2nd Green Energy Investments Forum

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Hellenic Wind Energy Association

The PROMITHEAS Network
10th International Conference
"Energy and Climate Change",
11-13 October 2017, Athens

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- ✓ Green Energy investment perspectives
- ✓ Green Climate Fund
- ✓ Perspectives of green investing in Greece
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Bloomberg New Energy Finance

New Energy Outlook 2017

The Bloomberg report:

The renewable-energy boom is here.

Trillions of dollars will be invested over the next 25 years, driving some of the most profound changes yet in how humans get their electricity.

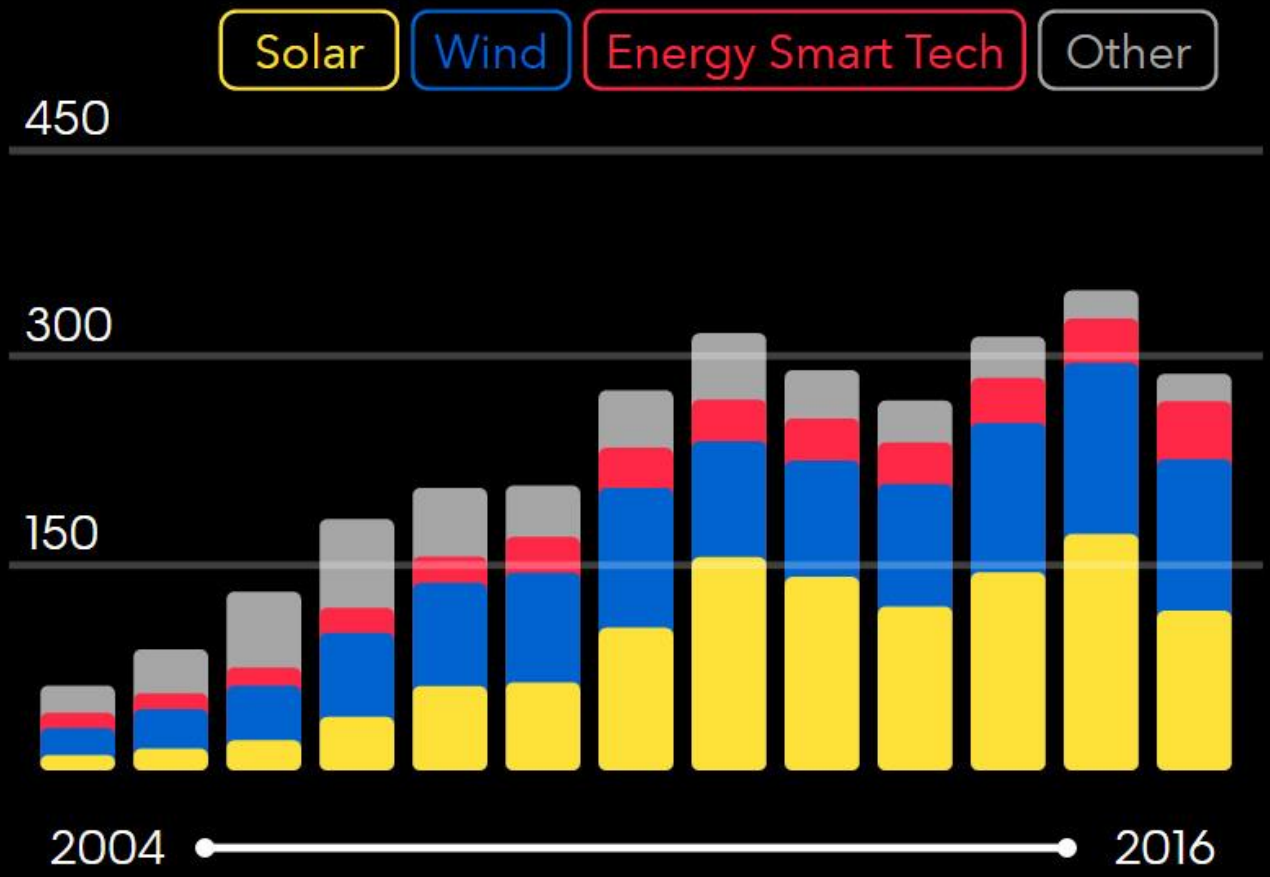
About $8 trillion, or two thirds of the world's spending on new power capacity over the next 25 years, will go toward renewables!!!!v

Thanks to rapidly falling costs for solar and wind power,
and a growing role for batteries (incl. electric vehicle batteries),
in balancing supply and demand.

Bloomberg Business

New forecast by Bloomberg New Energy Finance.

In 2016, 138,5 GW of renewable capacity were added globally compared to 127,5GW in 2015, (IEA),
The corresponding investment was lower by 23% due to cost reduction.
New renewable capacity added in 2016 was above 50% of total new capacity added.

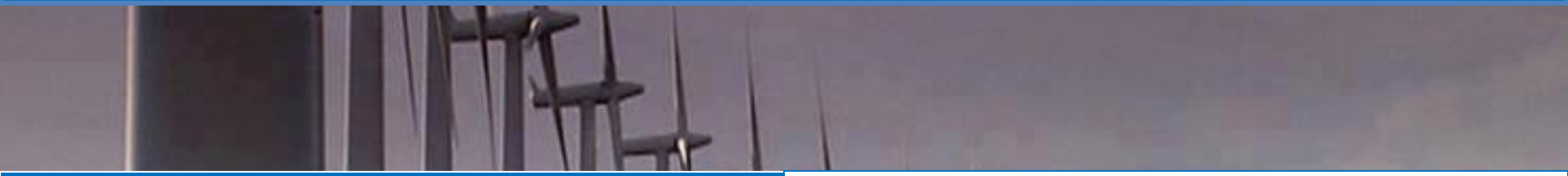


New investment in clean energy by sector, 2004-16 ($bn)
Source: Bloomberg New Energy Finance

IEA/GUARDIAN

New Energy Finance (BNEF)

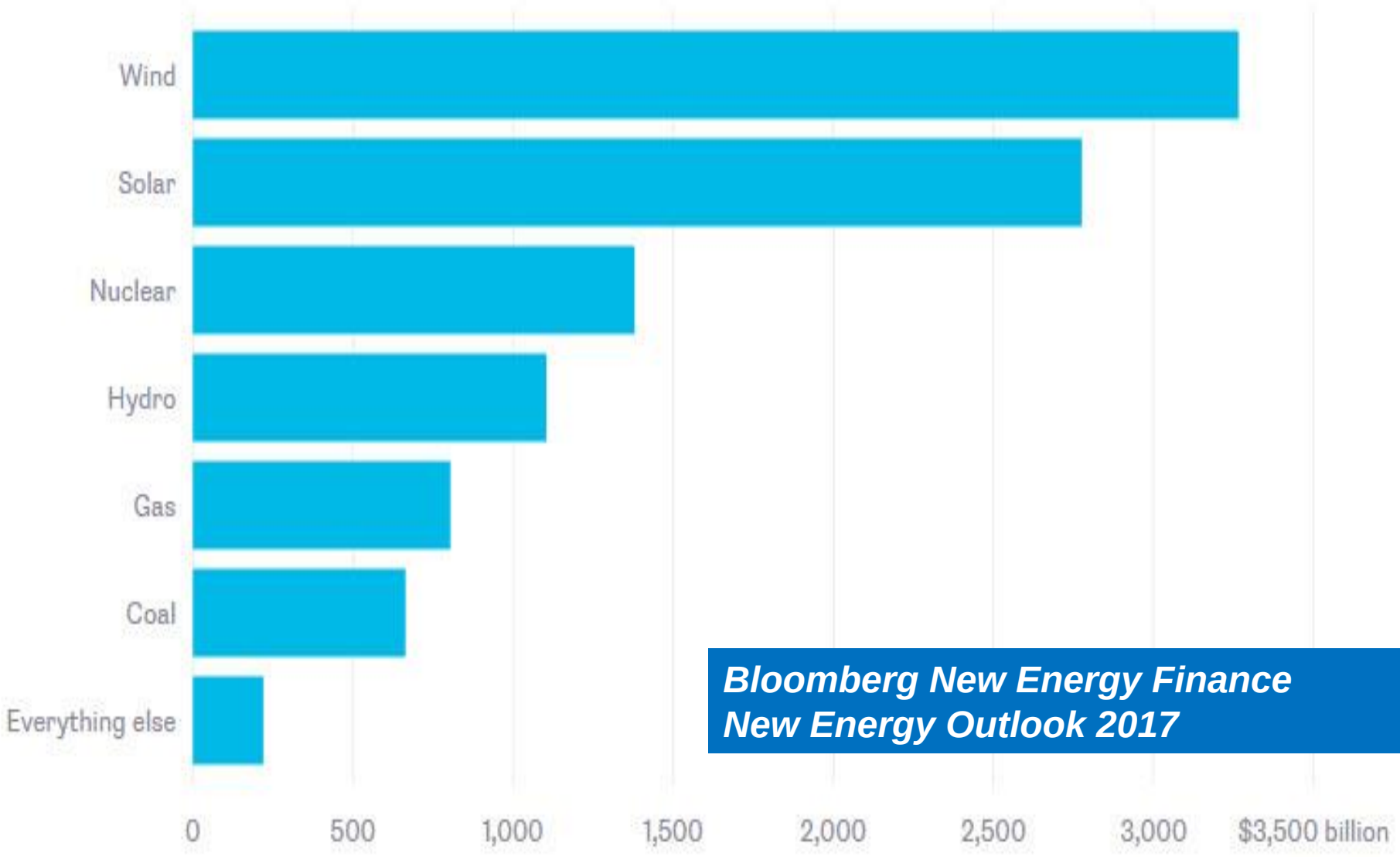
Rapidly falling costs for solar and wind power



- Solar is already at least as cheap as coal in
- Germany, Australia, the U.S., Spain and Italy.
- The levelized cost of electricity from solar is set to drop another 66% by 2040.
- By 2021, it will be cheaper than coal in
- China, India, Mexico, the U.K. and Brazil as well.

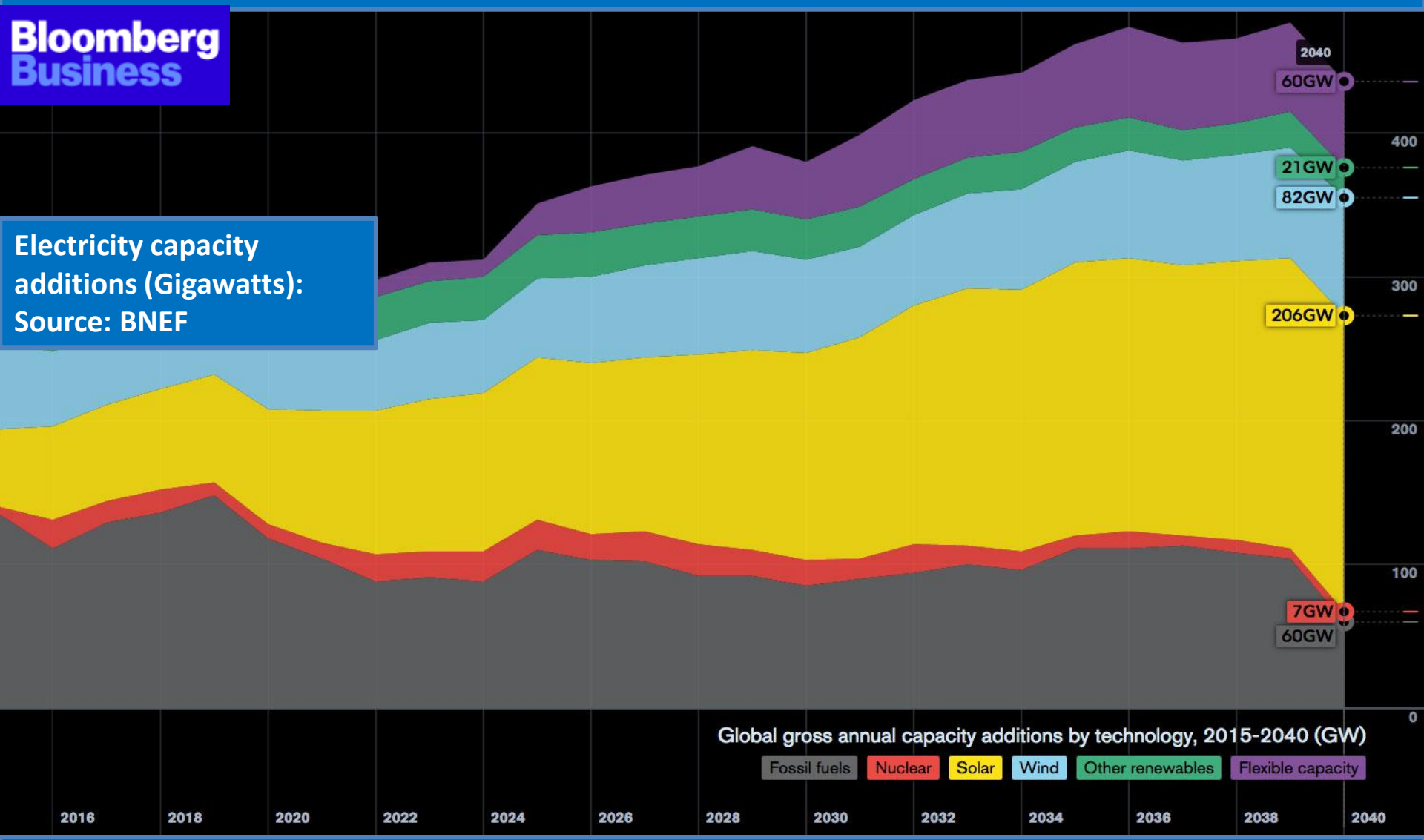
- Onshore wind costs fall fast, and offshore falls faster
- Onshore wind levelized costs will fall 47% by 2040, thanks to cheaper, more efficient turbines and advanced OPEX regimes.
- In the same period, offshore wind costs will slide a whopping 71%, helped by experience, competition, and economies of scale.

Into the Trillions
Investment in power generation technologies, 2017 to 2040.



Bloomberg New Energy Finance
New Energy Outlook 2017

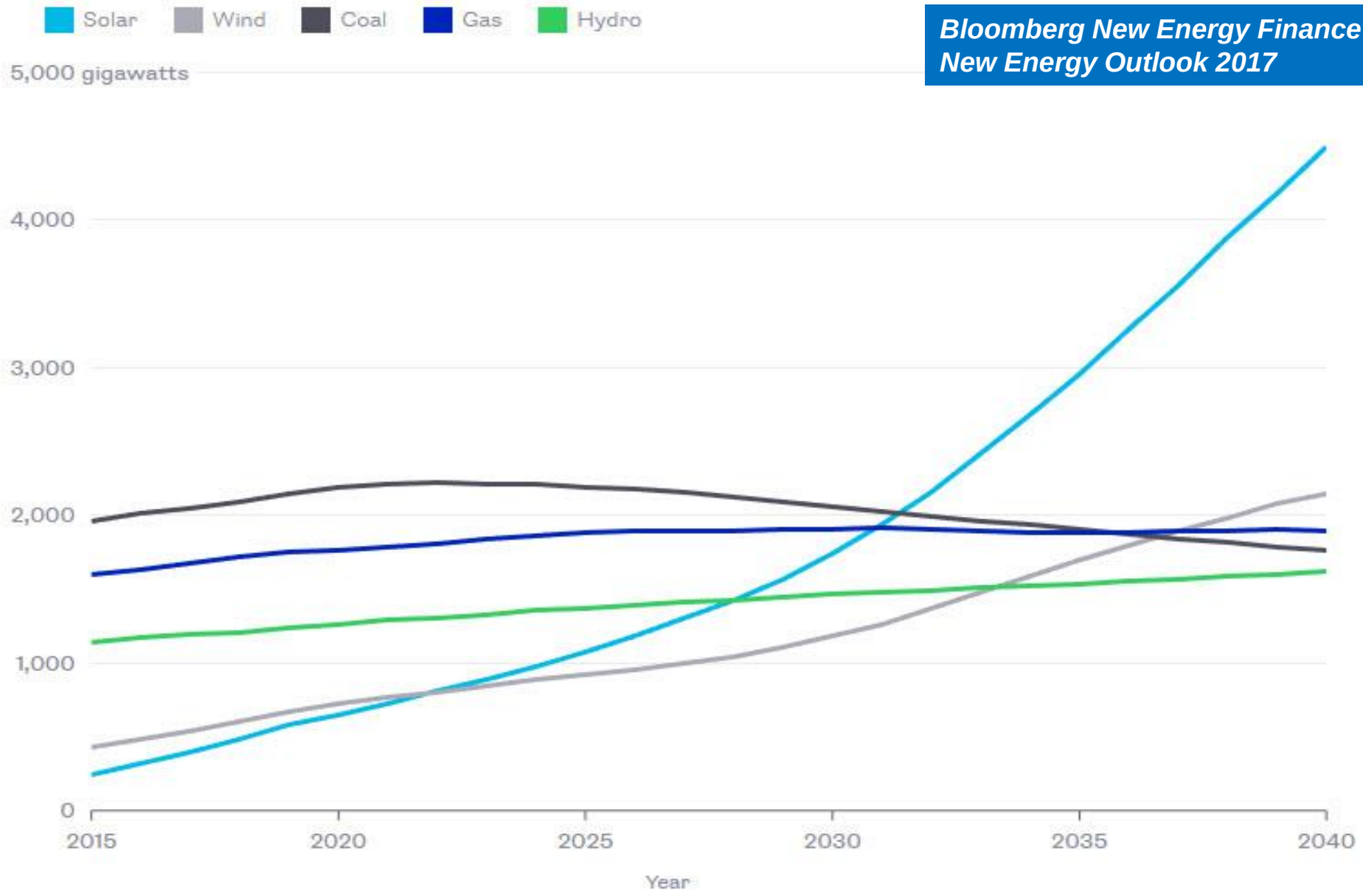
Solar Billions Become Solar Trillions



- With solar power so cheap, investments will surge.
- Expect $3.7 trillion in solar investments between now and 2040.
- Solar alone will account for more than a third of new power capacity.

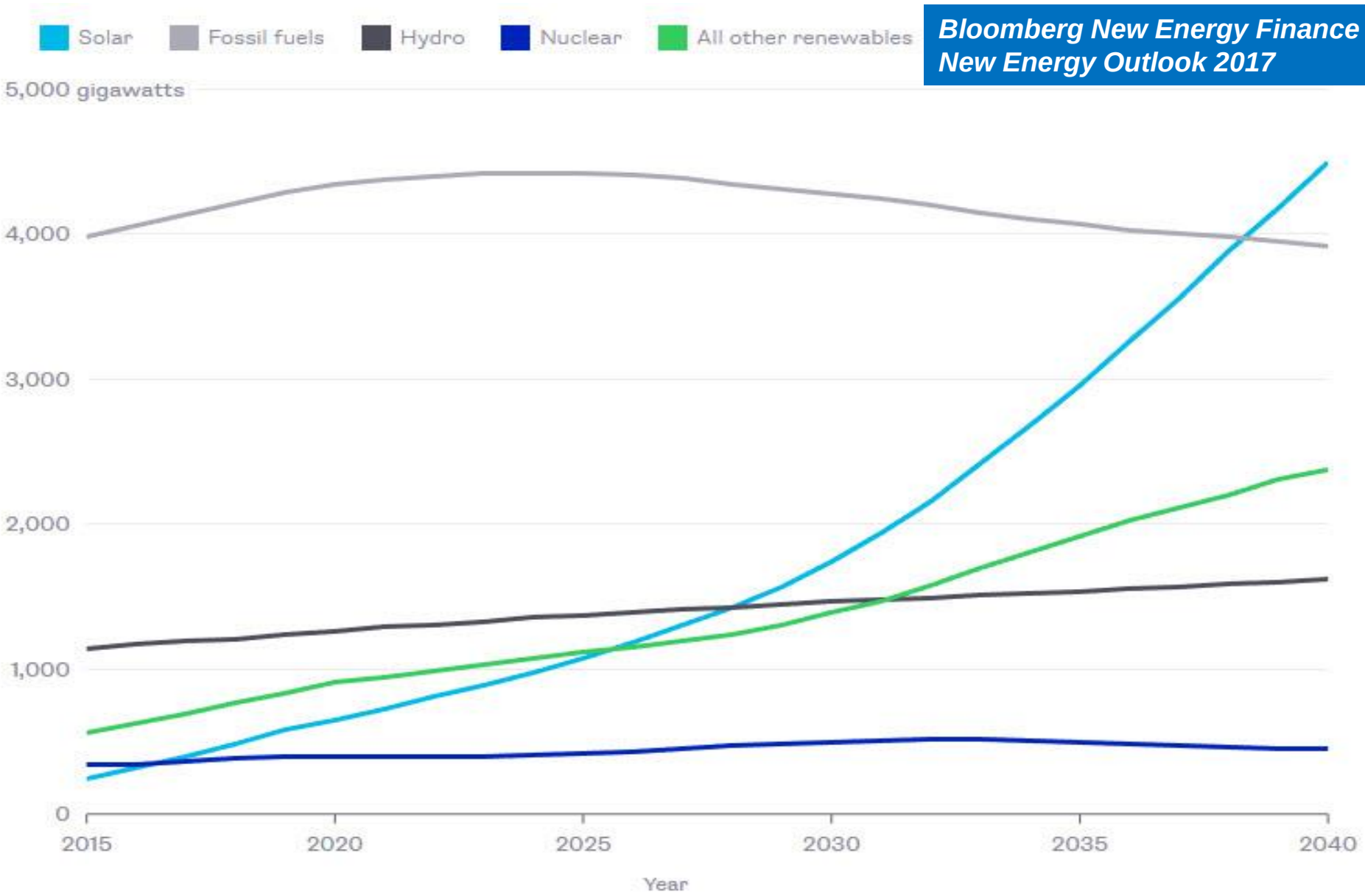
Solar Beats Coal in 2032 …
Cumulative installed power generation capacity.

