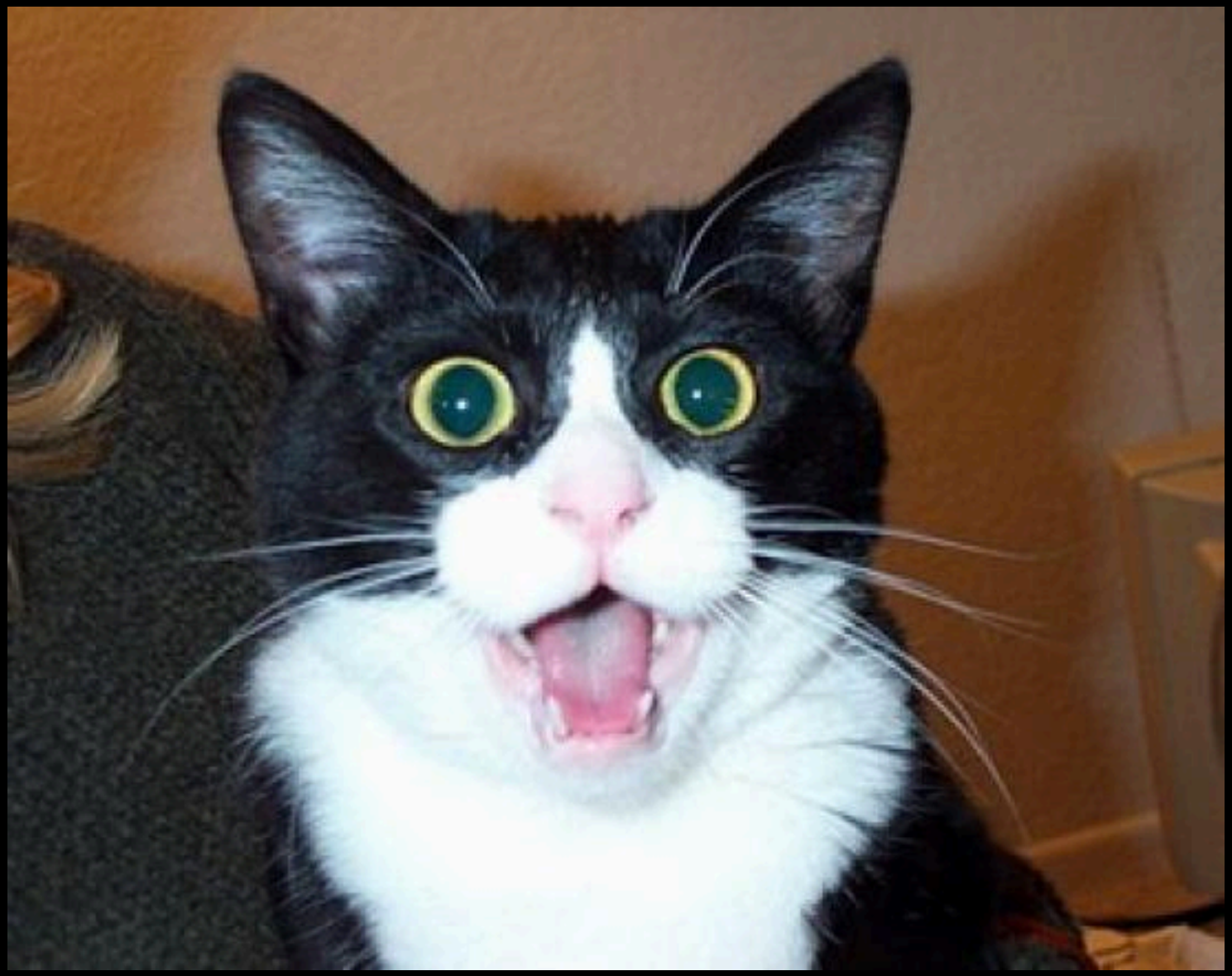
TUTTO QUELLO CHE SAPPIAMO SULL'ENERGIA

È

Gianluca Ruggieri
Università dell'Insubria



SPACE: 1999

PRINCE
1999

È GIUSTO TRIVELLARE PER CERCARE PETROLIO E GAS

CI GUADAGNIAMO

In Italia le Royalties sul petrolio e il gas sono pari al 10%

poi ci sono le tasse
che però non è difficile eludere

Il 10% di quanto estratto viene dato allo stato

LE RISERVE CERTE SONO PARI A 800 MILIONI DI BARILI

FONTE STRATEGIA ENERGETICA NAZIONALE

PER LO STATO COMPLESSIVAMENTE POSSIAMO STIMARE 4,5 MILIARDI DI EURO

75 EURO A TESTA

AI PREZZI CORRENTI (55$ AL BARILE)

