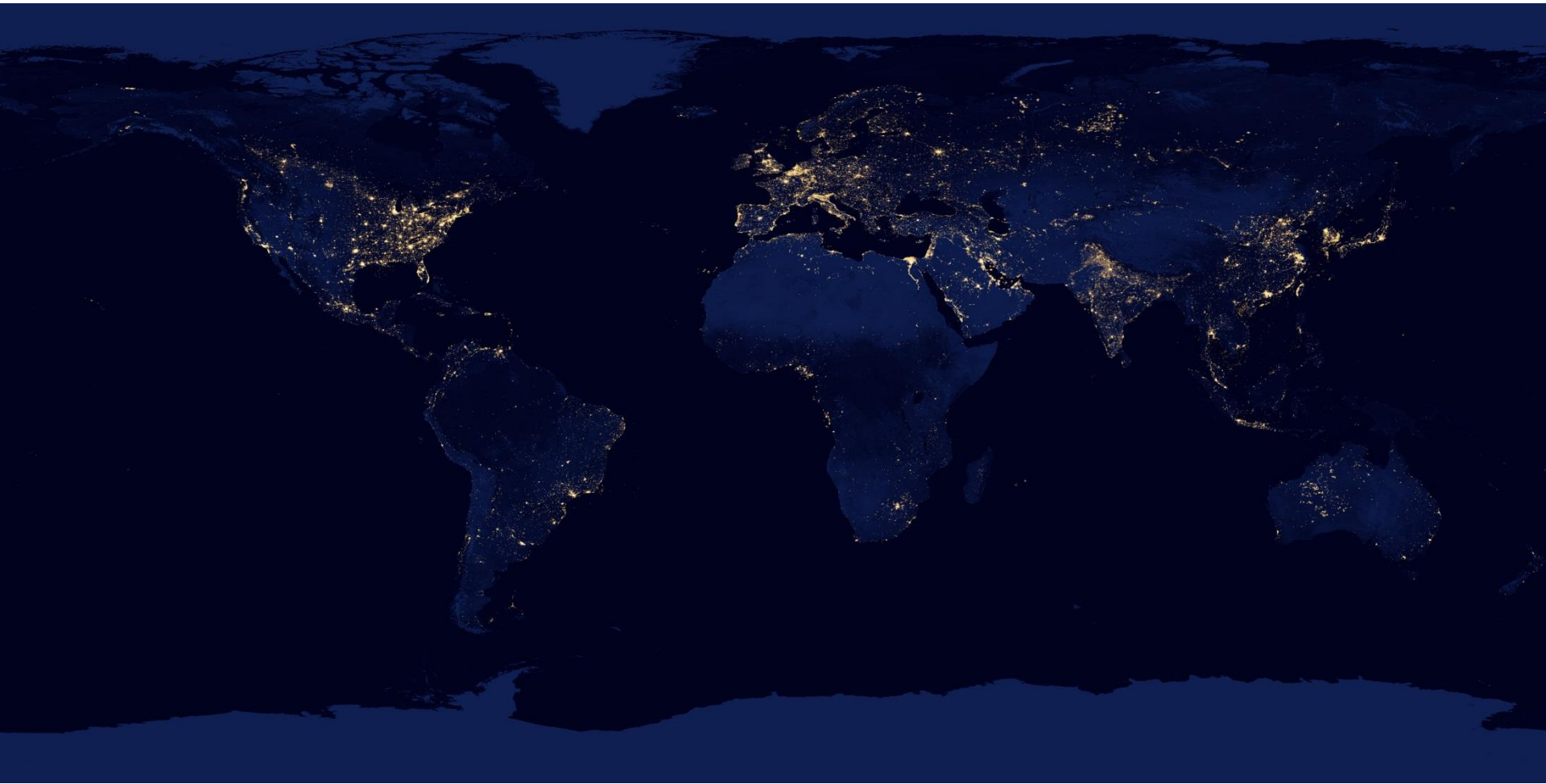
How many people?