Bloomberg New Energy Finance
New Energy Outlook 2017



… And All Fossil Fuels by 2039
Cumulative installed power generation capacity.

Bloomberg New Energy Finance
New Energy Outlook 2017



Homeowners' love of solar grows.

By 2040, rooftop PV will account for as much as 24% of electricity in Australia, 20% in Brazil, 15% in Germany, 12% in Japan, and 5% in the U.S. and India.

This, combined with the growth of large-scale renewables, reduces the need for existing large-scale coal and gas plants.

Growing role for batteries

Batteries and flexibility bolster the reach of renewables.

Utility-scale batteries increasingly compete with natural gas to provide system flexibility at times of peak demand.

In conjunction with small-scale batteries, this will help renewable energy reach 74% penetration in Germany, 38% in the U.S., 55% in China and 49% in India by 2040.

Gas is a transition fuel.

Gas is a transition fuel, but not in the way most people think.

Gas-fired power sees $804 billion in new investment and 16% more capacity by 2040.

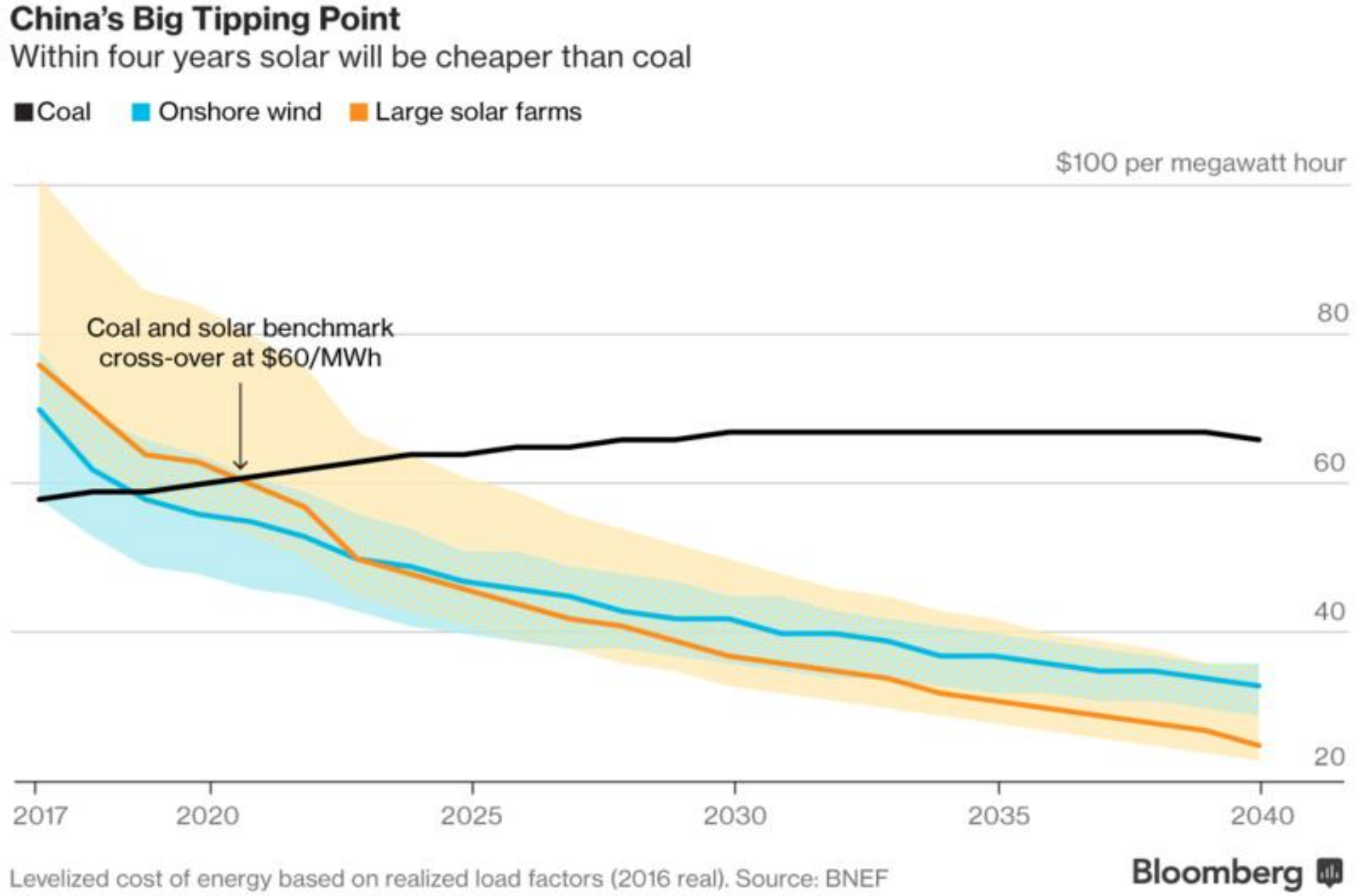
But save for the Americas, where gas is plentiful and cheap, gas plants will mainly act as one of the flexible technologies needed to help meet peaks and provide system stability.

Coal's point of no return.

Sluggish demand, cheap renewables and coal-gas fuel switching slash coal use by 87% in Europe and 45% in the U.S. by 2040, while coal generation continues to grow in China but reaches peak in 2026.

A mere 18% of planned new coal power plants will ever get built. That means 369GW of projects stand to be cancelled.

Coal's point of no return.



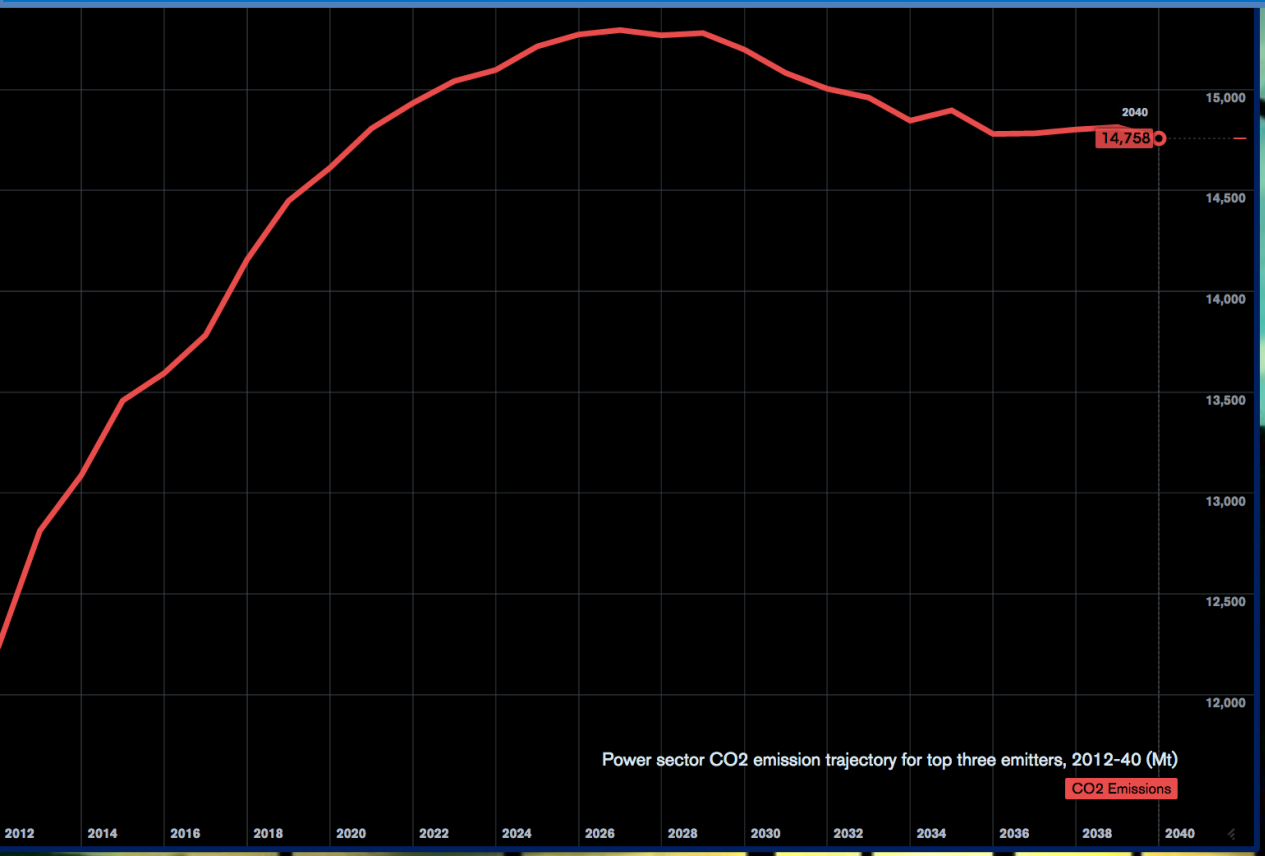
Global power sector emissions peak in 2026.

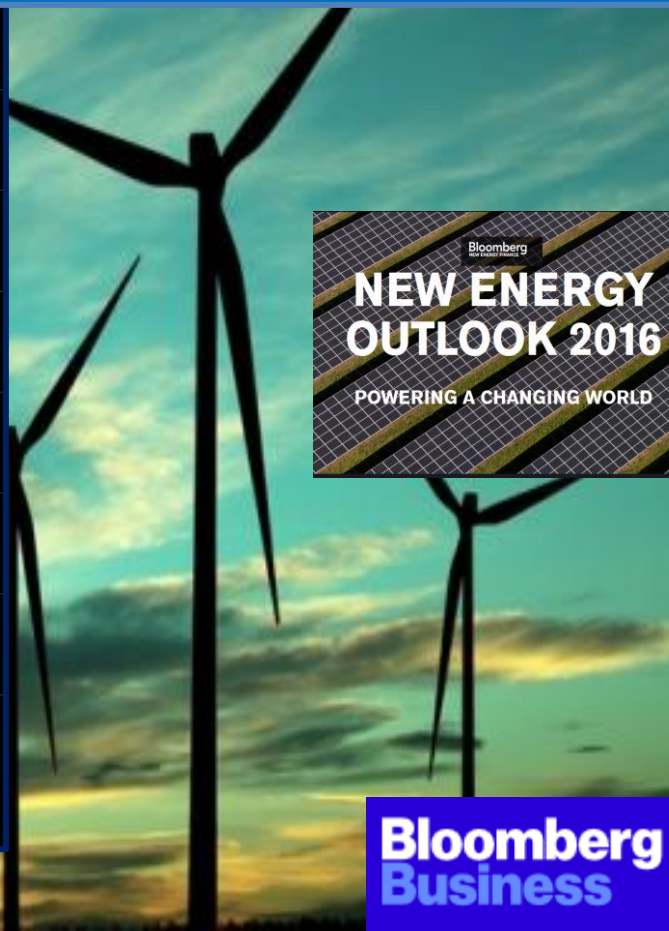
CO2 emissions from power generation increase by a tenth before peaking in 2026, then falling faster than we previously estimated, lining up with China's peak coal generation.

However, a further $5.3 trillion investment in 3.9TW of zero-carbon capacity would be required to keep the planet on a 2-degrees-Celsius trajectory.

The Climate Is Still Screwed

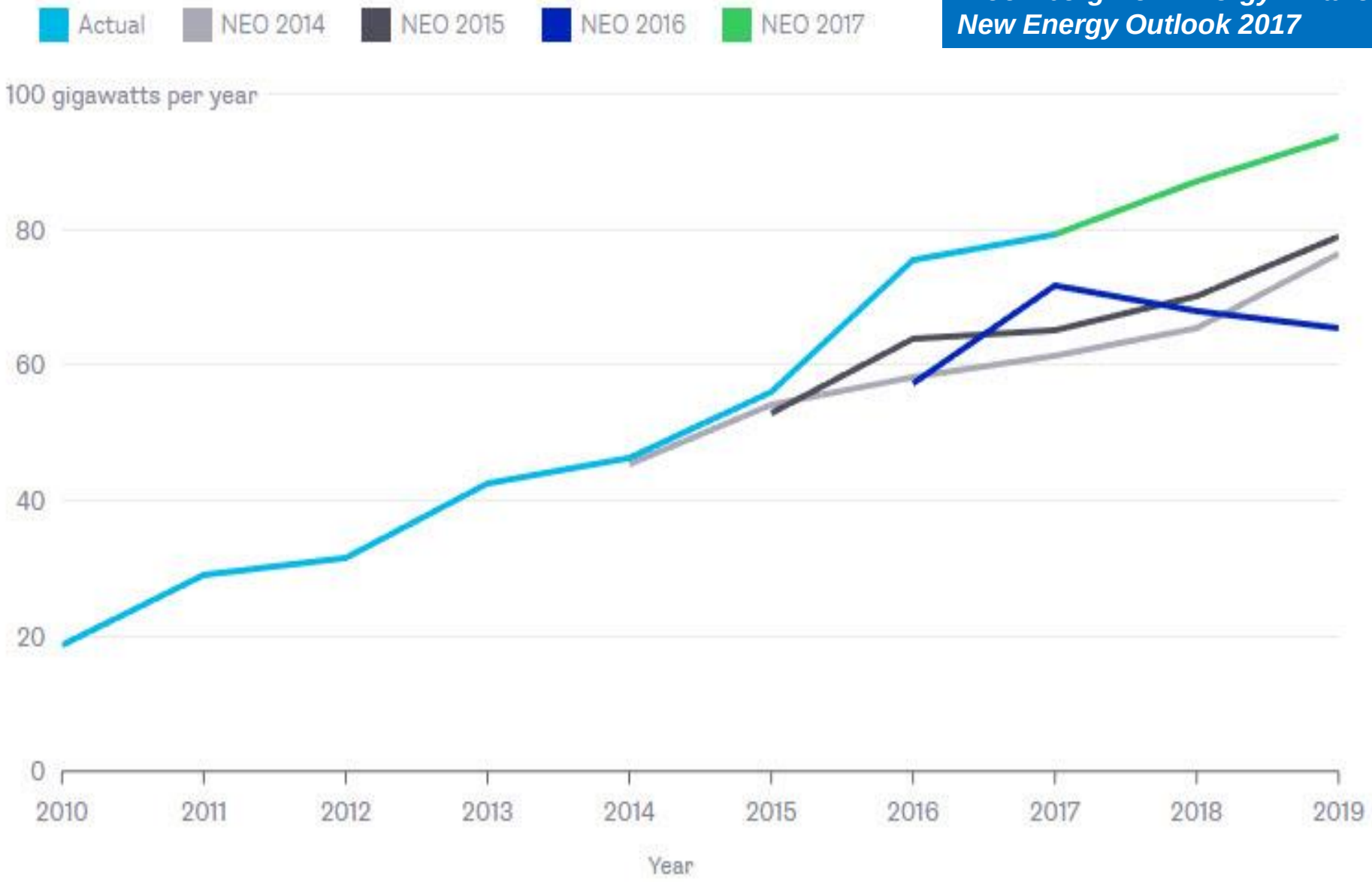
The shift to renewables is happening shockingly fast, but not fast enough to prevent perilous levels of global warming.
Without additional policy action by governments, global CO2 from the power sector will continue to rise until 2029 and will remain 13 % higher than today's pollution levels in 2040.
That's not enough to prevent global warming to rise more than 2 degrees Celsius.
That's considered the point-of-no-return for some worst consequences of climate change.





Bloomberg's Self Appraisal: Always Undershooting New Energy Outlook solar installation predictions since 2014.

Bloomberg New Energy Finance
New Energy Outlook 2017



Renewables 2017

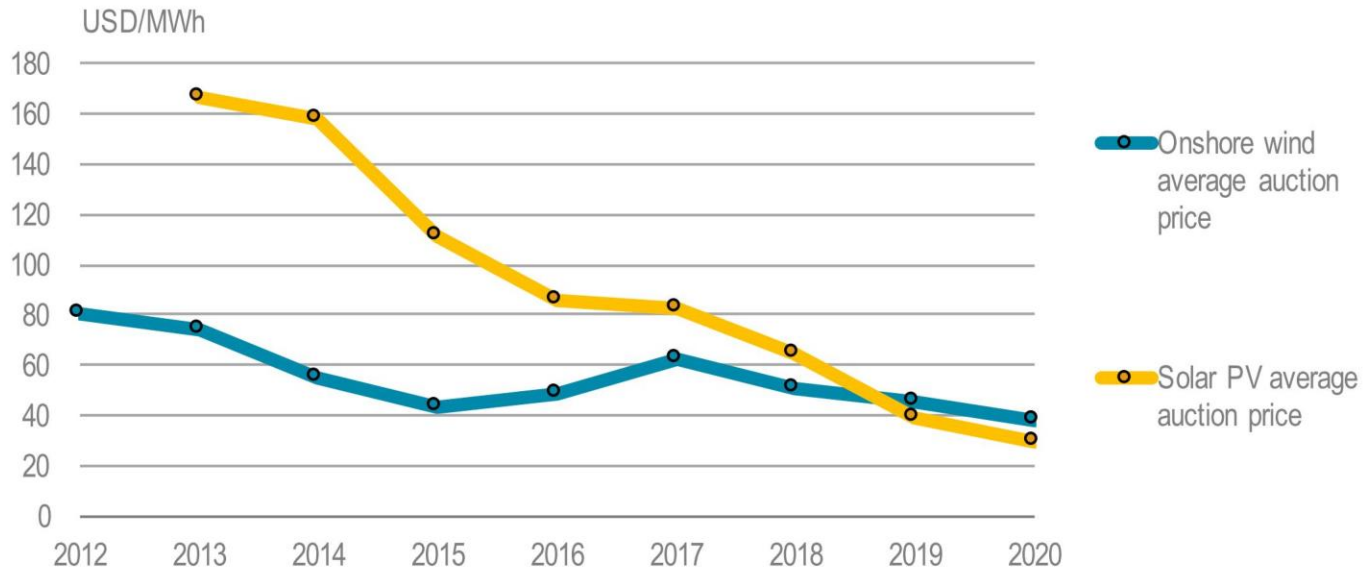
International Energy Agency

Solar leads the charge in another record year for renewables

I.E.A. RENEWABLES REPORT OCTOBER 2017.