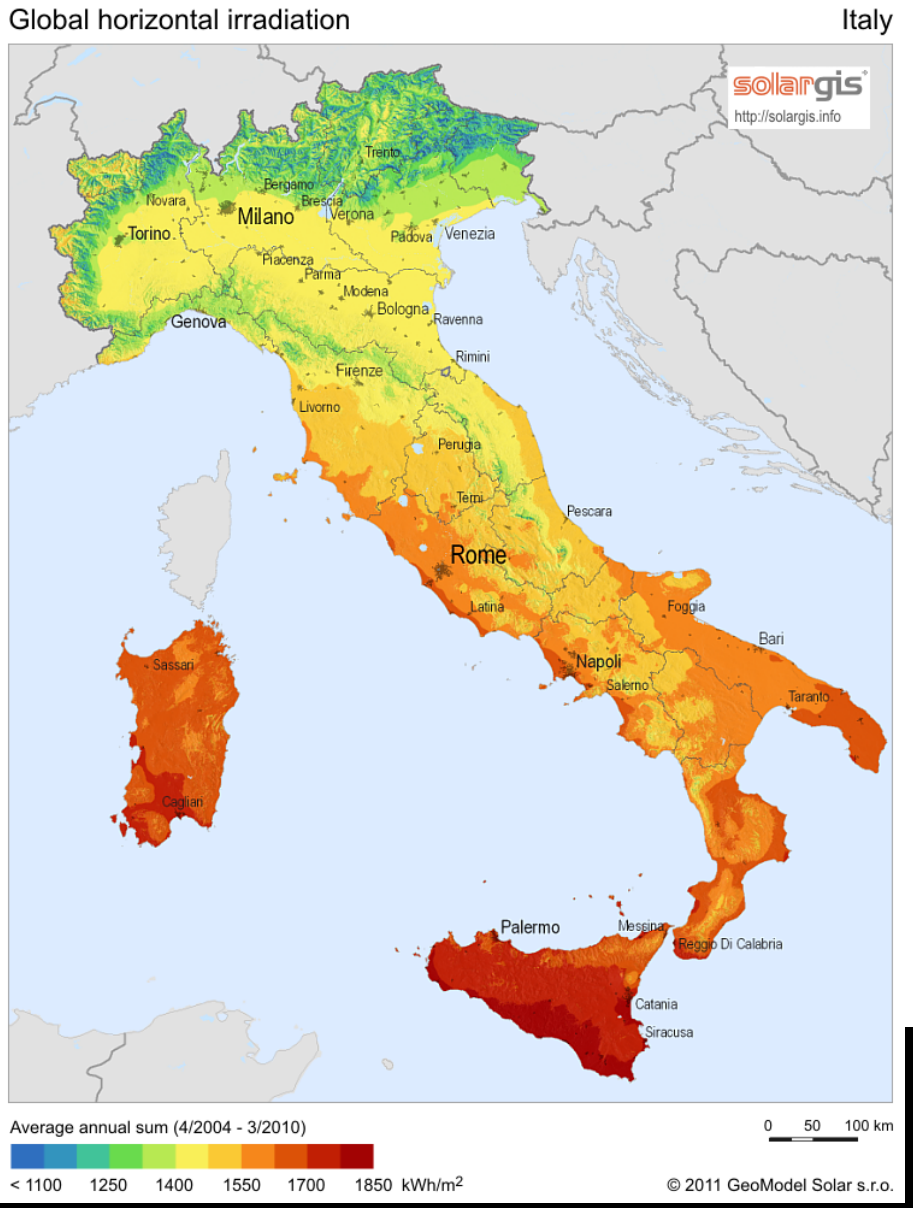
FACT

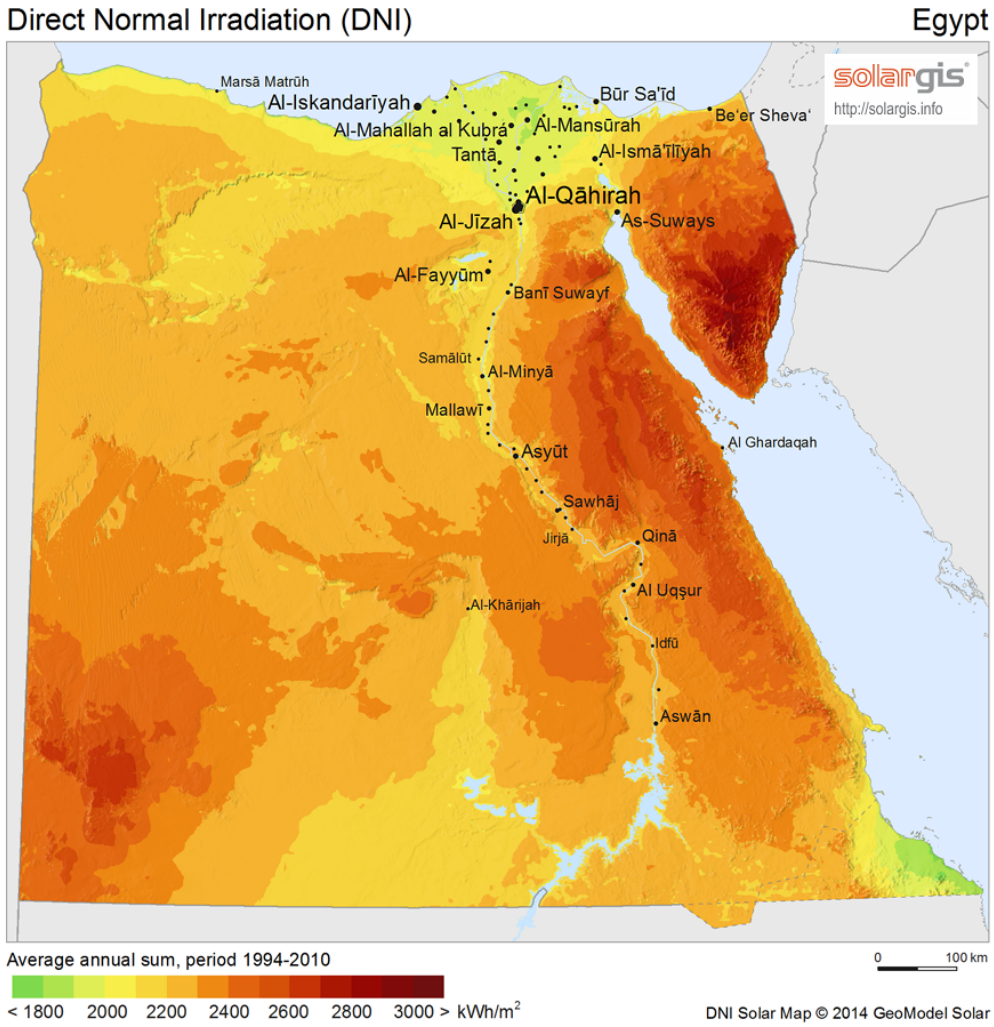
Eni scopre nell'offshore egiziano il più grande giacimento a gas mai rinvenuto nel Mar Mediterraneo