1 Billion people	1 Billion people	60+ year olds(1945-1999)
1 Billion people	1 Billion people	45-60 year olds (1999-2029)
1 Billion people	1 Billion people	30-45 year olds (2014-2029)
1 Billion people	1 Billion people	15 – 30 year olds (2029-2044)
1 Billion people	1 Billion people	Under 15 (born 2044-2059)

The great fill up: finally catch up with population explosion



If increasing population isn't the problem, what is?

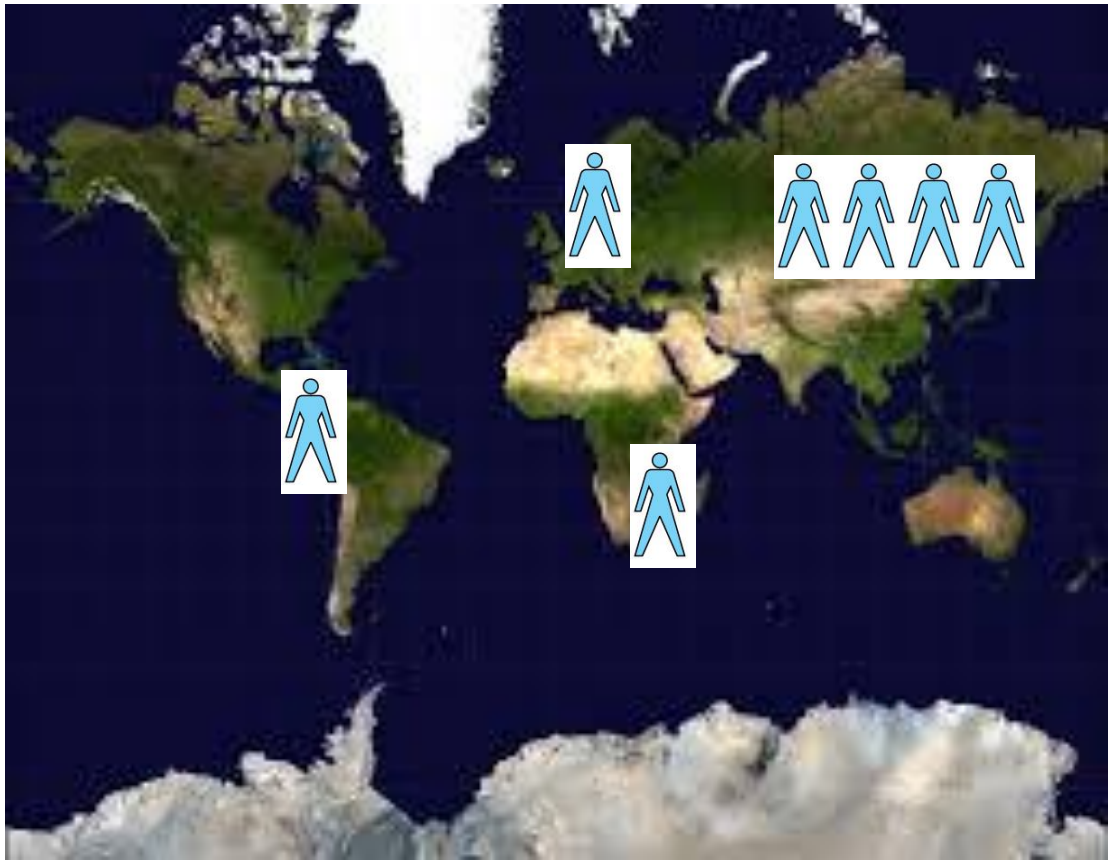


~7 billion people, but where?

~7 billion people, but where?

= 1,000,000,000 people = 1 billion people

http://www.google.ca/publicdata/explore?ds=d5bncppjof8f9_&met_y=sp_pop_totl&hl=en&dl=en&idim=country:CHN:IND



Focus on Africa

North and South Korea
6x as much energy