Competition driving costs down

Announced wind and solar PV average auction prices by commissioning date



Price discovery through competitive auctions effectively reduces costs along the entire value chain; Auctions with long-term contracts will drive almost half of new capacity growth over 2017-22

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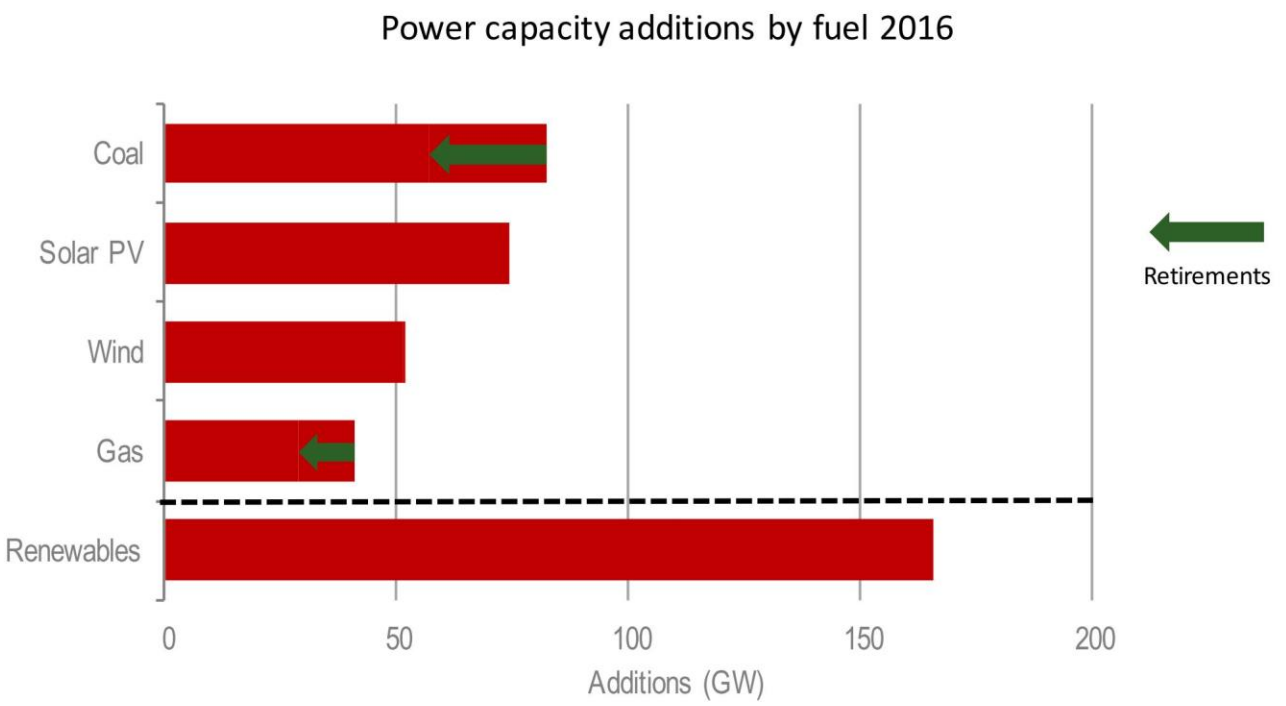
2016 – Renewables hitting new records driven by solar PV



Renewables breaking an all-time record accounting for two thirds of global net capacity additions;
For the first time solar PV becoming the global leader in net capacity growth

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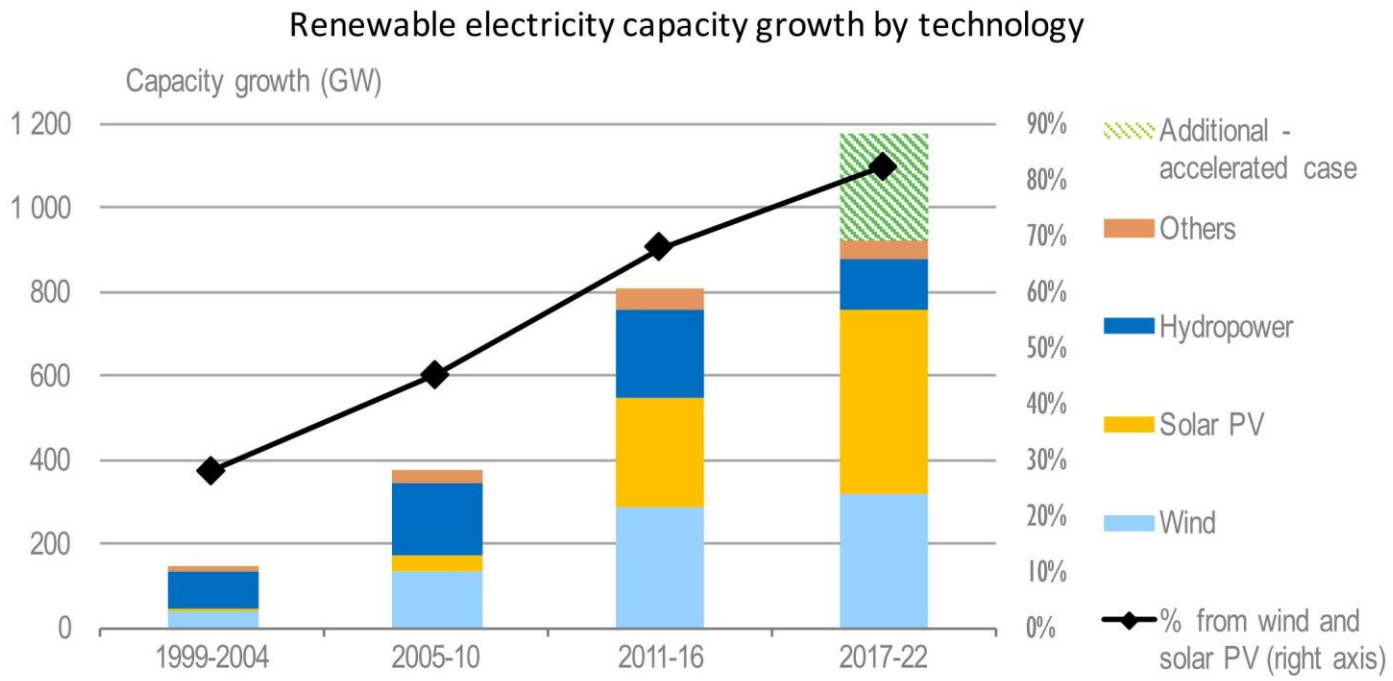
Renewables growth more and more dependent on wind and solar



Solar PV enters a new era, becoming the undisputed leader in renewable power capacity growth; PV also accounts for 60% of the upside potential in the accelerated case

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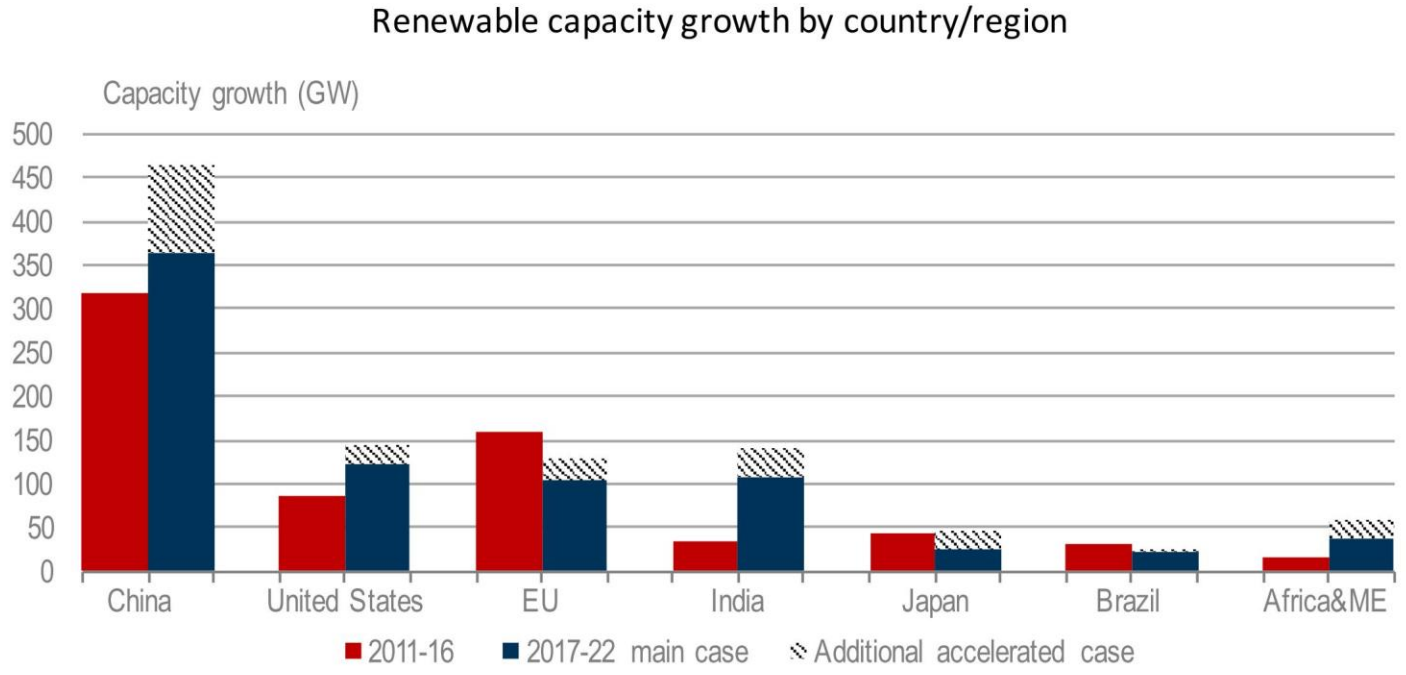
China continues to lead growth while India overtakes the EU



The forecast is 12% more optimistic vs. last year mainly due to solar PV revisions in China and India;
Growth could be 27% higher with enhanced policies addressing regulatory uncertainties and grid integration

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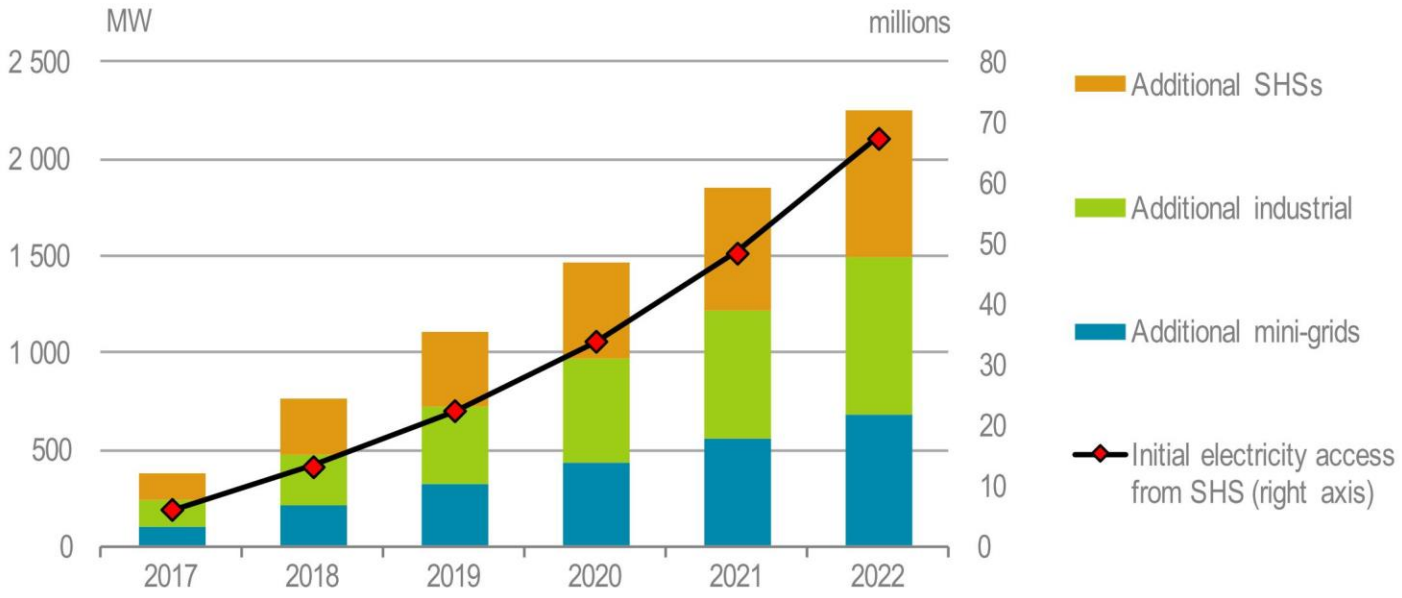
Solar PV enabling electrification in India, Bangladesh and sub-Saharan Africa

Cumulative growth of off-grid solar PV applications in developing Asia and sub-Saharan Africa



With government policies and innovative business models, off-grid PV capacity triples in Africa and developing Asia. Small home systems bring initial electricity access to almost 70 million by 2022

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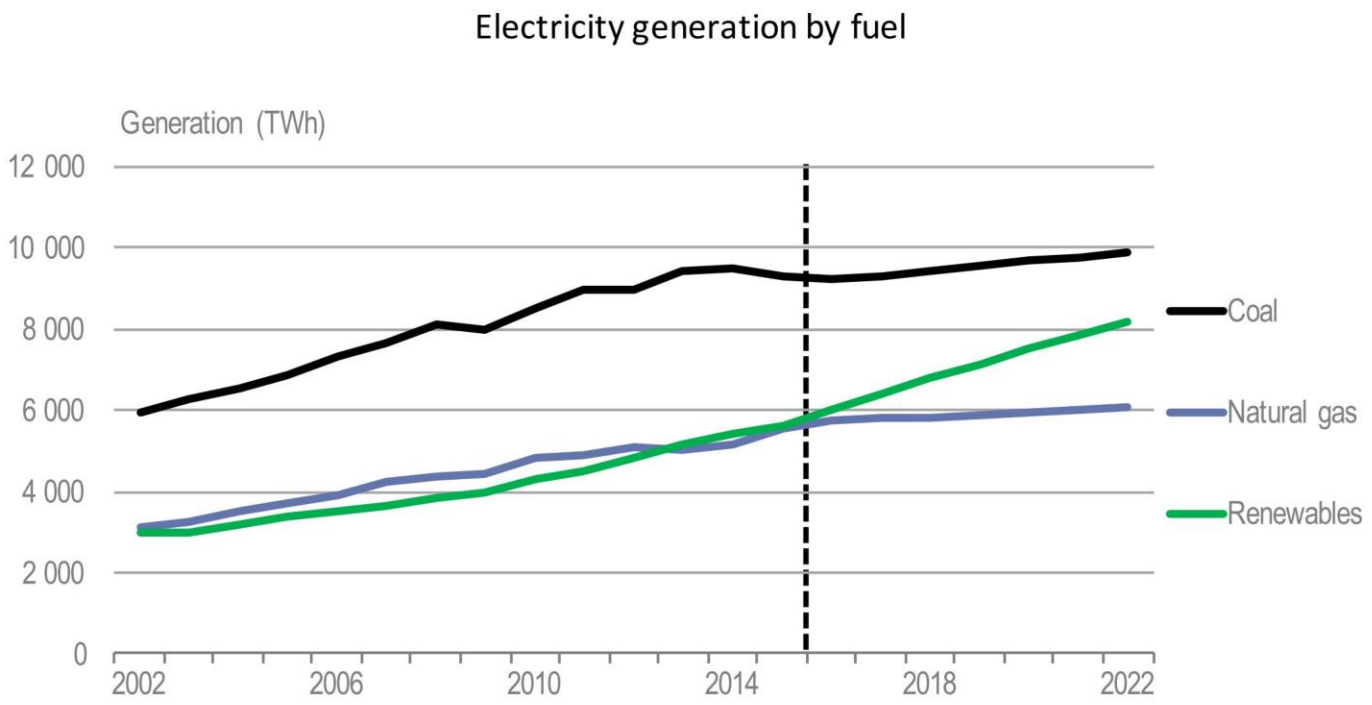
Renewables closing the gap with coal



Renewable generation to expand by over a third with its share increasing from 24% in 2016 to 30% in 2022, rapidly closing the gap with coal

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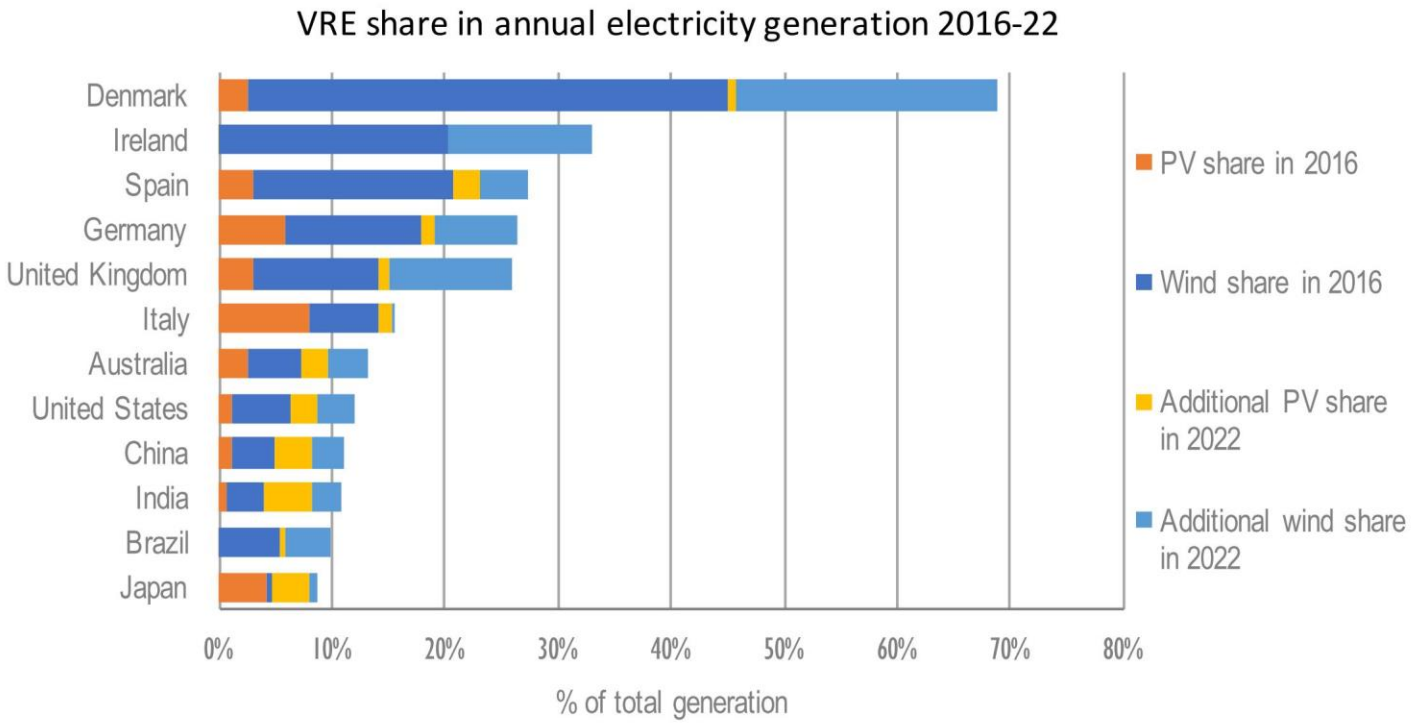
Wind and solar transforming power sector - system integration becomes key



More flexible power systems, adapted market design and policies will have to play a key role in integrating larger shares of wind and solar in a secure and cost-effective way

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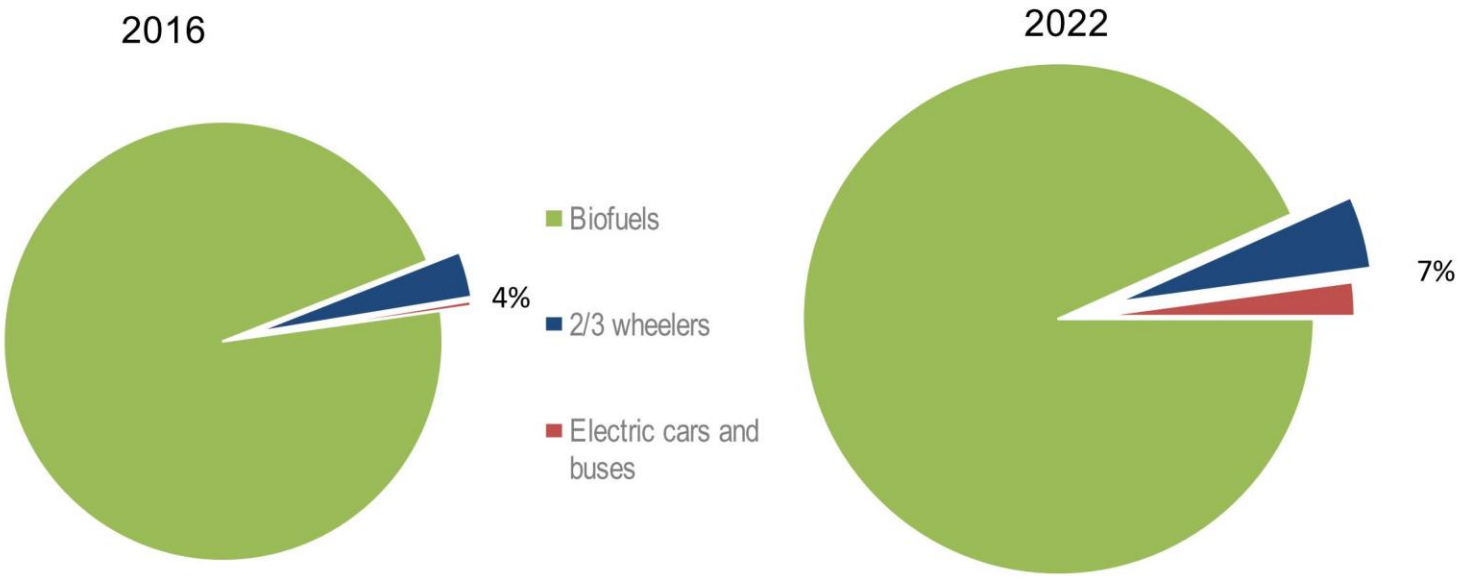
Surging EVs to complement biofuels in renewable transport

Biofuels and electric vehicles contribution to renewable energy consumption in road transport



Share of renewables in road transport increases from 4% in 2016 to almost 5% in 2022, with biofuels representing 80% of the growth led by Asia & Brazil; EV electricity consumption doubles by 2022, with renewables providing 30% of demand