- *La scoperta* supergiant *in seguito al suo pieno sviluppo potrà garantire la soddisfazione della domanda egiziana di gas naturale per decenni*
- *In base ai dati acquisiti in pozzo e alle evidenze geofisiche a disposizione, il giacimento può avere un potenziale fino a 850 miliardi di metri cubi di gas in posto e rappresentare quindi una delle maggiori scoperte di gas a livello mondiale, situata in un permesso detenuto da Eni al 100%*
- *L'Ad di Eni Claudio Descalzi nelle scorse ore si è recato al Cairo per illustrare il nuovo successo esplorativo ai vertici istituzionali del Paese*

MA ENI HA FATTO UNA GRANDE SCOPERTA

SALLOUM
MARSA MATROUH
SIDI ABDEL RAHMAN
EL ALAMEIN
BOROLLOS TOWER
BALTIM RESORT
NEW DAMIETTA
DAMIETTA
PORT SAID
ALEXANDRIA
DESOUK
DAMANHUR
SHOUBRAKHIT
MAHALA
TANTA
EAST GANTARA
ABU KABIR
ISMAILIA
SHEBIN
BANHA
SADAT CITY
TENTH OF RAMADAN CITY
CAIRO
SUEZ
RAS SIDR
FAYOUM
BENI SUEF
ZLANA
ABU ZENIMA
SIWA OASIS
BAHARIYA OASIS
MINYA
RAS GHARIB
TUR
KATRINA CITY
DAHAB
NUWEIBA
TABA
SHARM EL-SHEIKH
HURGHADA
ASSIUT
FARAFRA OASIS
SAFAGA
SOHAG
EGYPT
QENA
SHORT
LUXOR
DAKHLA OASIS
KHARGA OASES
MARSA ALAM
ASWAN
RAS BANAS
SHALATEEN
HALAYIB
GAZA STRIP
RAFAH
AL ARISH
ARISH
WEST BANK
ISRAEL
JORDAN
SAUDI ARABIA
LIBYA
SUDAN
LeadDog Consulting, LLC
http://goleaddog.com
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community





Italia 1500 kWh/m2

Egitto 2500 kWh/m2

Un unico impianto fotovoltaico quadrato da 14 km di lato
Potrebbe produrre tutta l'energia attualmente consumata in Egitto
dati BP 2012

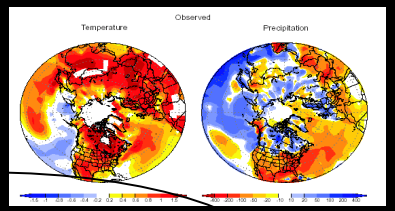
MERCATO SOLARE IN EGITTO
SI STIMA 2-3 GW/ANNO
INVESTIMENTI DA 3 MILIARDI €/ANNO

IL GAS È PULITO

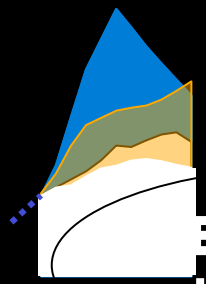
NON C'ENTRA CON IL CAMBIAMENTO CLIMATICO

Viziosi o virtuosi?

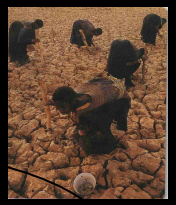
Concentrazioni
di gas serra



Temperatura media
Altri effetti climatici



Emissioni
di gas serra



Impatti
sull'uomo e sugli
ecosistemi

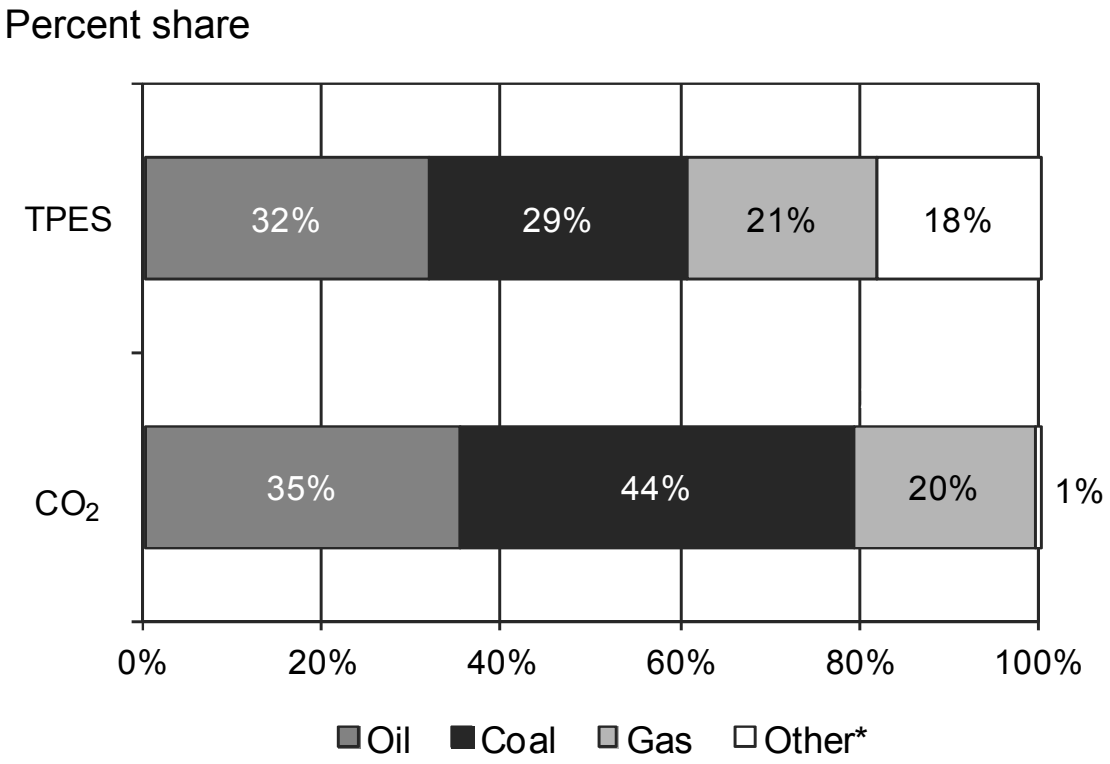
Mitigazione

Adattamento

Attività umane

Produzione e consumo
di energia, uso del
suolo

Figure 5. World primary energy supply and CO_2 emissions: shares by fuel in 2012



* Other includes nuclear, hydro, geothermal, solar, tide, wind, biofuels and waste.

IL CARBONE È PEGGIO DEL GAS MA QUESTO GAS SCOPERTO COSA ANDRÀ A SOSTITUIRE?

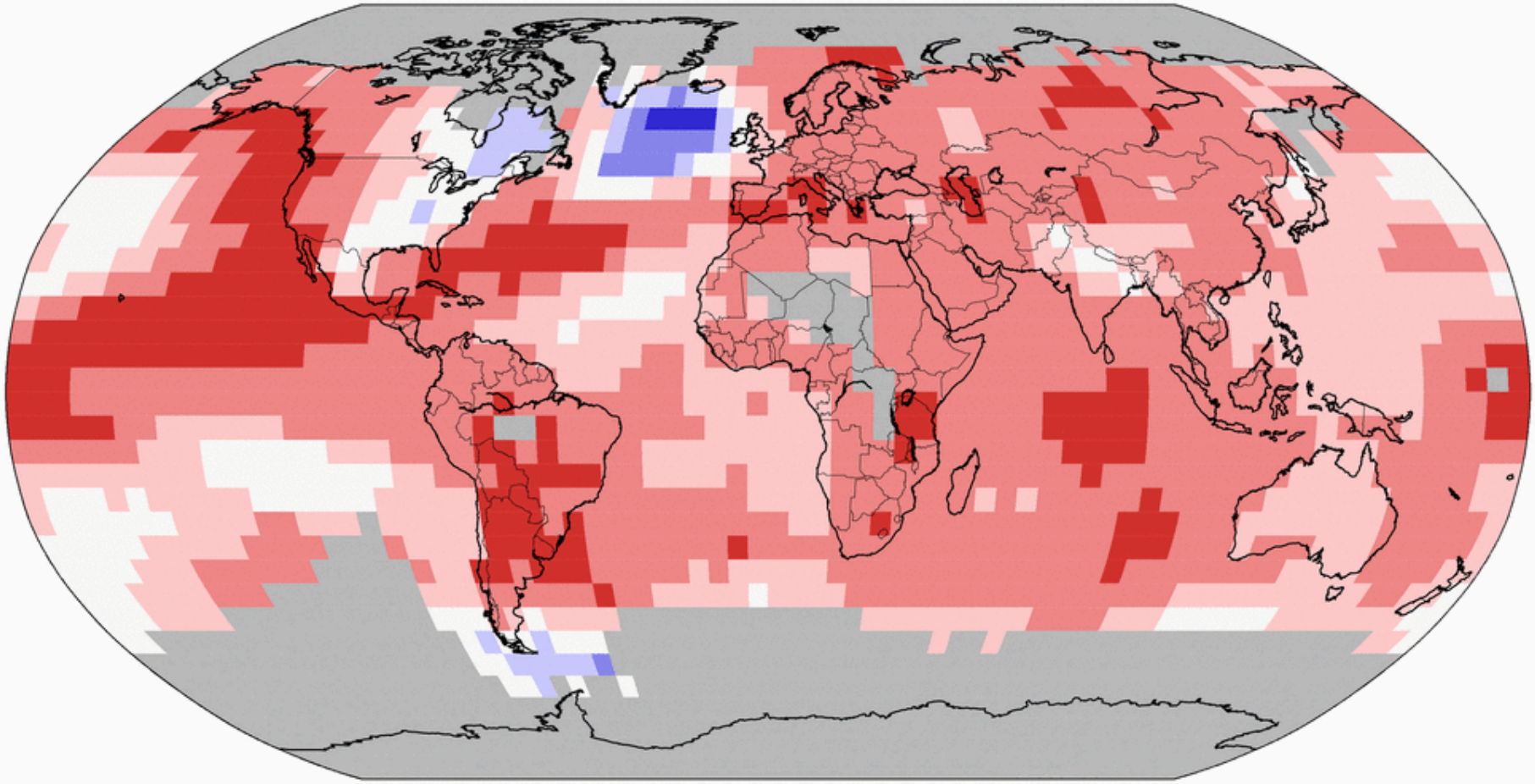
SONO PREOCCUPATO PER IL CAMBIAMENTO CLIMATICO