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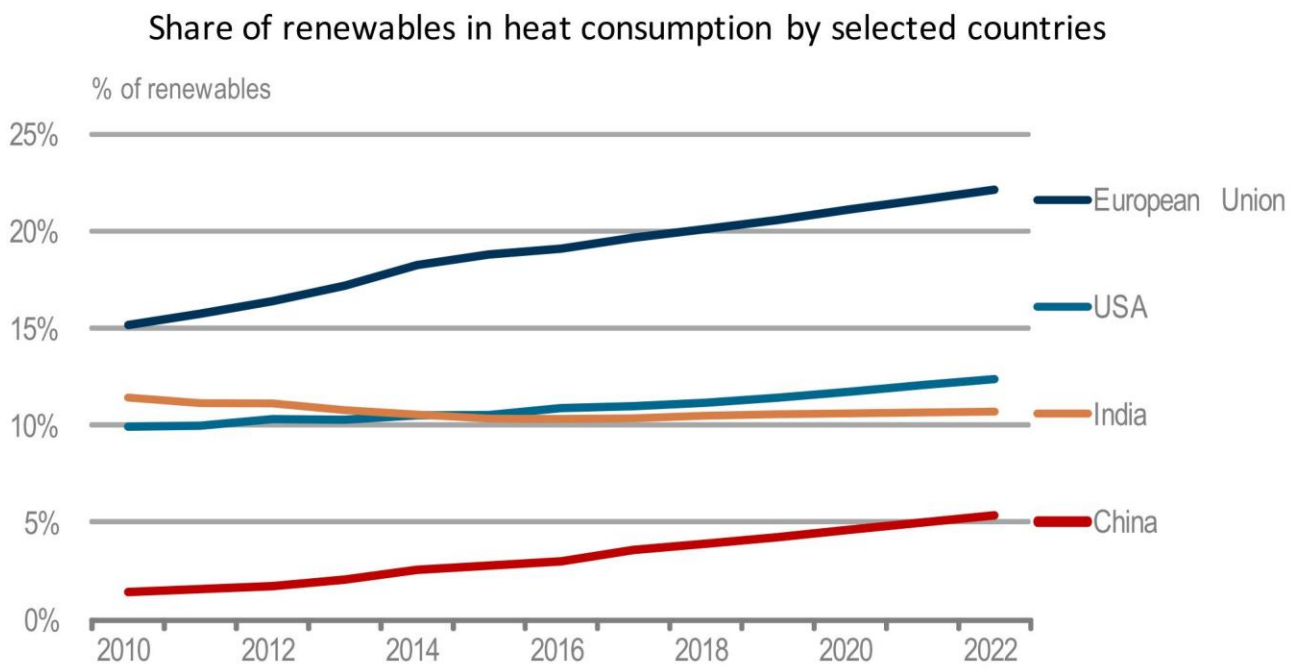
Progress in renewable heat depends on strong policies



Renewables share in heat consumption rises from 9% in 2016 to 11% in 2022. China leads absolute growth with new targets; EU remains the largest renewable heat consumer while total heat demand outpaces renewables growth in India

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Concluding remarks

- Renewables rise by 1,000 GW to 2022, equal to half of current total coal capacity
- Renewables generation exceeds 8,000 TWh by 2022, equal to total electricity consumption of China, India & Germany combined
- Solar PV enters a new era leading the growth in renewables, driven by a rapid expansion in deployment & manufacturing capacity in China
- Despite rapid growth in EVs, decarbonisation of transport is a long way off
  - *Only 30% of electricity used by EVs is sourced from renewables*
  - *Advanced biofuels require specific incentives to bolster deployment*
- Policymakers have to turn their focus to system integration & expanding the use of renewables for heating & cooling

© IEA 2017

Global consensus : the cost gap between RES and Fossil fuels disappeared (even without internalising all external costs).

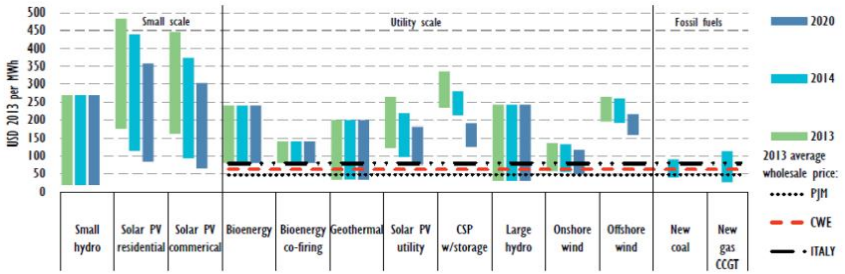
Fossil Fuels Losing Cost Advantage Over Solar, Wind, IEA Says

by Tara Patel

August 31, 2015 – 11:00 AM EEST *Updated on* August 31, 2015 – 3:15 PM EEST

BloombergBusiness

Renewable electricity increasingly competitive



- **Levelised cost of electricity generation continue to decrease for most renewable technologies**

BloombergBusiness

© OECD/IEA 2015

Renewables growth is driven by increasing competitiveness...

Cost of power generation from new-build plants*

*Levelized cost of power over the lifetime of the project for solar and wind; fuel prices for g

2017 Energy Outlook

Stunning drops in solar and wind costs turn global power market upside down

The world built more renewables for far less money last year, report UN and Bloomberg New Energy Finance.

If carbon tax and the elimination of fossil fuel subsidies are introduced, then it makes even more economic sense TO TURN TO RENEWABLES.

Now Is The Time For A Carbon Tax, IMF Chief Says

CLIMATEPROGRESS

BY SAMANTHA PAGE OCT 8, 2015 12:50PM

International Monetary Fund chief Christine Lagarde answers a question during a press conference, in Lima, Peru, Thursday, Oct. 8, 2015. The world's finance ministers and central bankers are in Lima for the joint annual meetings of the World Bank and IMF that run through Sunday.

Vulnerable nations call on G20 to end fossil fuel subsidies by 2020

Published on 24/04/2017, 4:39pm

Ministers from countries on the front line of climate change have urged rich nations to stop pouring money into the coal, oil and gas industries

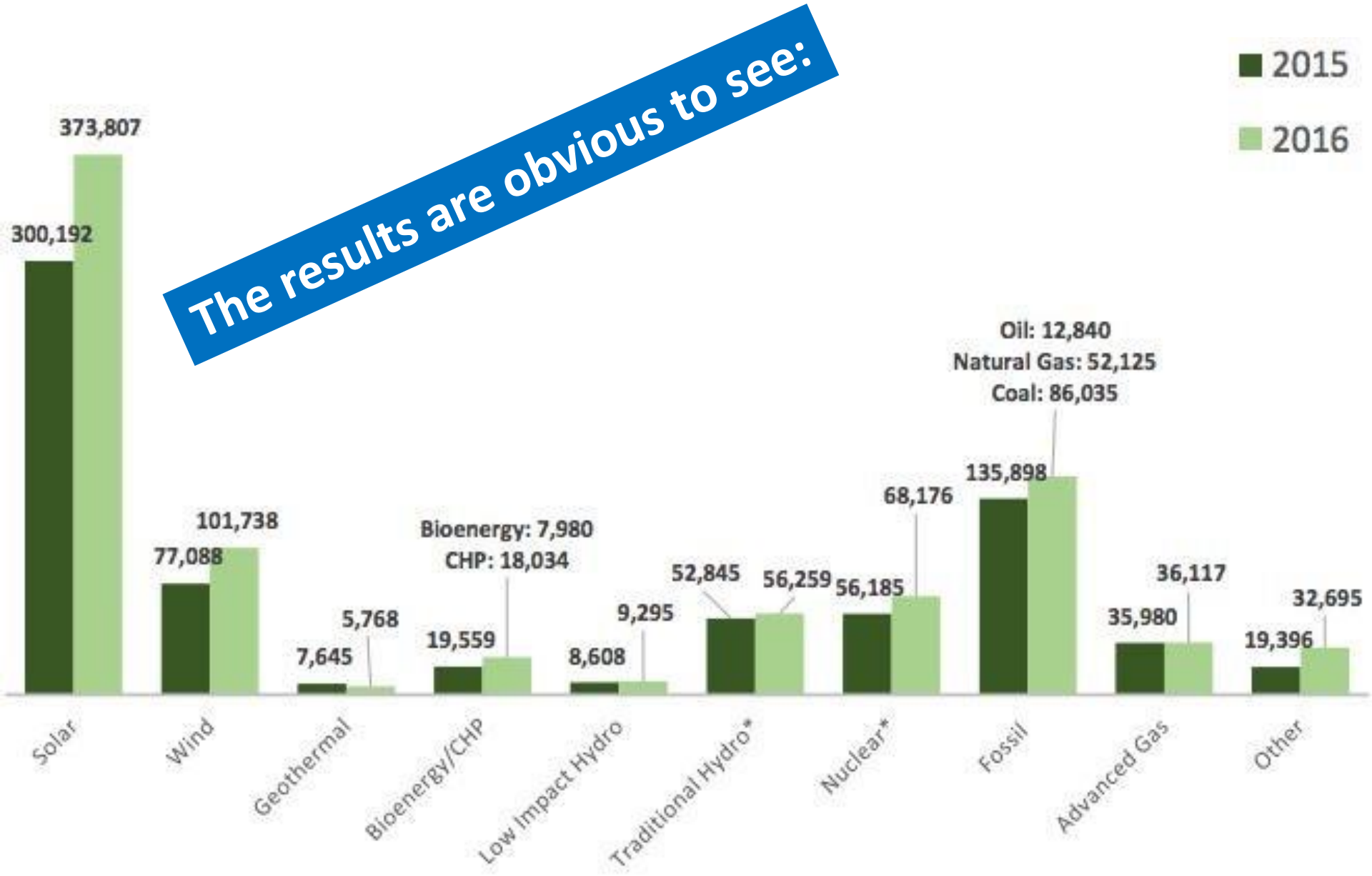
Fragile communities: Ebeye atoll in the Marshall Islands (Photo: NASA)

By Karl Mathiesen

The world's 49 most climate vulnerable countries have called on the G20 to finally set a date – preferably 2020 – for a phase out of fossil fuel

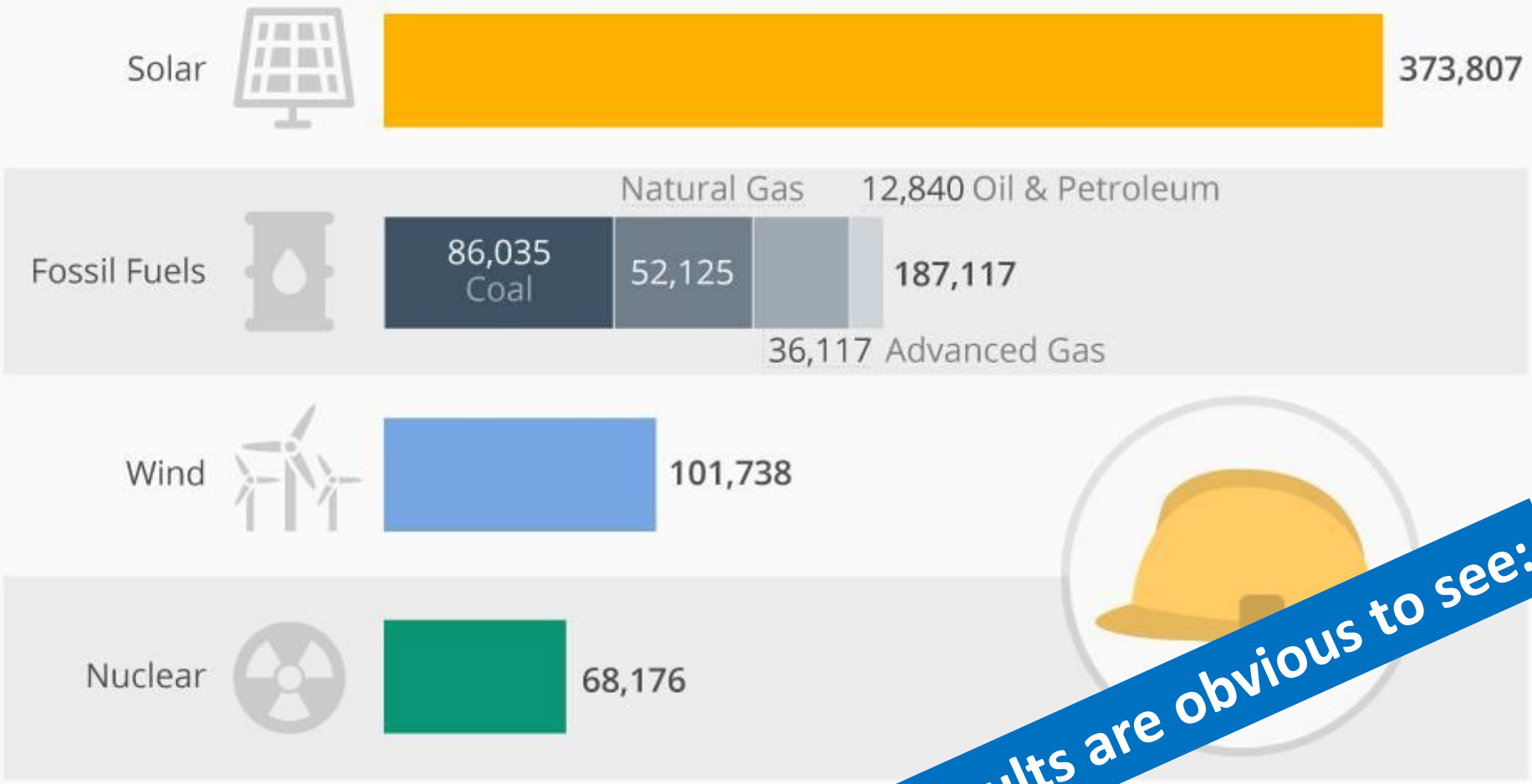
Meet America's fastest growing profession: wind technician

U.S. Energy and Employment Report



More Workers In Solar Than Fossil Fuel Power Generation

Employment in energy generation by source in the U.S. in 2016



The results are obvious to see:

@StatistaCharts

Source: U.S. Department of Energy

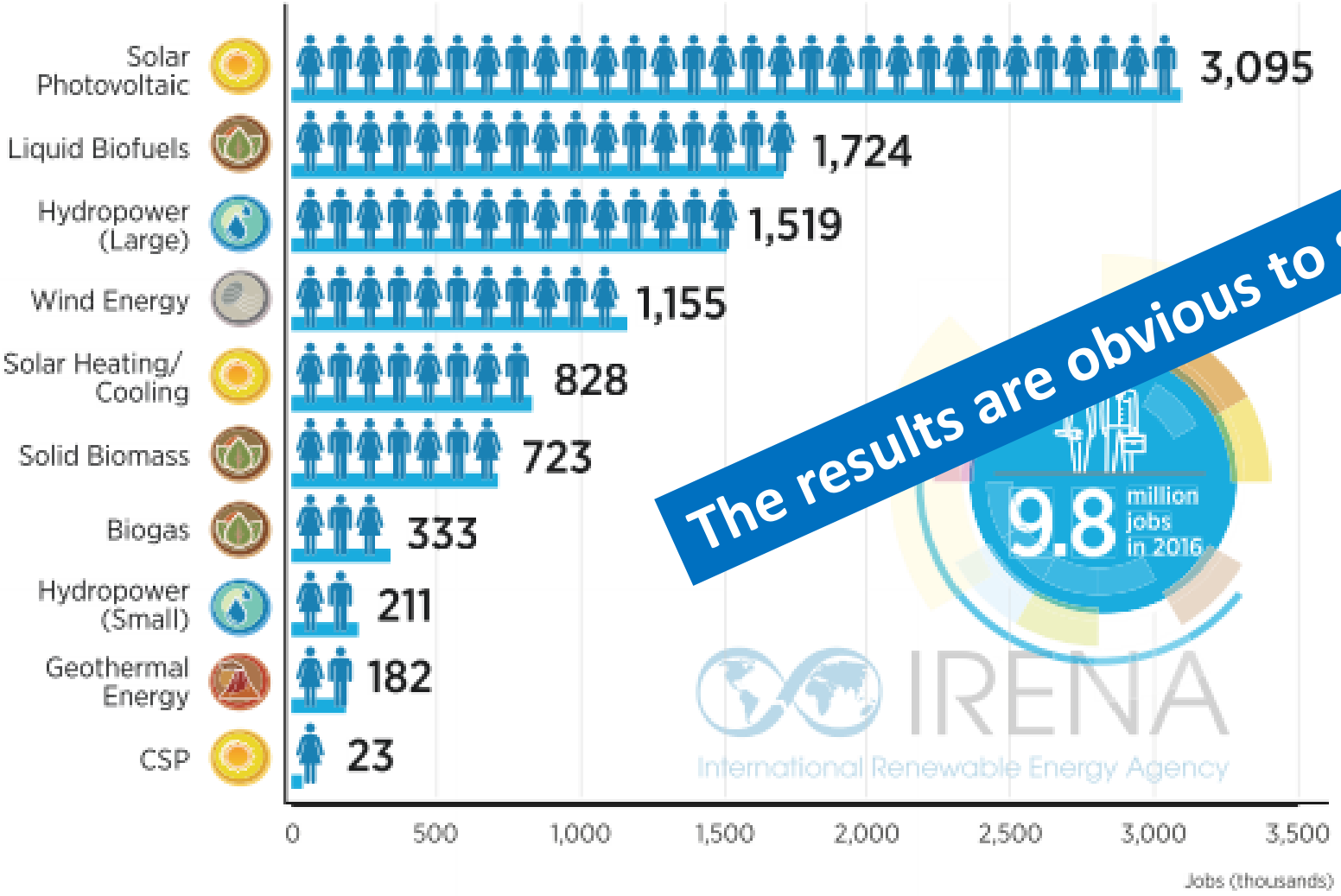
Forbes statista

[U.S. Energy and Employment Report]

9,8 million jobs in renewables in 2016

IRENA
Renewable Energy and Jobs
Annual Review 2017

FIGURE 2: RENEWABLE ENERGY EMPLOYMENT BY TECHNOLOGY



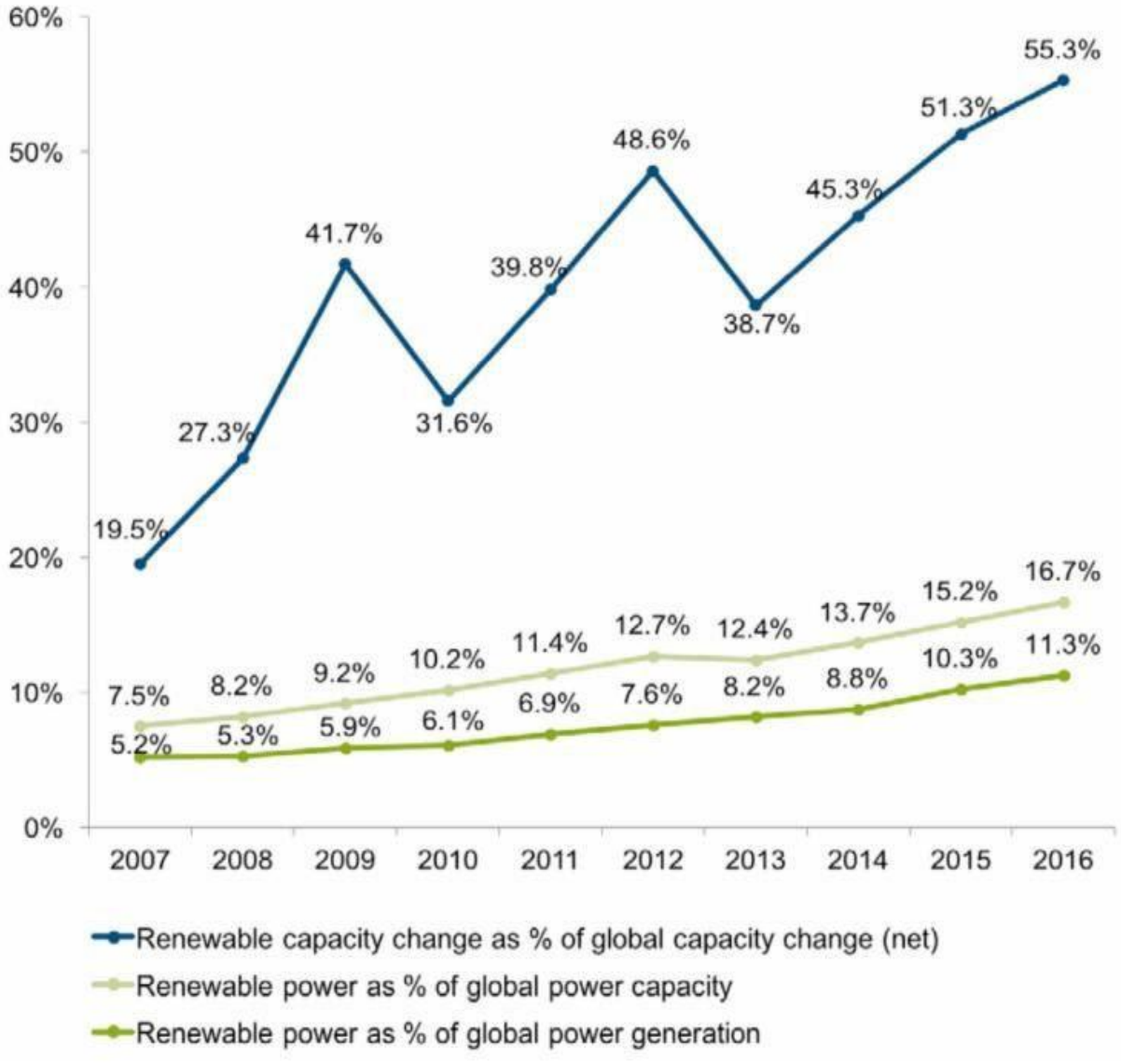
The results are obvious to see:

9.8 million jobs in 2016

IRENA
International Renewable Energy Agency

However, we still have a long way to go……

FIGURE 23. RENEWABLE POWER GENERATION AND CAPACITY AS A SHARE OF GLOBAL POWER, 2007-2016, %



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The Green Climate Fund (GCF).