PER QUELLO CHE LASCERÒ AI MIEI NIPOTI

Land & Ocean Temperature Percentiles Jan–Aug 2015

NOAA's National Centers for Environmental Information

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



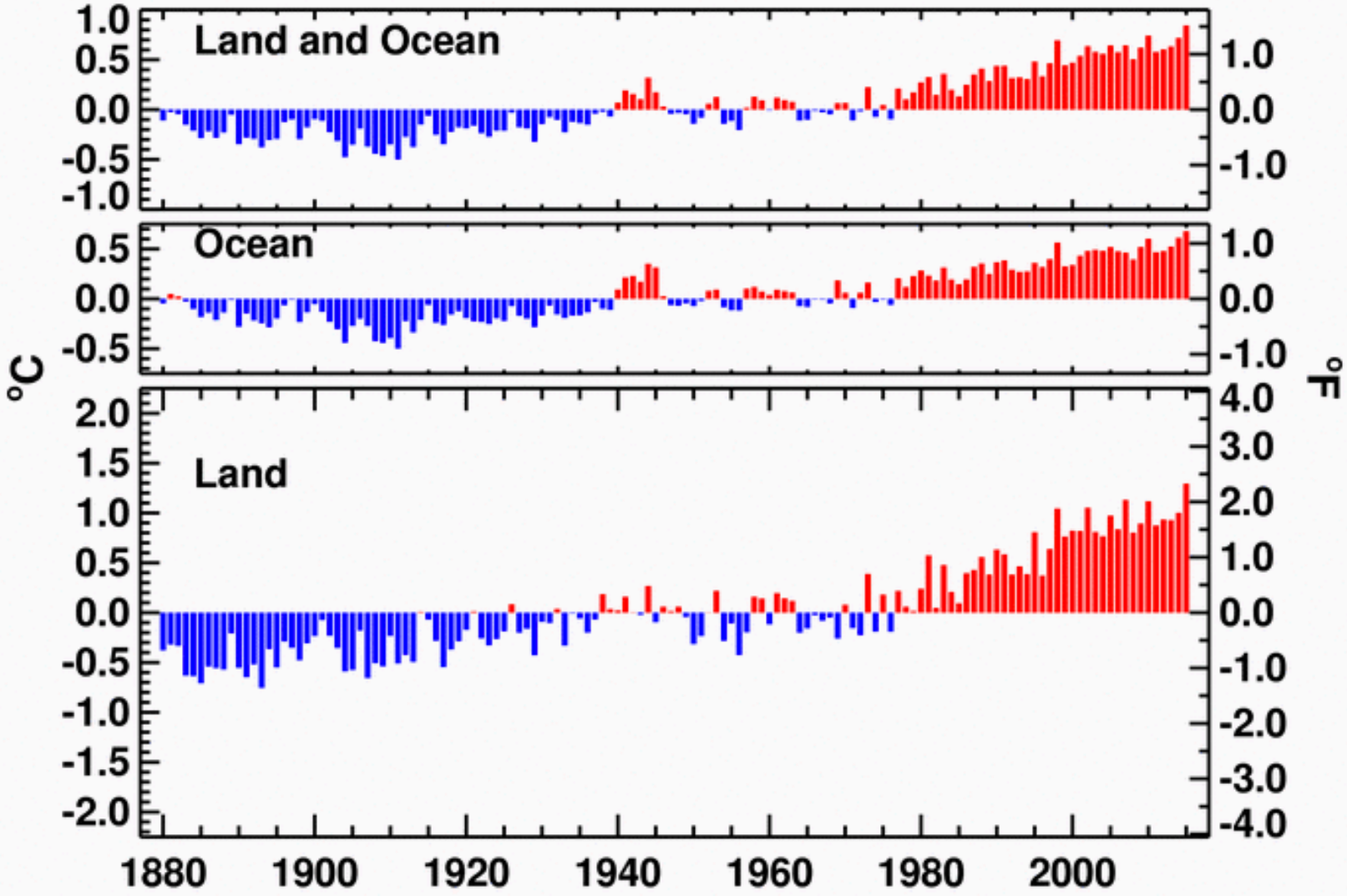
Record Coldest	Much Cooler than Average	Cooler than Average	Near Average	Warmer than Average	Much Warmer than Average	Record Warmest

Mon Sep 14 06:43:31 EDT 2015

Jan-Aug Global Surface Mean Temp Anomalies

NCEI/NESDIS/NOAA

Analysis is based upon Smith et al. (2008) methodology.



SONO PREOCCUPATO PER IL CAMBIAMENTO CLIMATICO

PER IL FUTURO DEL PIANETA

Climate change

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

Craig Bennett

Bennett is CEO of Friends of the Earth

Monday 7 September 2015 10.11 BST

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

The New York Times

U.S.

Pentagon Signals Security Risks of Climate Change

By CORAL DAVENPORT OCT. 13, 2014

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WASHINGTON — The Pentagon on Monday released a report asserting decisively that climate change poses an immediate threat to national security, with increased risks from terrorism, infectious disease, global poverty and food shortages. It also predicted rising demand for military disaster responses as extreme weather creates more global humanitarian crises.

The report lays out a road map to show how the military will adapt to rising sea levels, more violent storms and widespread droughts. The Defense

23 July 2015

NATIONAL SECURITY IMPLICATIONS OF CLIMATE-RELATED RISKS AND A CHANGING CLIMATE

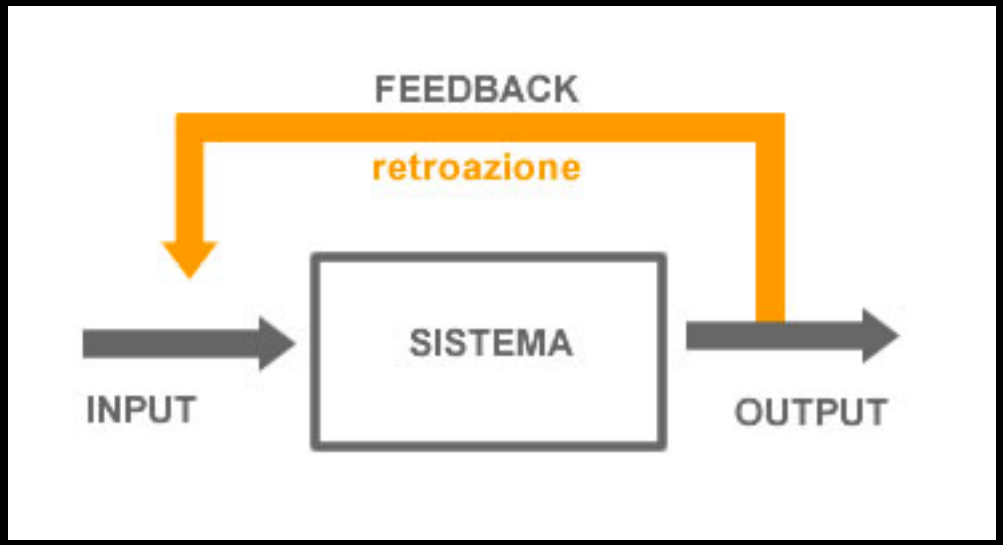
- **Persistently recurring conditions such as flooding, drought, and higher temperatures** increase the strain on fragile states and vulnerable populations by dampening economic activity and burdening public health through loss of agriculture and electricity production, the change in known infectious disease patterns and the rise of new ones, and increases in respiratory and cardiovascular diseases. This could result in increased intra- and inter-state migration, and generate other negative effects on human security. For example, from 2006-2011, a severe multi-year drought affected Syria[2] and contributed to massive agriculture failures and population displacements. Large movements of rural dwellers to city centers coincided with the presence of large numbers of Iraqi refugees in Syrian cities, effectively overwhelming institutional capacity to respond constructively to the changing service demands. These kinds of impacts in regions around the world could necessitate greater DoD involvement in the provision of humanitarian assistance and other aid.

I CAMBIAMENTI CLIMATICI HANNO CONTRIBUITO A CAUSARE LA GUERRA IN SIRIA (?)

NASA Worldview image, Sept. 7, 2015.

“Si tratta probabilmente di un evento climatico favorito da quanto avvenuto negli ultimi anni in Siria perché la fuga di massa dei contadini dalle aree di combattimento ha spopolato i campi, lasciandoli in uno stato di abbandono e di conseguenza l’assenza di coltivazioni ha fatto mancare un freno naturale alla sabbia sul terreno”