The Green Climate Fund (GCF) is a global fund created

- **to support the efforts of developing countries to respond to the challenge of climate change.**
- **GCF helps developing countries limit or reduce their greenhouse gas (GHG) emissions and adapt to climate change,**
- **taking into account the needs of nations that are particularly vulnerable to climate change impacts.**

The Green Climate Fund (GCF).

- It was set up by the 194 countries who are parties to the United Nations Framework Convention on Climate Change (UNFCCC) in 2010, as part of the Convention's financial mechanism.
- It aims to deliver equal amounts of funding to mitigation and adaptation, while being guided by the Convention's principles and provisions.
- When the Paris Agreement was reached in 2015, the Green Climate Fund was given an important role in serving the agreement and supporting the goal of keeping climate change well below 2 degrees Celsius.

The Green Climate Fund (GCF).

- Advanced economies have agreed to jointly mobilize significant financial resources.
- Coming from a variety of sources, these resources address the pressing mitigation and adaptation needs of developing countries.
- GCF launched its initial resource mobilization in 2014, and rapidly gathered pledges worth USD 10.3 billion.
- These funds come mainly from developed countries, but also from some developing countries, regions, and one city (Paris).

The Green Climate Fund (GCF).

GCF's activities are aligned with the priorities of developing countries through the principle of country ownership,
and the Fund has established a direct access modality so that national and sub-national organisations can receive funding directly, rather than only via international intermediaries.
The Fund pays particular attention to the needs of societies that are highly vulnerable to the effects of climate change, in particular

- Least Developed Countries (LDCs),
- Small Island Developing States (SIDS),
- and African States.

The Green Climate Fund (GCF).

- GCF aims to catalyze a flow of climate finance to invest in low-emission and climate-resilient development, driving a paradigm shift in the global response to climate change.
- Use of public investment to stimulate private finance, unlocking the power of climate-friendly investment for low emission, climate resilient development.
- The Fund's investments can be in the form of grants, loans, equity or guarantees.

The Green Climate Fund (GCF).

GCF invests in adaptation and mitigation activities in developing countries, managing a project portfolio that is implemented by its partner organisations, known as Accredited Entities.
GCF's approach is marked by several distinct features:

BALANCED PORTFOLIO.

- The Fund aims for a 50:50 balance between mitigation and adaptation investments over time.
- It also aims for a floor of 50 percent of the adaptation allocation for particularly vulnerable countries, including Least Developed Countries (LDCs), Small Island Developing States (SIDS), and African States.

The Green Climate Fund (GCF).

UNLOCKING PRIVATE FINANCE.

- The Fund is unique in its ability to engage directly with both the public and private sectors in transformational climate-sensitive investments.
- GCF engages directly with the private sector through its Private Sector Facility (PSF).
- As part of its innovative framework, it has the capacity to bear significant climate-related risk, allowing it to leverage and crowd in additional financing.

The Green Climate Fund (GCF).

COUNTRY OWNERSHIP.

GCF recognizes the need to ensure that developing country partners exercise ownership of climate change funding and integrate it within their own national action plans. Developing countries appoint a National Designated Authority (NDA) that acts as the interface between their government and GCF, and must approve all GCF project activities within the country. This country-driven approach ensures GCF's activities operate in harmony with national priorities.

The aim of all GCF activities is to support developing countries limit or reduce their greenhouse gas emissions and adapt to climate change impacts.

The Green Climate Fund (GCF).

- **2009:** The general concept for GCF is first proposed at the Conference of the Parties (COP) to the UNFCCC in Copenhagen, Denmark (COP 15).
- **2010:** The COP in Cancun, Mexico (COP 16), decides to establish GCF.
- **2014:** Following the establishment of its operational principles and guidelines, GCF commences its initial resource mobilization, raising over USD 10 billion equivalent by the end of the year. Initial mobilization lasts until 2018, while the Fund remains open for further contributions during this time from both public and private sources.
- **2015:** The first investment decisions are taken, including both mitigation and adaptation projects, meeting the target set by the UNFCCC in advance of the Paris COP. 195 countries agree to the historic Paris Agreement, which GCF now serves as a financial mechanism of the Convention.
- **2016:** Marks GCF's first full year of operations, with the Fund developing a project portfolio of 35 projects, worth over USD 1.5 billion by the end of the year, to be implemented by its 48 Accredited Entities.

The Green Climate Fund (GCF).

Cairo, 02 Oct 2017

The Green Climate Fund (GCF) concluded its last Board meeting of 2017 by approving 11 new projects and programmes valued at USD 392.86 million to assist developing countries respond to climate change.

Taking these projects into account, the Fund's portfolio now consists of 54 projects and programmes amounting to USD 2.59 billion in GCF funding.

The Green Climate Fund (GCF).

The following projects and programmes were approved :

- ✓B.18: FP046 – USD 8.65 million for the Renewable Energy Programme #1 – Solar in Mongolia with XacBank.
- ✓FP047 – USD 110 million for the GCF-EBRD Kazakhstan Renewables Framework programme in Kazakhstan with the European Bank for Reconstruction and Development (EBRD).
- ✓FP048 – USD 20 million for Low Emissions and Climate Resilient Agriculture Risk Sharing Facility programme in Guatemala and Mexico with the Inter-American Development Bank.
- ✓FP049 – USD 9.98 million for Building the Climate Resilience of Food Insecure Smallholder Farmers Through Integrated Management of Climate Risk project in Senegal with the United Nations World Food Programme (WFP).
- ✓FP050 – USD 26.56 million for the Bhutan for Life project in Bhutan with the World Wildlife Fund (WWF).
- ✓FP051 – USD 17.35 million for the Scaling-up Investment in Low-Carbon Public Buildings project in Bosnia and Herzegovina with the United Nations Development Programme (UNDP).

The Green Climate Fund (GCF).

The following projects and programmes were approved :

- ✓FP052 – USD 26.91 million for the Sustainable and Climate Resilient Connectivity for Nauru project in Nauru with the Asian Development Bank (ADB).
- ✓FP053 – USD 31.39 million for the Enhancing Climate Change Adaptation in the North Coast and Nile Delta Regions in Egypt project with the United Nations Development Programme (UNDP).
- ✓FP054 – USD 58.53 million for the Implementation Project for the Management Plan of the Lujan River Basin in Argentina with the Development Bank of Latin America (CAF).
- ✓FP056 – USD 38.5 million for the Scaling up Climate Resilient Water Management Practices for Vulnerable Communities in La Mojana project in Colombia with the United Nations Development Programme (UNDP).
- ✓FP058 – USD 45 million for the Responding to the Increasing Risk of Drought: Building Gender-responsive Resilience of the Most Vulnerable Communities project in Ethiopia with the Ethiopian Ministry of Finance and Economic Cooperation (MoFEC).

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Greece's targets according to EU Directive 28/2009

Overall target : **18% of share of energy generated** from renewable sources in gross final energy consumption (**20%** unilaterally):

✓**Heating and cooling**: **20% of heat consumption** met by renewable sources;

✓**Electricity**: **40% of electricity demand** met by electricity generated from renewable energy sources;

✓**Transport**: **10% of energy demand** met by renewable energy sources.

Share of renewable consumption to gross final energy consumption.

Comprises of direct use of renewables (e.g. biofuels) plus energy produced from renewables (e.g. wind, hydro).

Final energy consumption is the energy that households, industry, services, agriculture and the transport sector use.

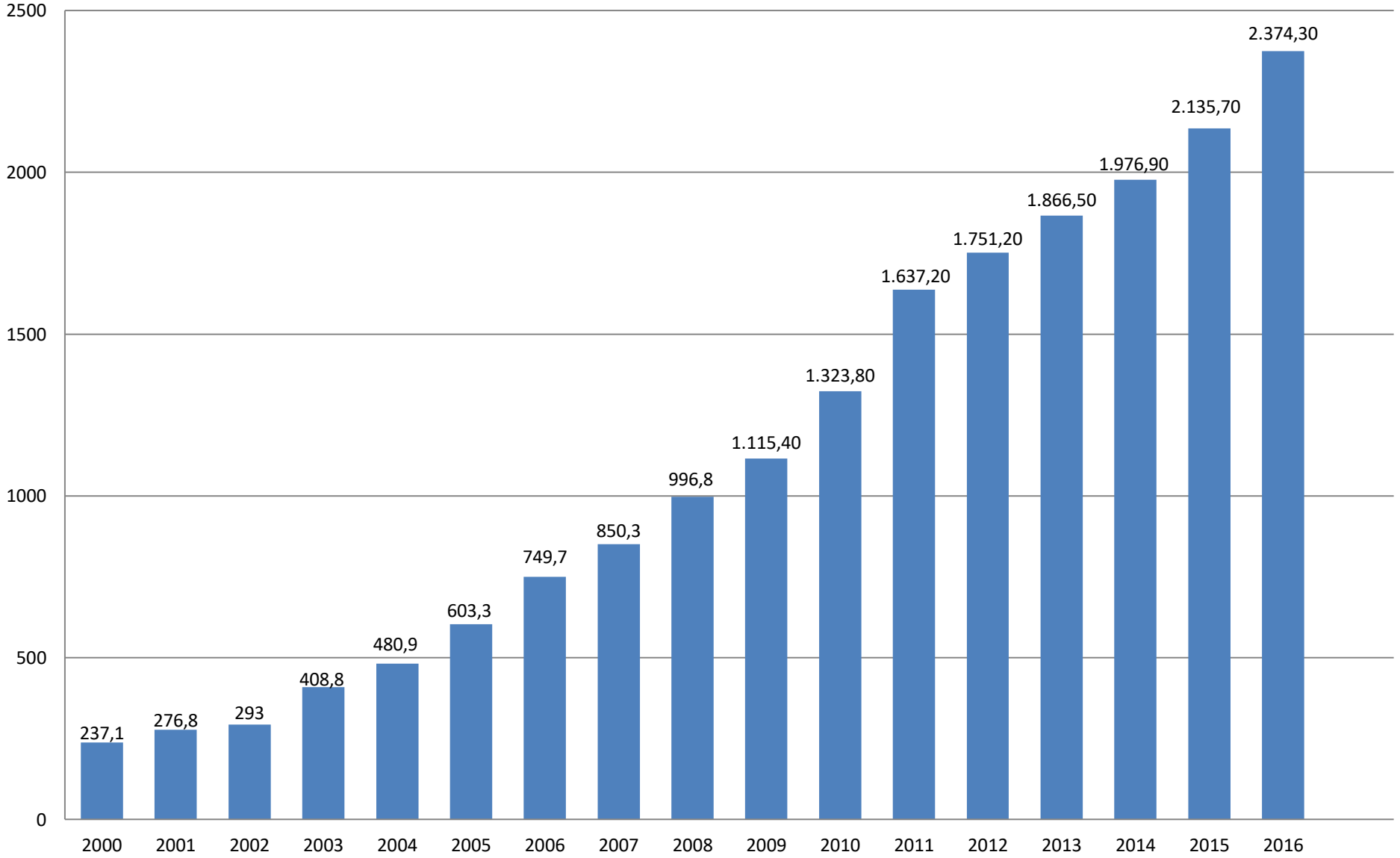
EU Member State	2006	2007	2008	2020 Target	% To cover:
Greece	7.2 %	8.1 %	7.9 %	18 %	**10.1 %**
Germany	6.9 %	9 %	8.9 %	18 %	**9.1 %**
Denmark	16.8 %	18.1 %	18.7 %	30 %	**11.3 %**
Portugal	20.5 %	22.2 %	23 %	31 %	**8 %**

The road map to the 2020 target (2014 - 2020)

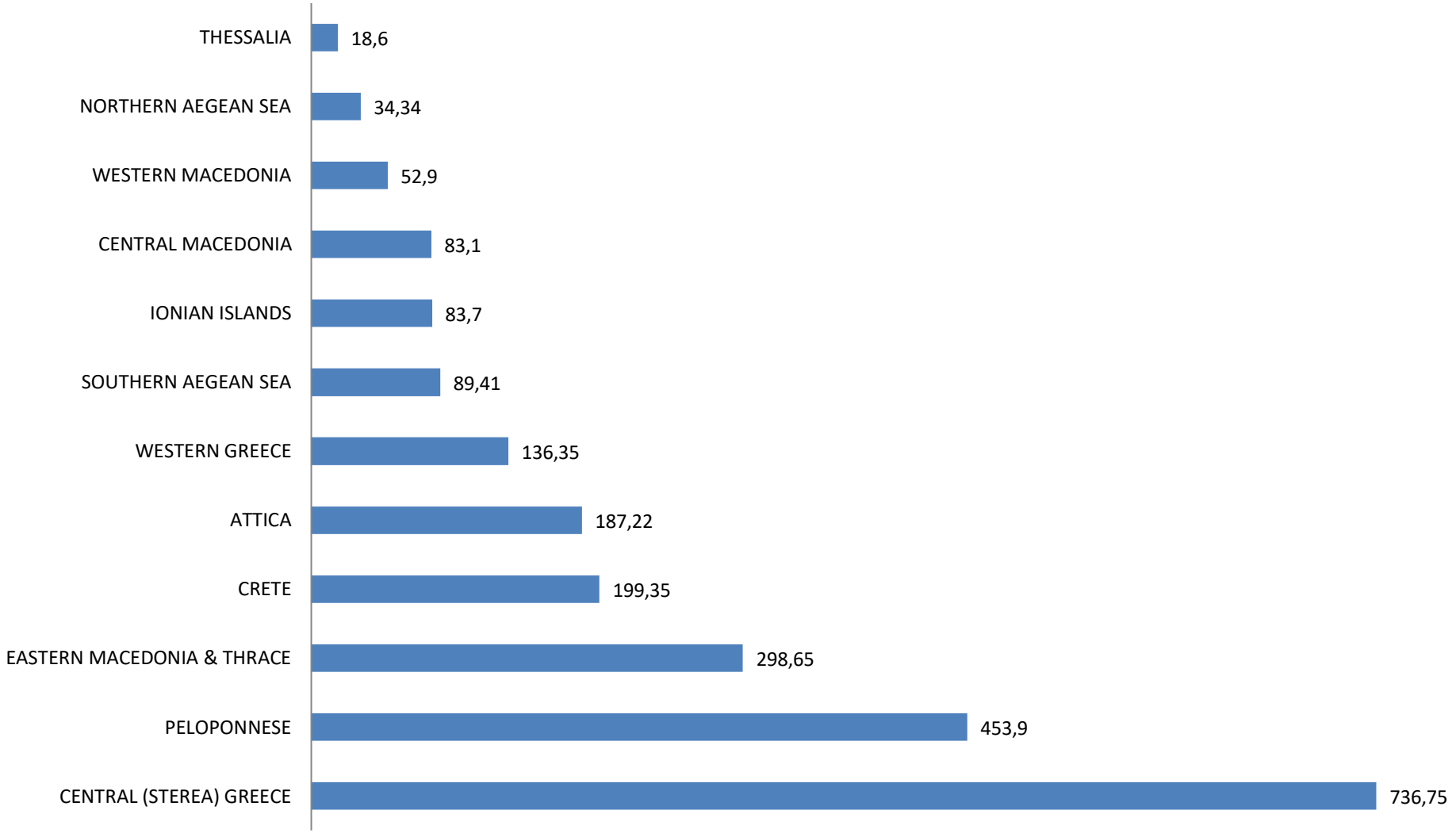
Technology	Capacity (MW)	
	2014	2020
Small Hydro (<=15MW)	300	350
PV	1500	2200
CSP	120	250
Wind (inland and offshore)	4000	7500
Geothermal	0	120
Biomass	200	350

Estimated investment in RES (2010-2020) = 16,5 b€

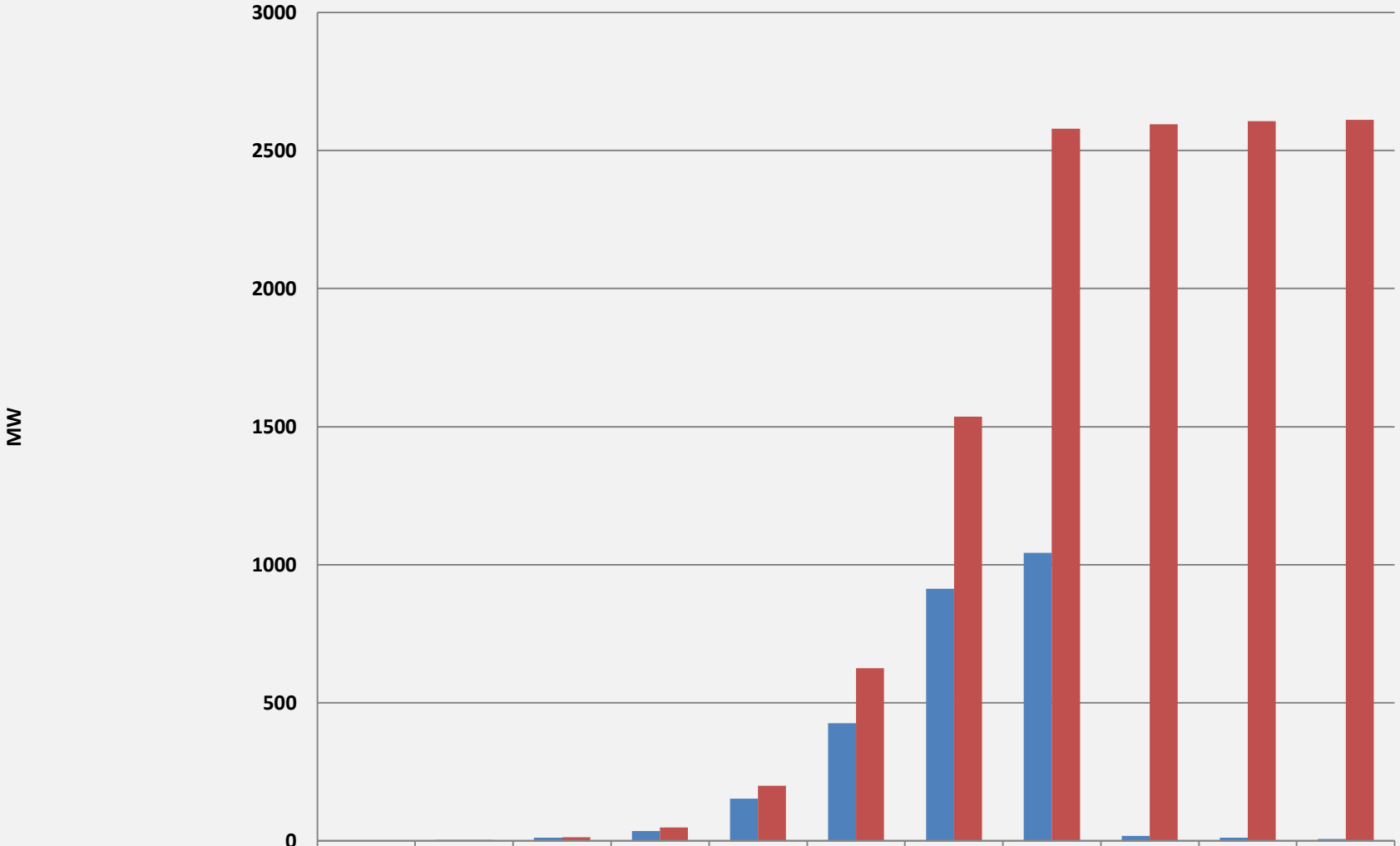
Wind total installed MW per year



Wind installed MW per region



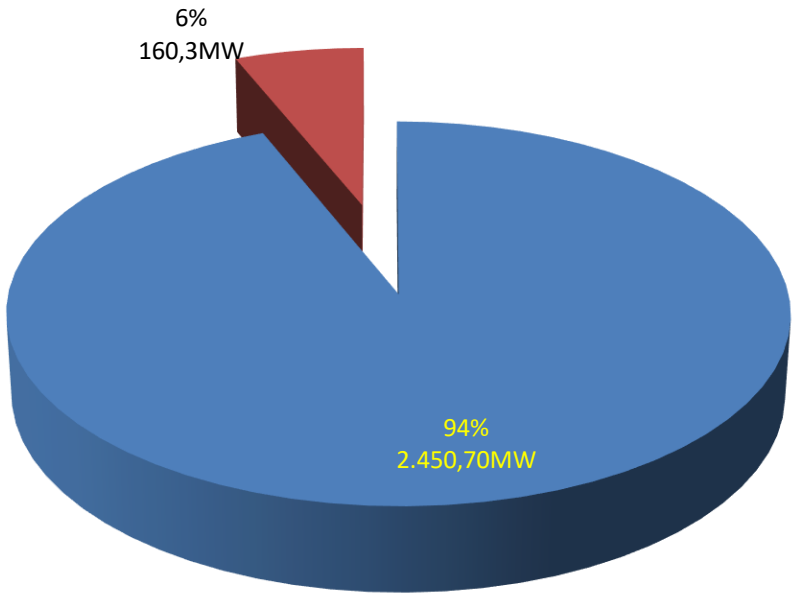
Solar PV total installed capacity per year 2016