RETROAZIONE POSITIVA



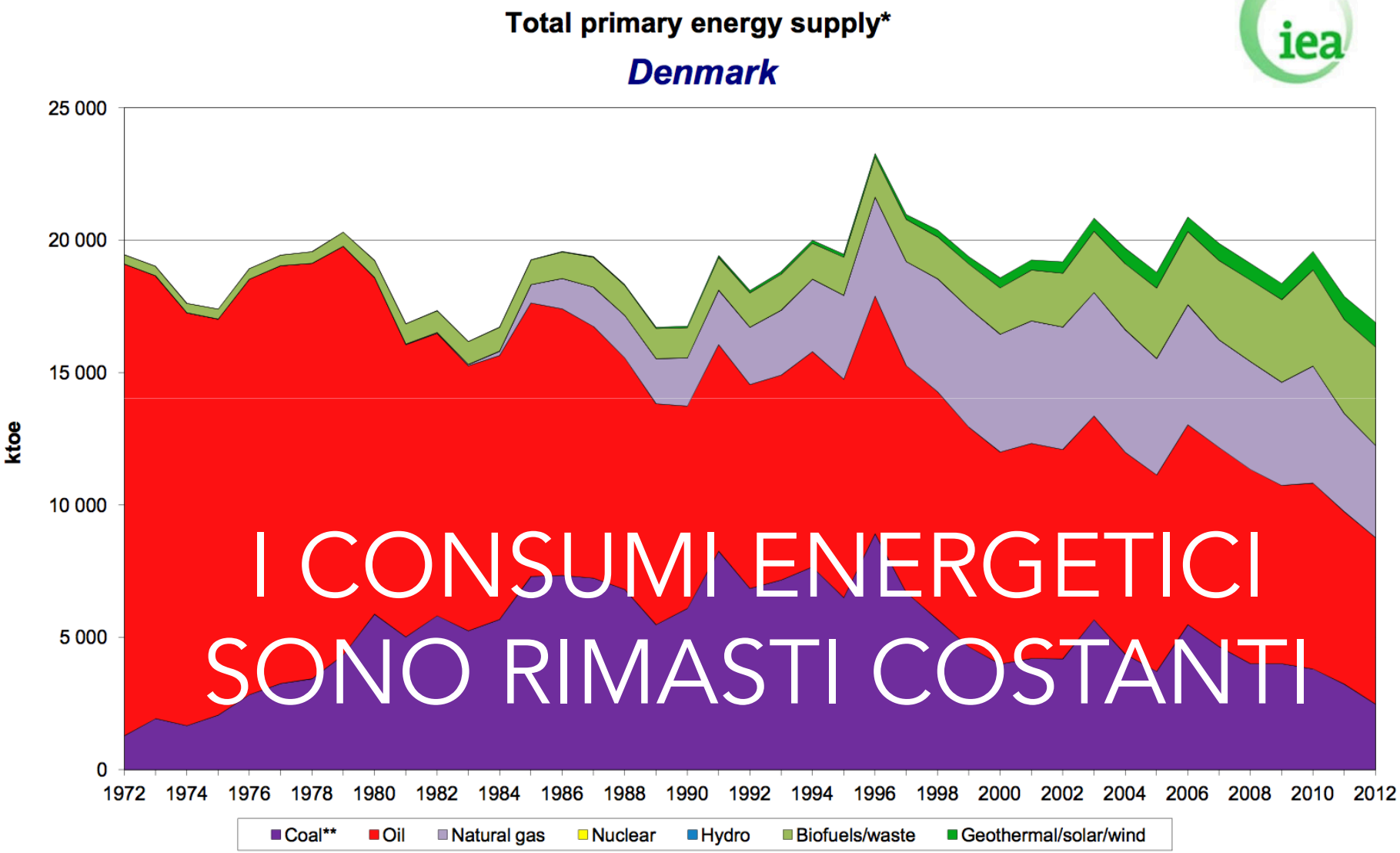
LOOP POSITIVO

I hope that this conference will be a success, it can be a wonderful signal against terror, against war, against the reasons that force people to flee
COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

SÌ È VERO, È UN PECCATO

MA SE VUOI LO SVILUPPO DEVI CONSUMARE ENERGIA

IL PIL DELLA DANIMARCA SI È DECUPLICATO IN QUARANT'ANNI



I CONSUMI ENERGETICI SONO RIMASTI COSTANTI

* Excluding electricity trade.

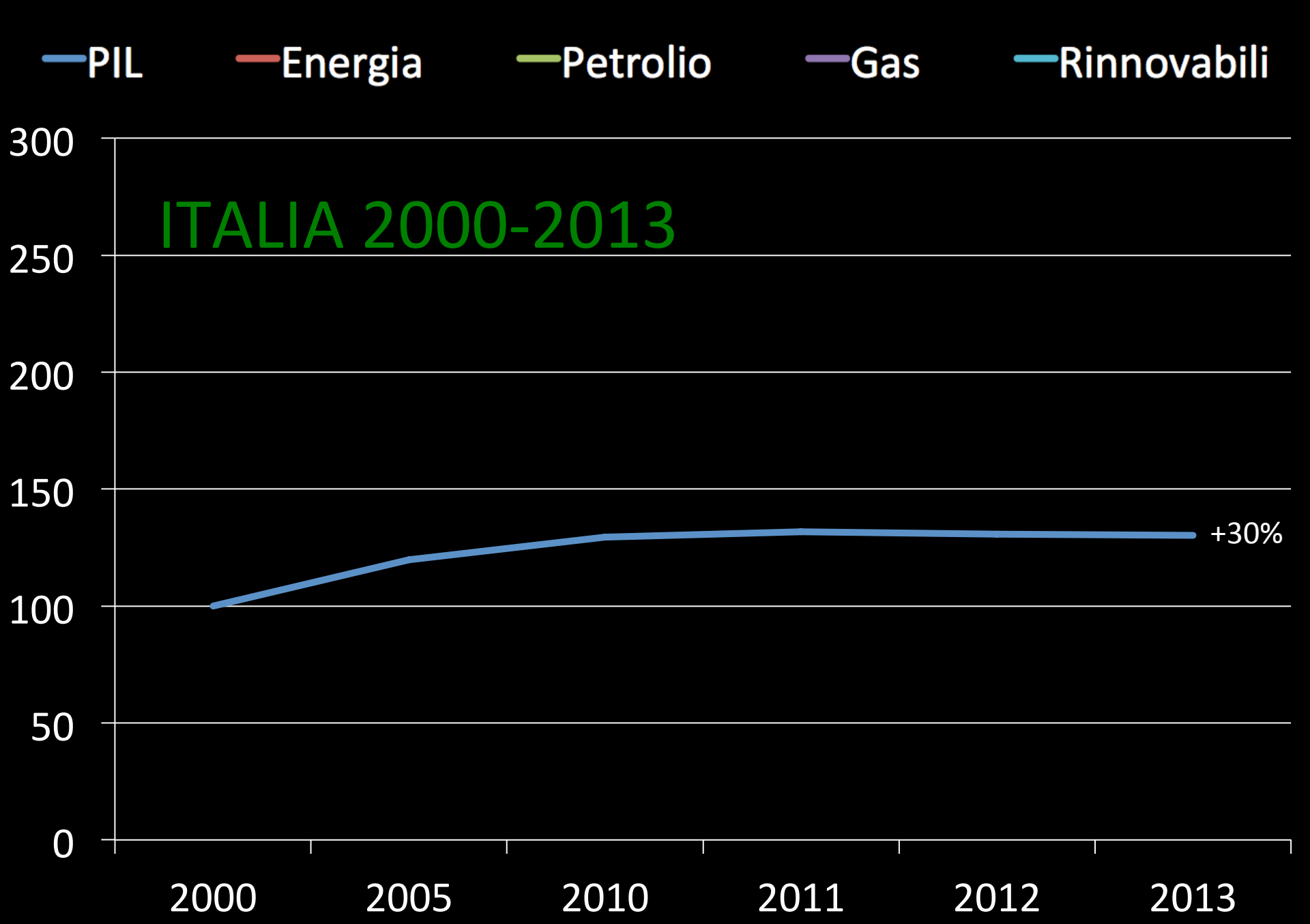
** In this graph, peat and oil shale are aggregated with coal, when relevant.