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual istalled capacity (MW)	0	2	10	35	152	425	912	1.043	17	10	5,4
Total installed capacity (MW)	0	2	12	47	199	624	1.536	2.579	2.596	2.606	2.611

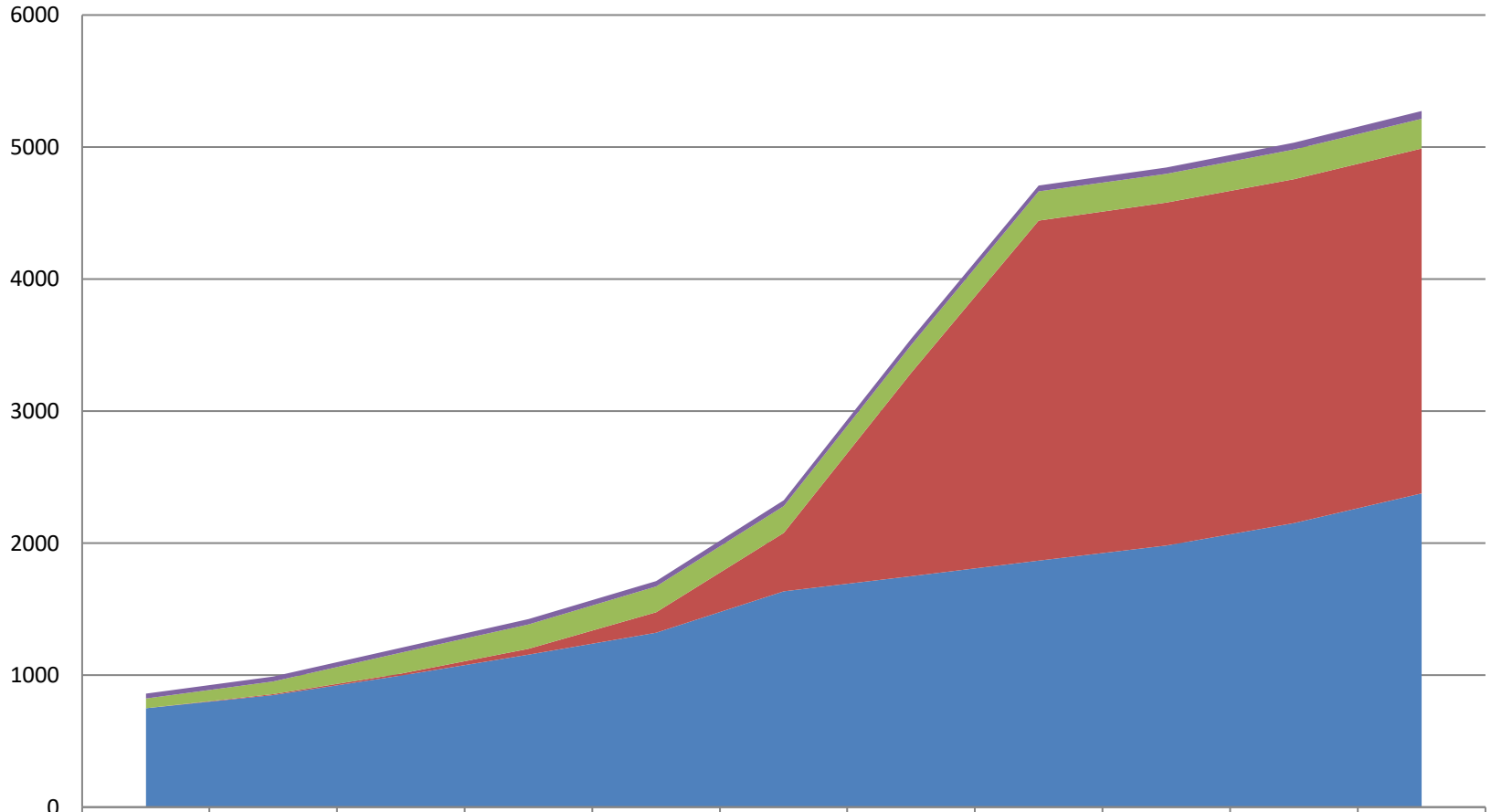
RedPro email: info@redpro.gr

Solar installed capacity 2016



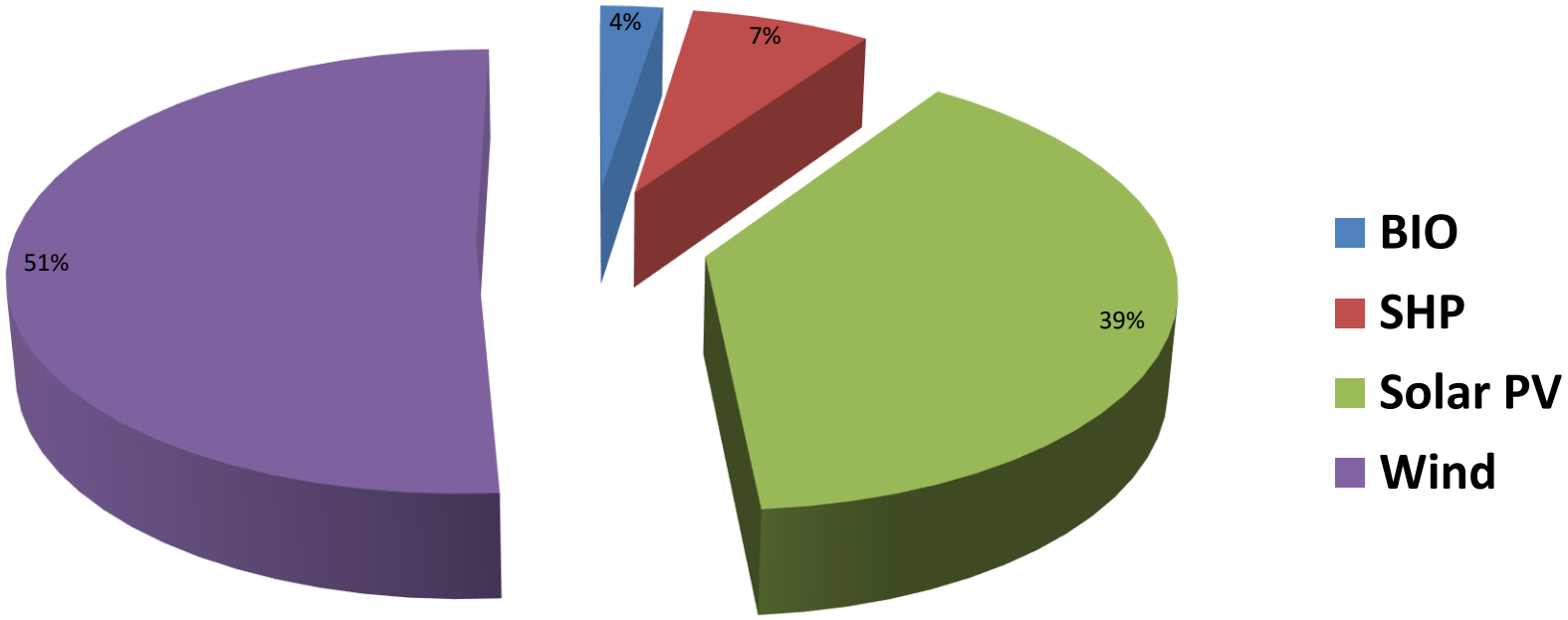
- continental grid
- Non-interconnected islands

Cumulative RES Installed capacity in Greece

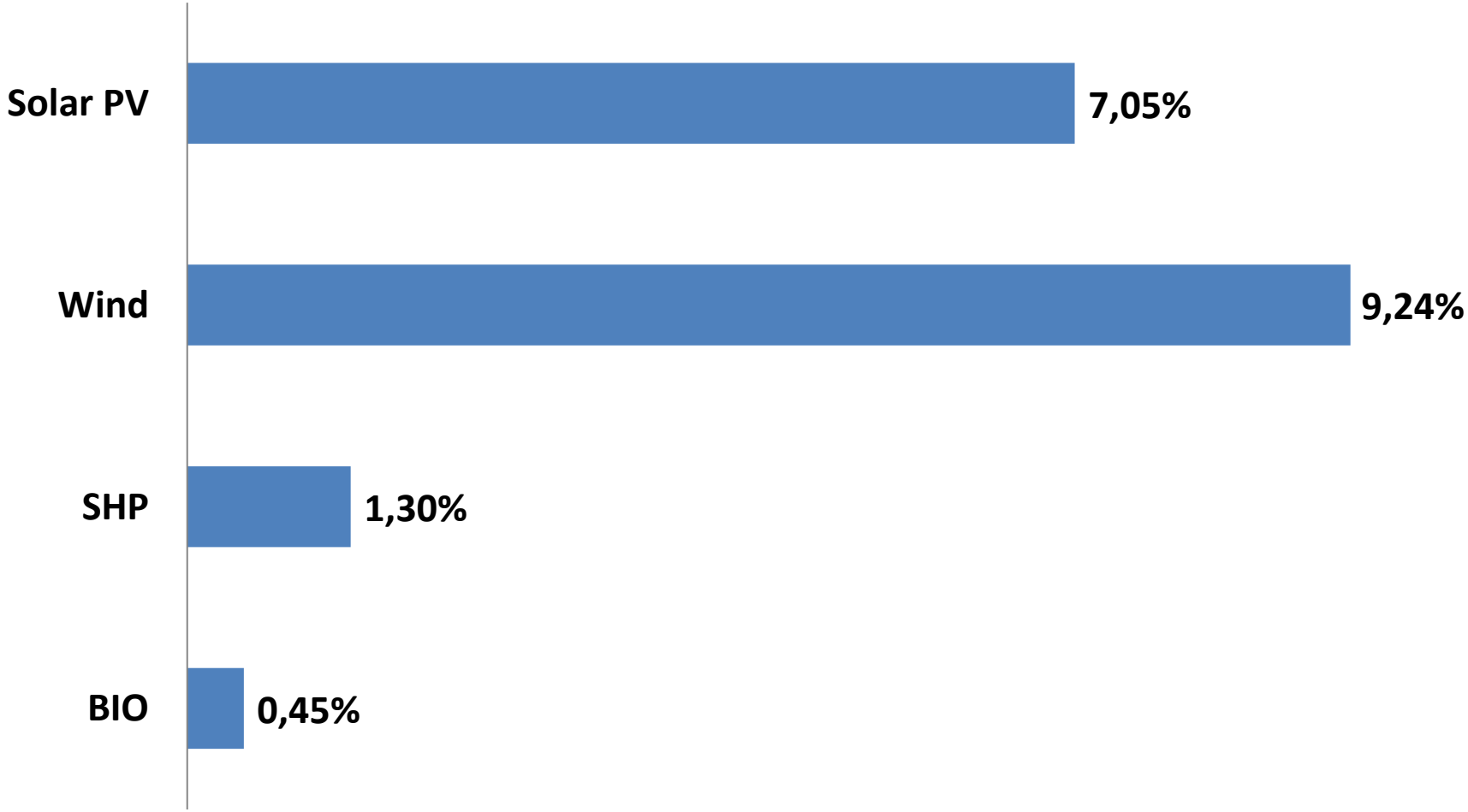


	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
BIO (MW)	37	37	39	41	41	45	45	46	47	52	58
SHP (MW)	74	96	158	183	197	205	213	220	220	224	227
Solar PV(MW)		4	15	45	153	440	1.536	2.577	2.596	2.604	2.611
Wind (MW)	748	849	995	1.154	1.320	1.635	1.749	1.865	1.980	2.151	2.375

Share of RES technologies in total electricity generation from RES 2016



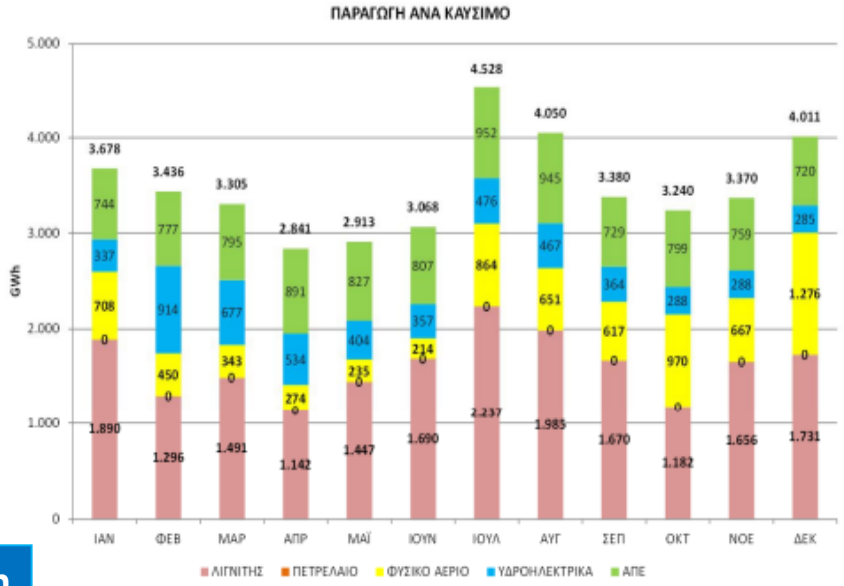
Share of RES technologies in total electricity demand 2016



2015 Res contribution to electricity consumption

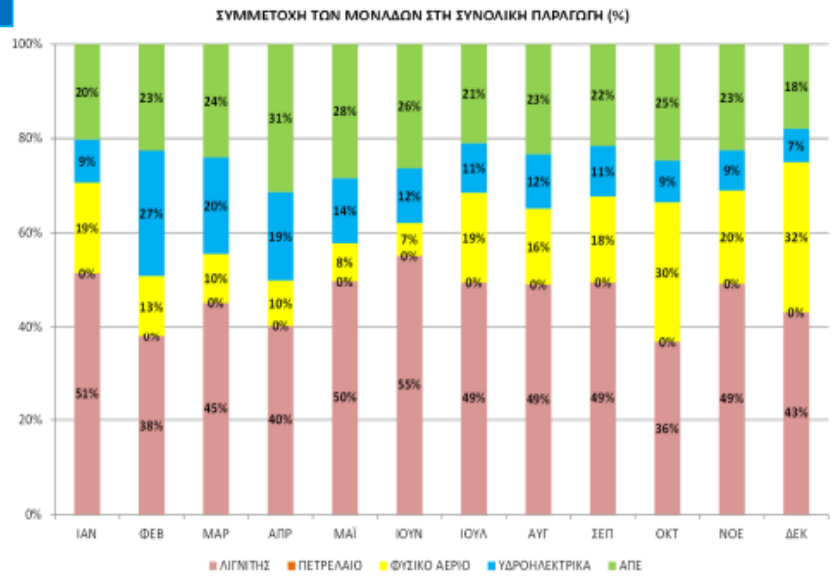
In 2015 the total share of RES in electricity consumption was:

- **26,78%** including large Hydro
- While the 2020 target stands at 40% (L.3851/2010)
- **The European statistics estimate this figure at 22,09%**



2015 res participation in national electricity consumption

	GWh	share(%)
Wind Parkas	4.621,00	8,34%
PV	3.406,00	6,14%
Roof PV	494,00	0,89%
Small hudro	708,00	1,28%
Biomass/Biogas	222,00	0,40%
Total RES w/o large hydro	**9.451,00**	**17,05%**
Large Hydro	5.391,00	9,73%
Total RES	**14.842,00**	**26,78%**
National consumption	55.430,50	



Sources: LAGHE ADMHE


Total RES annual investments in Greece, mil €
3000
2500
2000
1500
1000
500
0
million €
2004
2006
2008
2010
2012
2014
2016
2018
Year

Licensing Progress of RES up to 31-12-2015						
(in MW)	Applications	Production license	Installation license	Binding connection terms	PPA	Operating
Wind	24.103	20.208	6.640	2.635	978	2.090
Biomass/gas	534	316	141	83	44	52
Small Hydro	1.079	620	182	80	24	265
PV	4.422	488	1.554	567	1.008	2.602
CSP	787	442	252	70	0	0
Total	30.925	22.074	8.769	3.435	2.054	5.009

The road map to the 2030 target?
To the 2050 target?

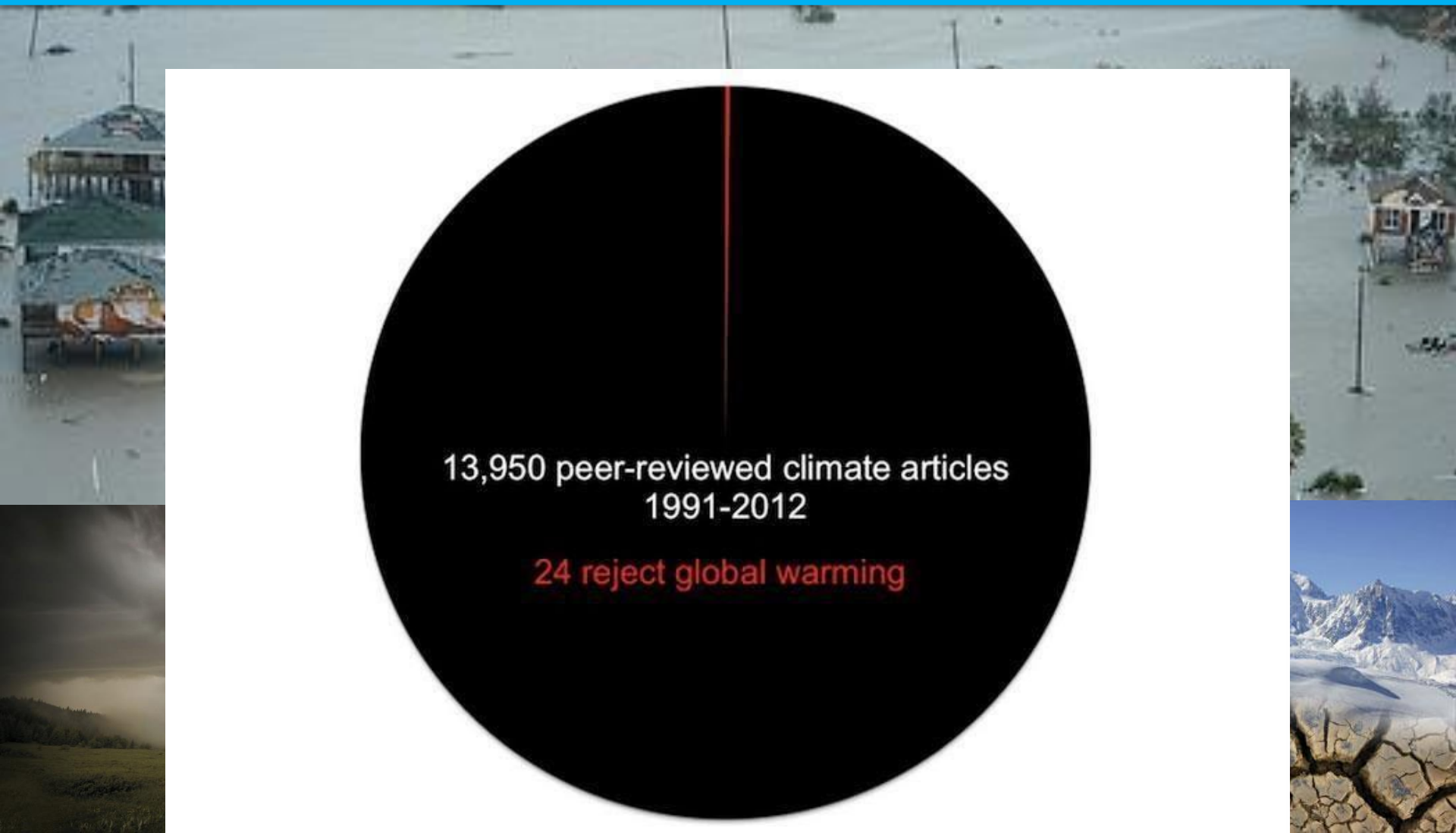
Contents.

- ✓ Green Energy investment perspectives
- ✓ Green Climate Fund
- ✓ Perspectives of green investing in Greece
- ✓ **100% RES**

Climate change: Who says so?

The overwhelming majority of the scientists (> 97%) agree that:

- **climate change is happening now and**
- **the primary cause are human activities**

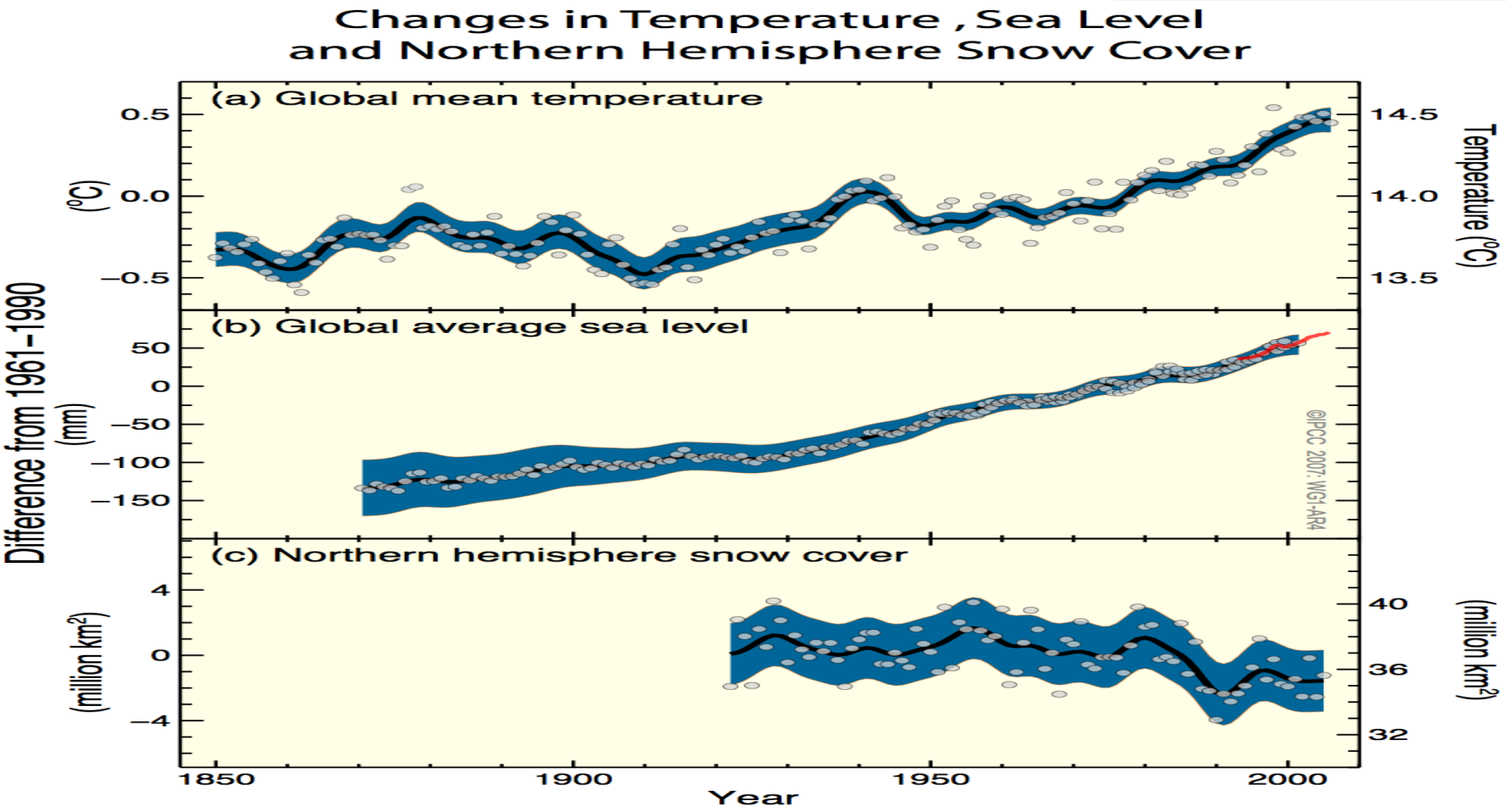


Climate change: How do they know?

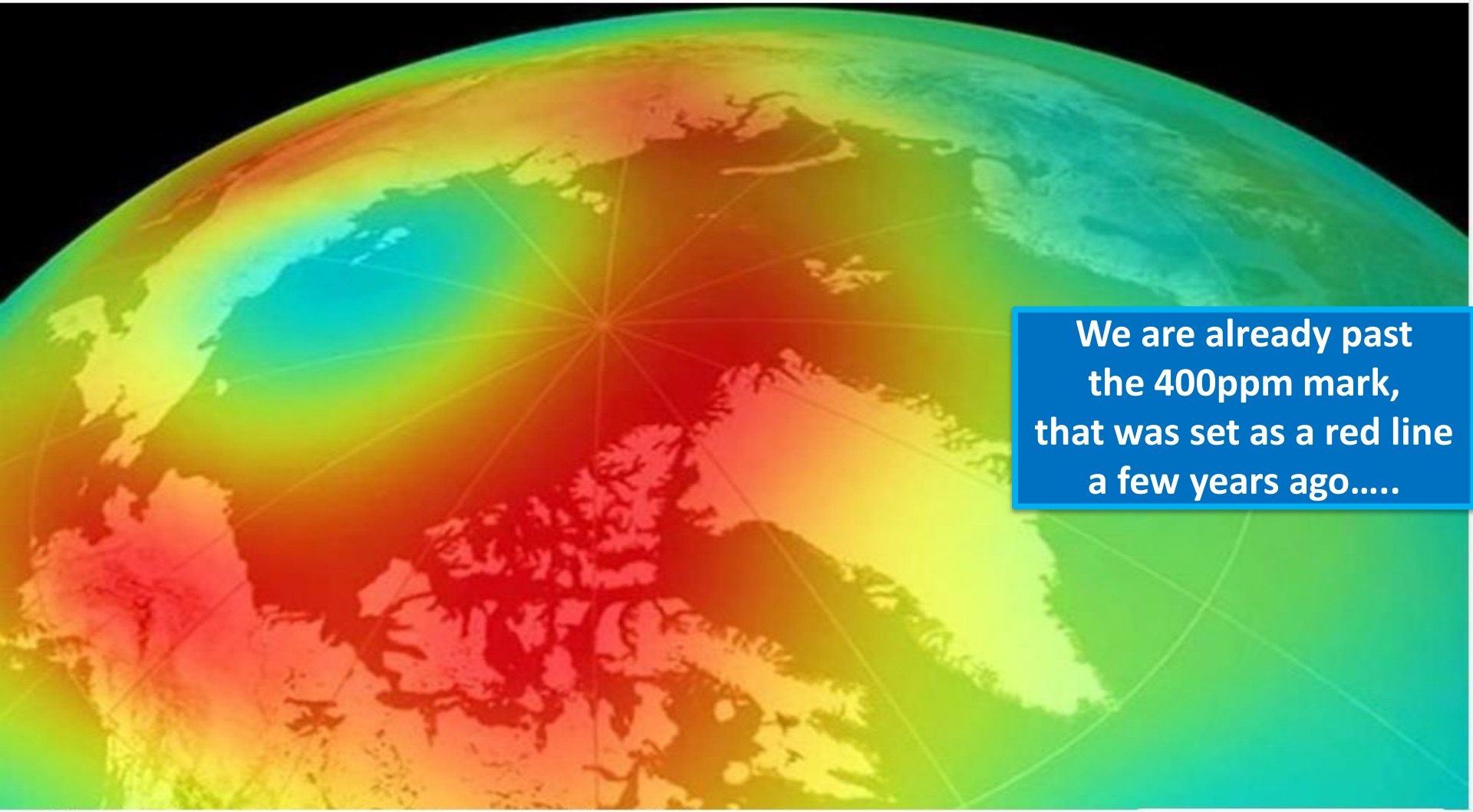
The main scientific findings that led scientists to this conclusion are:

- **The increase in the average global temperature**
- **The sea level rise**
- **The reduction of ice cover in the Northern Hemisphere**

http://www.metoffice.gov.uk/climate-change/resources/hadleycentre



Climate change: Why is it happening?
The greenhouse effect.



We are already past the 400ppm mark, that was set as a red line a few years ago…..

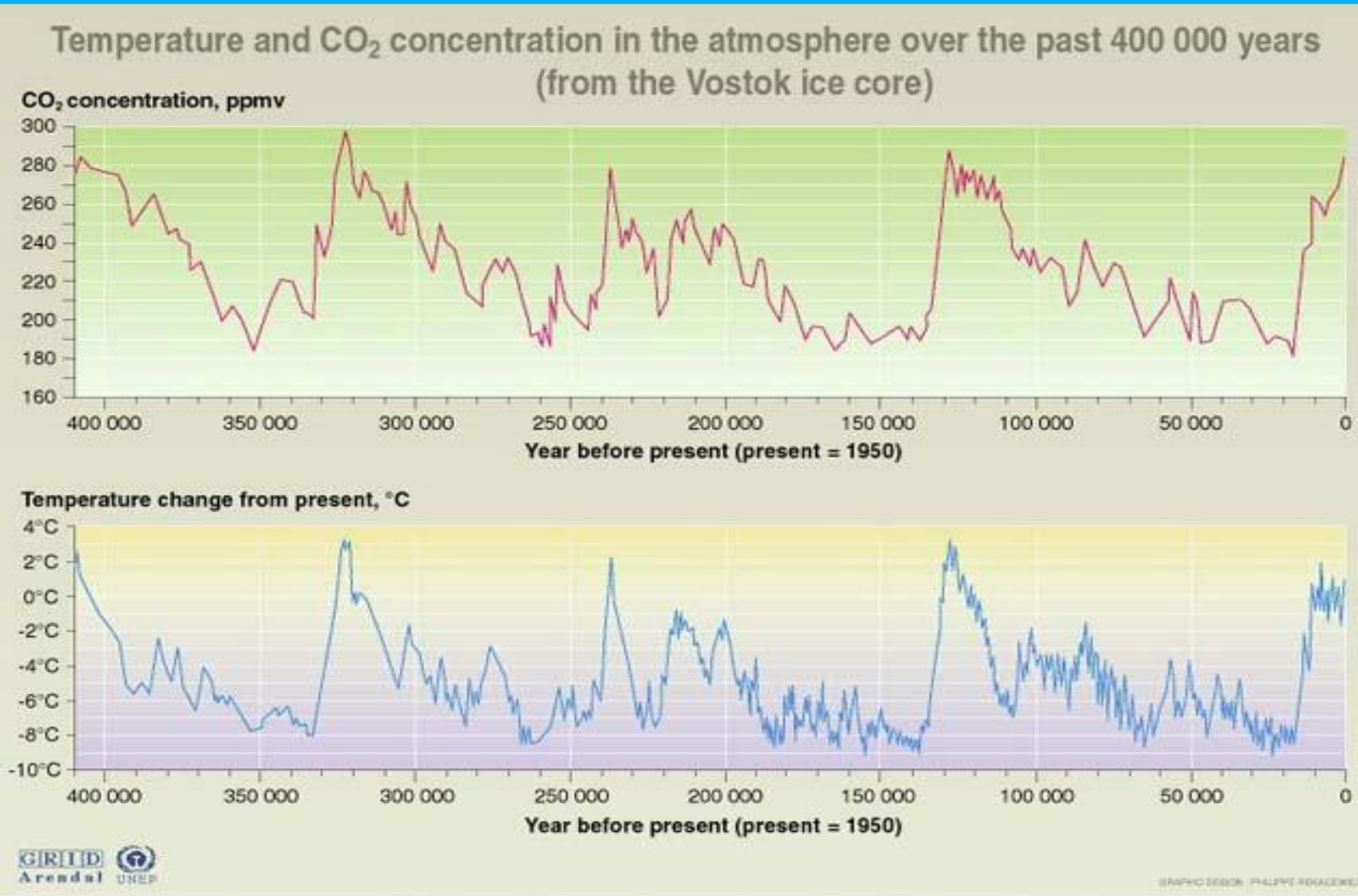
First look at new NASA satellite map reveals global carbon dioxide hotspots. *NASA*

Planet Breaches 410 ppm for First Time in Human History

By Lauren McCauley

EcoWatch

And it is due to the perennial relationship between atmospheric CO2 concentration and mean global surface temperature over hundreds thousand years



Source: J.R. Petit, J. Jouzel, et al. Climate and atmospheric history of the past 420 000 years from the Vostok ice core in Antarctica, Nature 399 (3/June), pp 429-436, 1999.

For some, however, it is already late.
The small islands (atolls) already face flooding from rising sea levels.
The Cabinet of Tuvalu, in an effort to raise awareness of developed countries and public opinion, held an underwater cabinet meeting. (20/09/2011)

Climate change threat

Climate change will create more climate refugeees

theguardian

Failure to act on climate change means an even bigger refugee crisis

Global warming does not cause the conflicts that have caused mass movement of people, but it would be wrong to say it does not contribute

WORLD RESOURCES INSTITUTE

THE CARBON BUDGET

The international consensus of climate experts is clear: The world is warming, and it's largely due to human activities. We're now living on a planet where global temperatures are warmer than most of the past 11,000 years.

The Intergovernmental Panel on Climate Change (IPCC) recently identified the world's "carbon budget," the amount of carbon dioxide that can be emitted if we are to have a likely chance of averting the most dangerous of climate change impacts. The world is currently on track to spend the remainder of this budget in just three decades.

The carbon budget red line.

To reduce the possibility of the global average surface temperature rising above 2° C, to below 20% the total carbon that can be emitted in the atmosphere in the period 2000-2050 ,has been calculated at

886 GT CO2.

By 2011 emissions reached

282 GT CO2

Hence for the next 40 years the carbon that can be emitted "safely" is

565 GT CO2

If the global community adapts the lower temperature limit of 1,5 ° C, as many already demand the "allowed" carbon budget will be further educed.

The known proven fossil fuel reserves, public and private, amount to

2.795 GT CO2

Therefore we can only use "safely"

20% of all reserves (565/2.795)

The rest must STAY IN THE GROUND!

Carbon Tracker Initiative

Financial specialists making carbon investment risk real today in the capital market.

THE ENERGY TRANSITION

Reasons for bringing about an energy transition

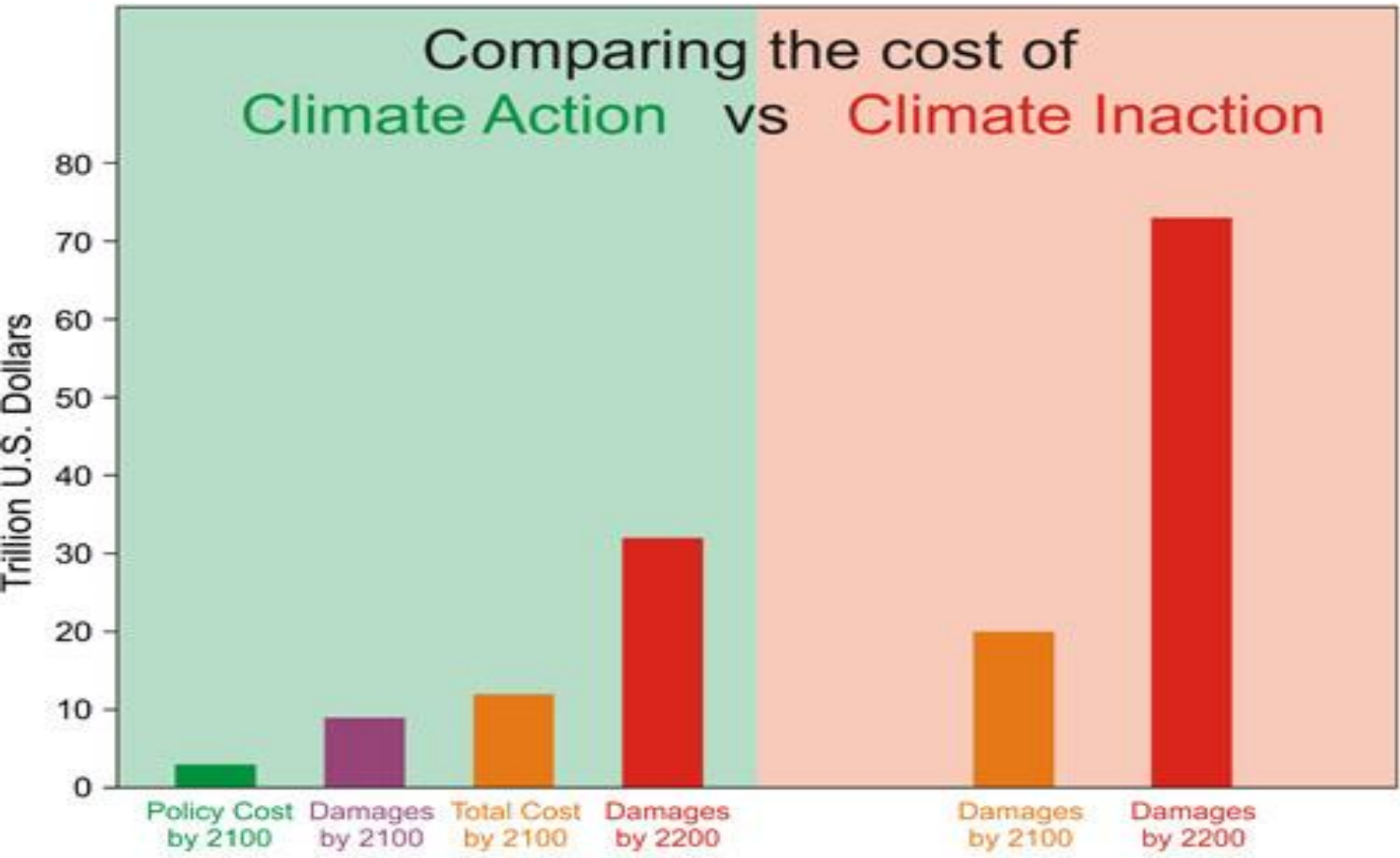
(i.e. replacement of fossil fuels).

- **Exhaustion of fossil fuels,**
- **Environmental pollution and above all**
- **Climate change**

And as a consequence

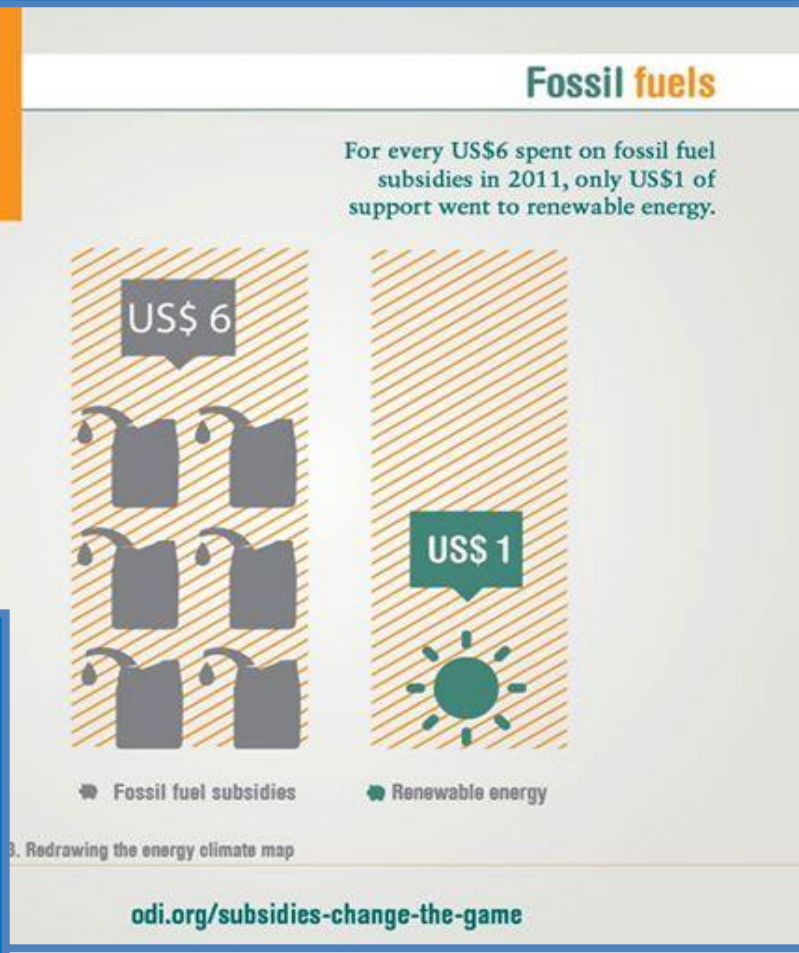
- **Cost of energy**

Climate action is the cheaper choice and the wiser,

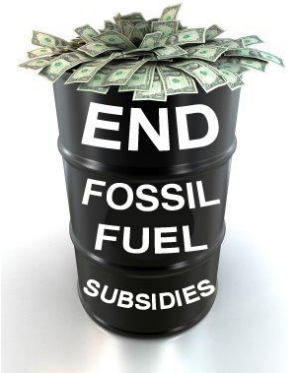


COST ELEMENT (1) - Fossil fuels - External cost from subsidies.

IMF reveals the huge subsidies directed to Fossil Fuels
2 trillion dollars in 2011!!
2,5% of Global GDP - USA CHINA RUSSIA at the top of the list!



"Subsidies for fossil fuels amount to $1.9 trillion a year, according to the International Monetary Fund; surely this is money that could be used to develop and support growing technologies with massive potential like offshore wind. http://www.ewea.org



Subsides to fossil fuels amount to 110€/ton CO2.
Currently CO2 prices are below 10€/ton CO2.

COST ELEMENT (2) - Fossil fuels - External cost from environmental pollution

THE WALL STREET JOURNAL.

IMF Estimates Trillions in Hidden Fossil-Fuel Costs

Use of coal in China and India surpasses savings as governments slash traditional energy subsidies

Fossil fuel use has catastrophic environmental consequences along the whole chain of utilization, namely drilling/mining, transport, storage, burning. The environmental cost is enormous.

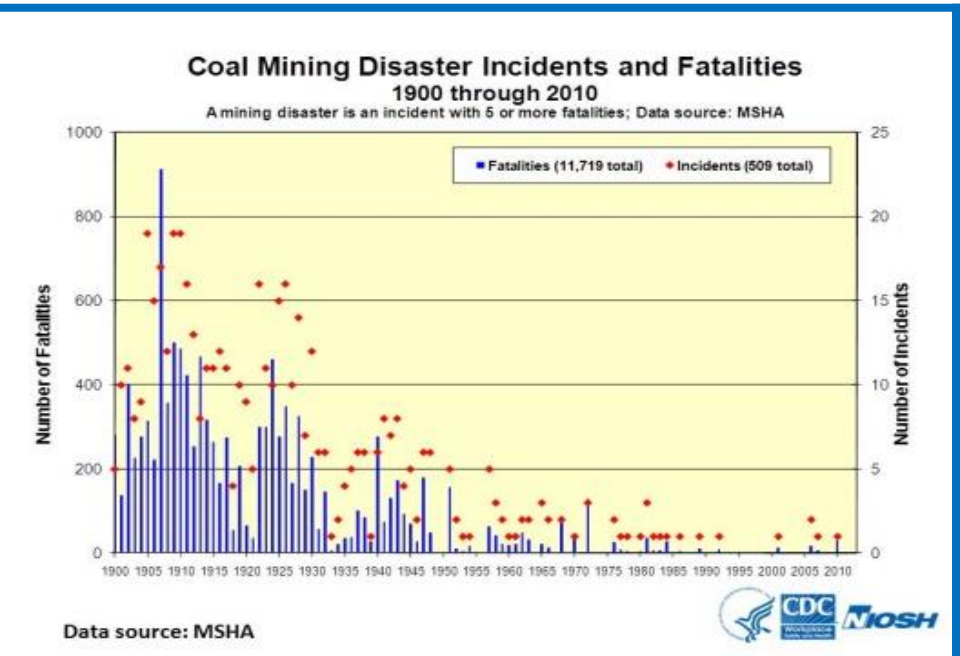
It is estimated that in the USA alone, environmental pollution costs between 14-35 dollar cents per KWh.
This corresponds to 886 billion dollars or 6% of its GDP.

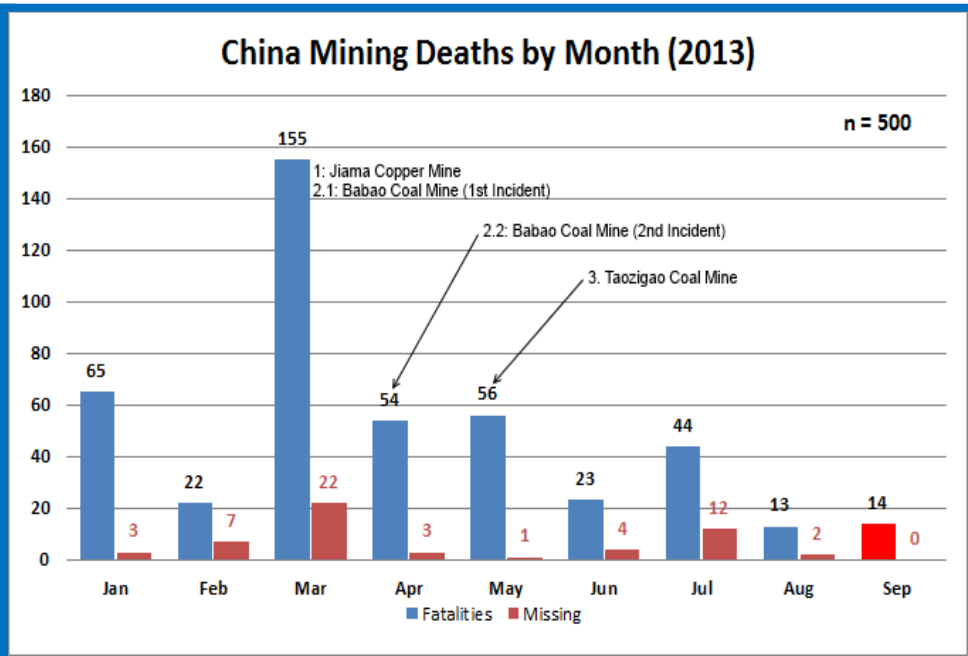
If this figure is extrapolated on a global level, the total cost will be a staggering figure of trillions.

COST ELEMENT (3) - Fossil fuels - External cost from public health damage

The cost to public health and the deaths associated with the use of fossil fuels is enormous….. but it is not taken into account .

- **In 279 major energy accidents from 1907 to 2007, 182.000 people were killed and the property damage is estimated to 41 billion dollars**
- **According to World Health Organisation (WHO) atmospheric pollution associated with fossil fuel use is responsible for the death of 3 million people annually.**
- **Direct damage to health from fossil fuel use is estimated for the USA at 850 billion dollars for 2009 alone. Globally it runs in trillions.**





Fossil fuels - External cost from climate changes

The cost from climate catastrophes is rising ….
….but still ignored:

The destruction to peoples and property from climate change phenomena, recorded by the United Nations for the period 2007-2012 is estimated at **2,5 trillion dollars,** with increasing tendencies, of course.

Presently the climate cost is estimated at **1,6% of global GDP** and expected to rise to **3,2% by 2030**.

Paris December 2015

The greatest global mobilization ever led 196 countries to agree on the new climate deal, a historic agreement.

Renewable Energy Sources and Energy Efficiency unlock the solution to the climate crisis.

The world recognizing that the reform of the global energy system is the back bone of climate action, joined forces in the Paris Climate Summit COP21.

The energy sector responsible for 2/3 of carbon emissions must be in the heart of the effort to keep the rise in the average global temperature below 2o Celsius.

The energy reform

- ✓Meets the climate crisis,
- ✓Increase energy access,
- ✓And achieves global sustainability targets

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

THE ENERGY TRANSITION

THE ENERGY TRANSITION

Transition to 100% RES! Is it feasible?

SCIENTIFIC AMERICAN.

SUSTAINABILITY

139 Countries Could Get All of their Power from Renewable Sources

Energy from wind, water and sun would eliminate nuclear and fossil fuels

By Mark Fischetti on November 19, 2015

Transition to 100% RES! Is it feasible?

100% RENEWABLE ENERGY VISION

Click on a state to launch an interactive experience showcasing the benefits of a transition to 100% clean, renewable energy.

Data from Stanford
http://go100.me/50S

100% USA

Transition to 100% wind, water, and solar (WWS) for all purposes (electricity, transportation, heating/cooling, industry)

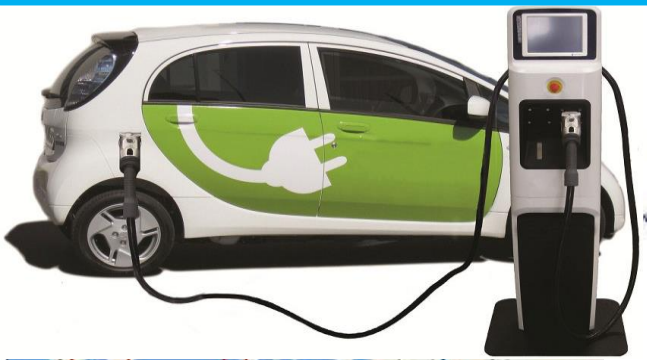
35-Year Jobs Created

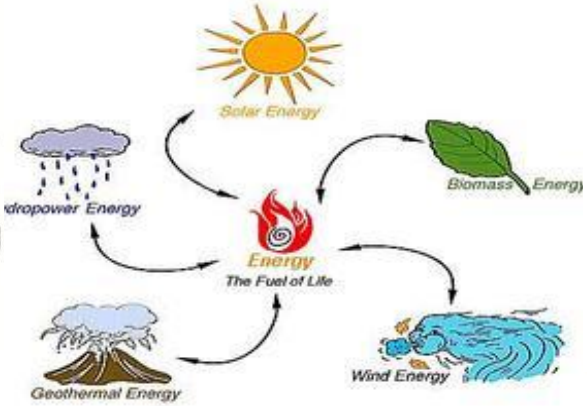
Number of jobs where a person is employed for 35 consecutive years

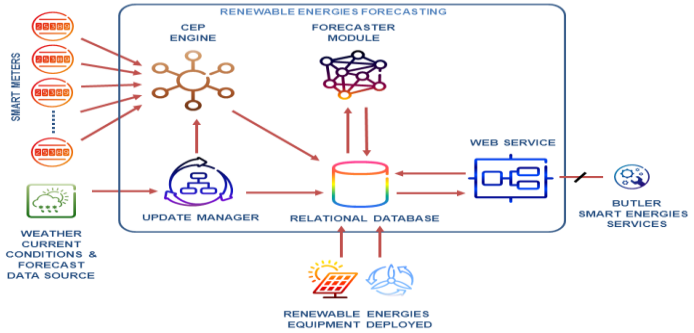
Operation jobs: **1,971,907**

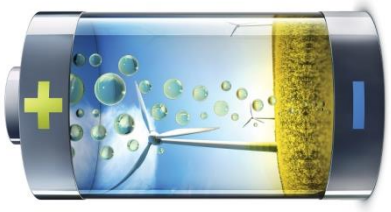
Construction jobs: **3,931,527**

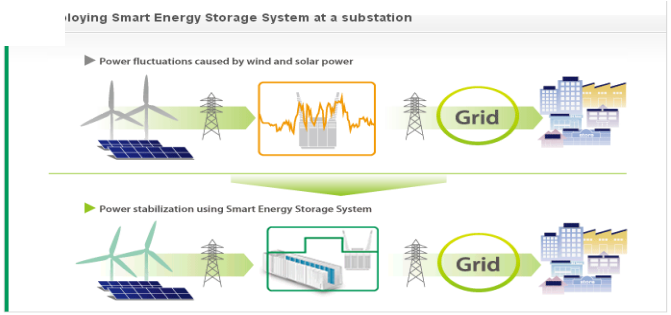
Transition to 100% RES! Is it feasible?











1. All renewables – complimentary benefits
2. Forecasting generation services improving
3. Grid connections – smooth out generation variations
4. Load management – Smart grids
5. Storage – Pump storage/Batteries
6. Electric cars
7. Biofuels

Cost of a 100% RES solution

- **Climate change catastrophes cost is huge (Stern review)**
- **Already RES cost is competitive due to technological improvements and economies of scale**
- **Integrating external cost and eliminating subsidies to fossil fuels will make RES even more competitive.**
- **The state of the climate is so dramatic, that it threatens our life as we know it and therefore a zero carbon economy and 100% RES should be our choice even if RES were more expensive.**

The costs are huge, but the savings are even bigger.
The investment costs for the switch to 100% renewables by 2050 is about US $1 trillion a year. But because renewable energies don't need fuel, the average fuel cost savings are US $1.07 trillion a year. So the investment over the period is met in full by fuel cost savings, with the cross-over happening between 2025 and 2030.

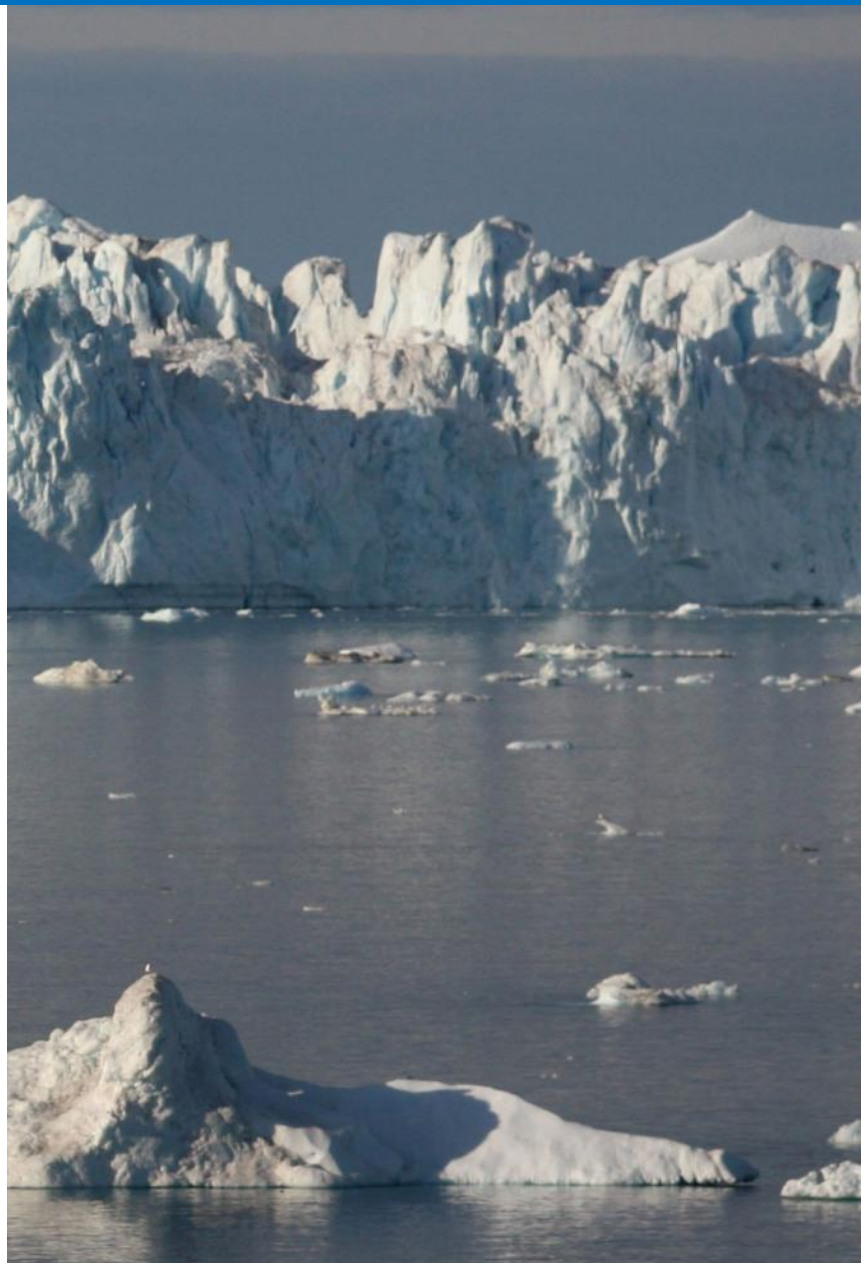
EXXON new about climate change and kept funding climate deniers……

Exxon knew of climate change in 1981, email says – but it funded deniers for 27 more years

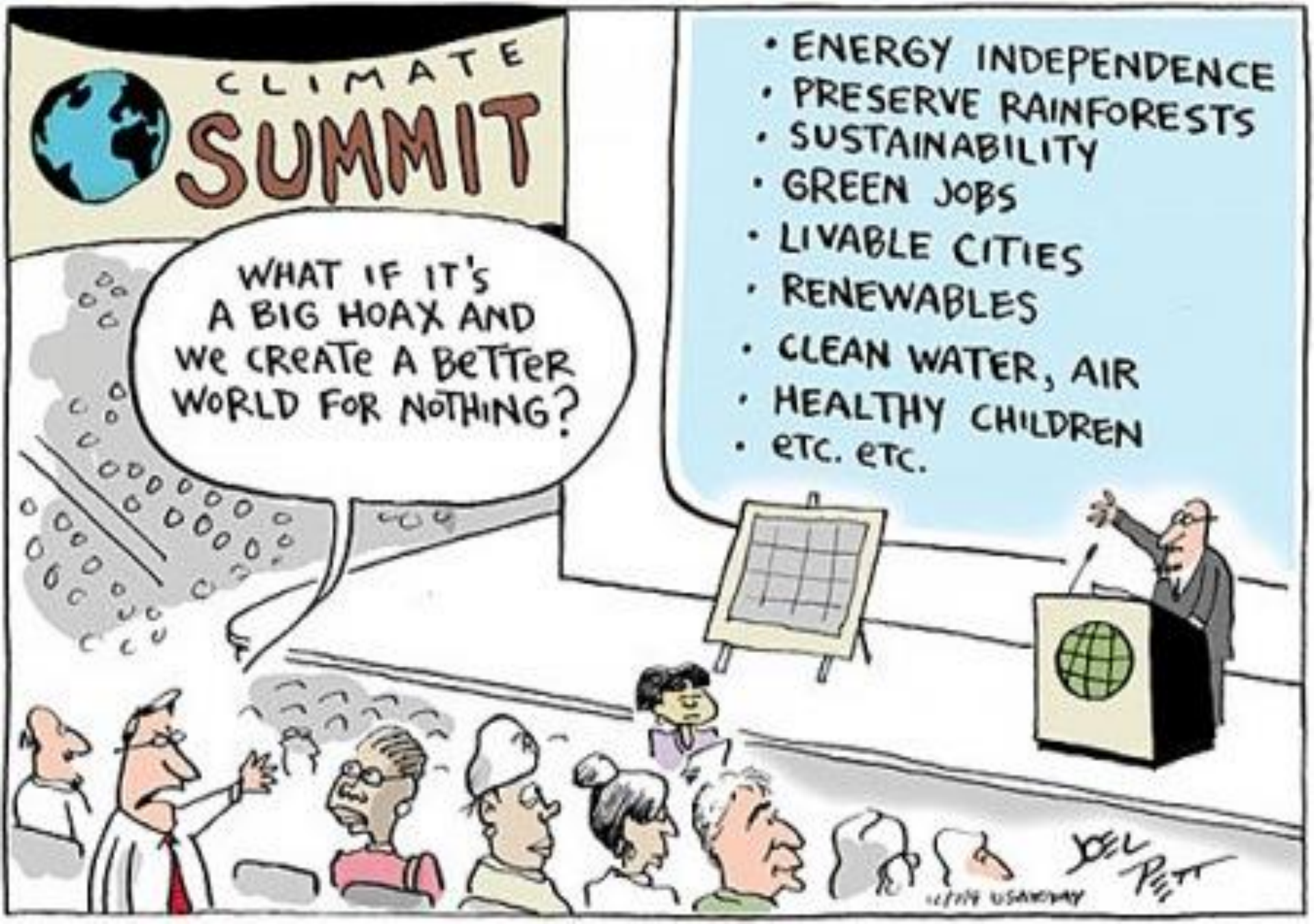
theguardian

A newly unearthed missive from Lenny Bernstein, a climate expert with the oil firm for 30 years, shows concerns over high presence of carbon dioxide in enormous gas field in south-east Asia factored into decision not to tap it

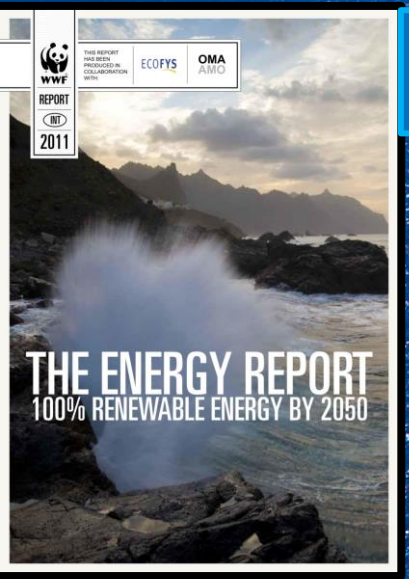
Tugboats tow the oil tanker Exxon Valdez off Bligh Reef in Prince William Sound 5 April 1989. Exxon became aware of climate change as early as 1981, according to a newly discovered email. Photograph: Chris Wilkins/AFP /Getty Images



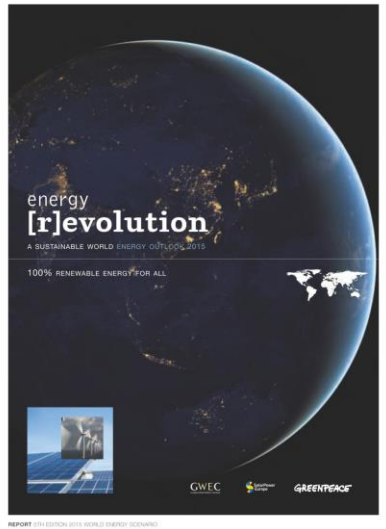
What if….. A win - win scenario



Turning to Renewables it's not the best solution.



It is the ONLY solution!!




100% RENEWABLE

Yes to wind power

Yes to wind power

THANK YOU !