© OECD/IEA 2014

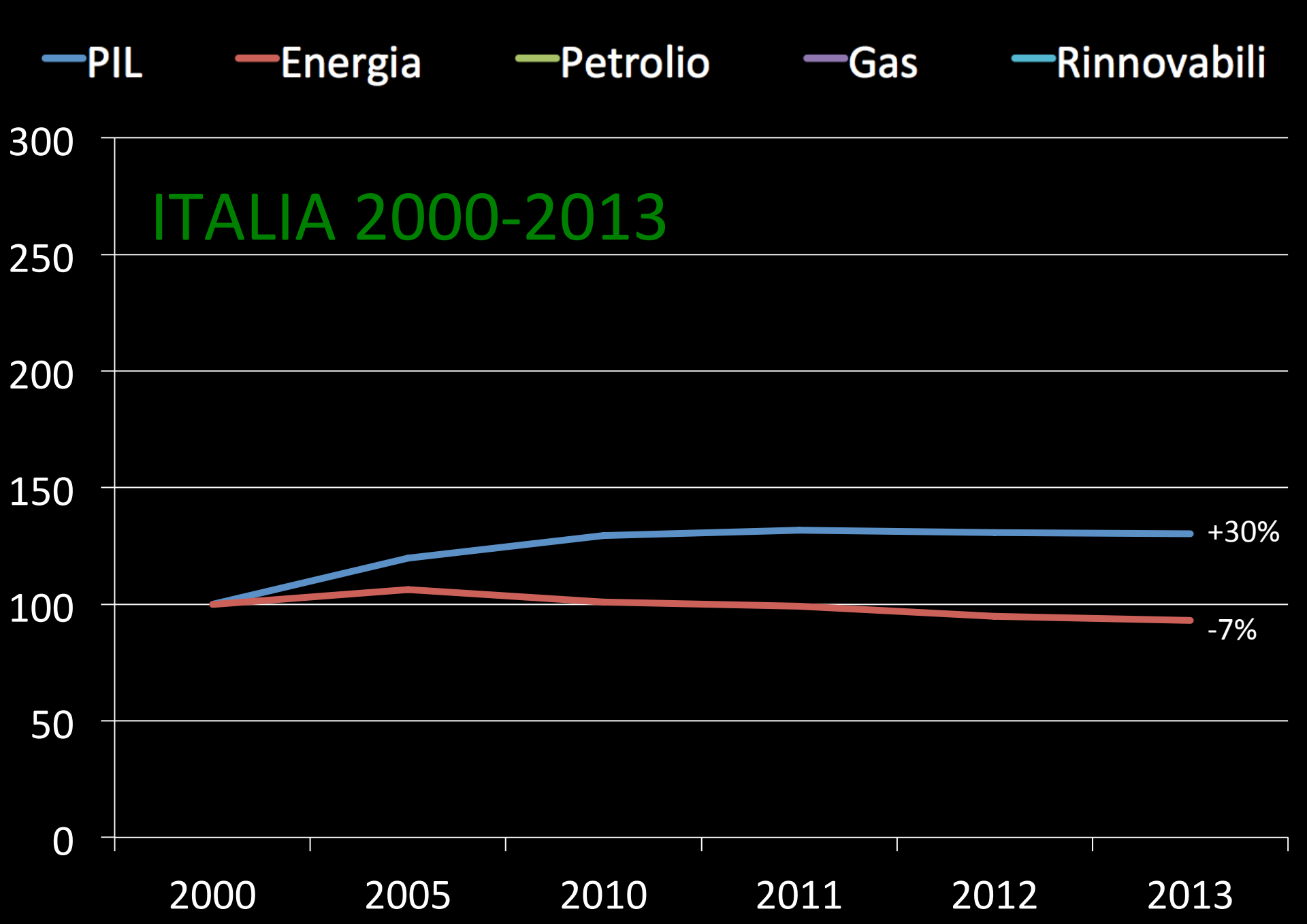
For more detailed data, please consult our on-line data service at http://data.iea.org.

LA DANIMARCA…

MA NOI SIAMO IN ITALIA!!!



DATI: ISTAT e Unione Petrolifera



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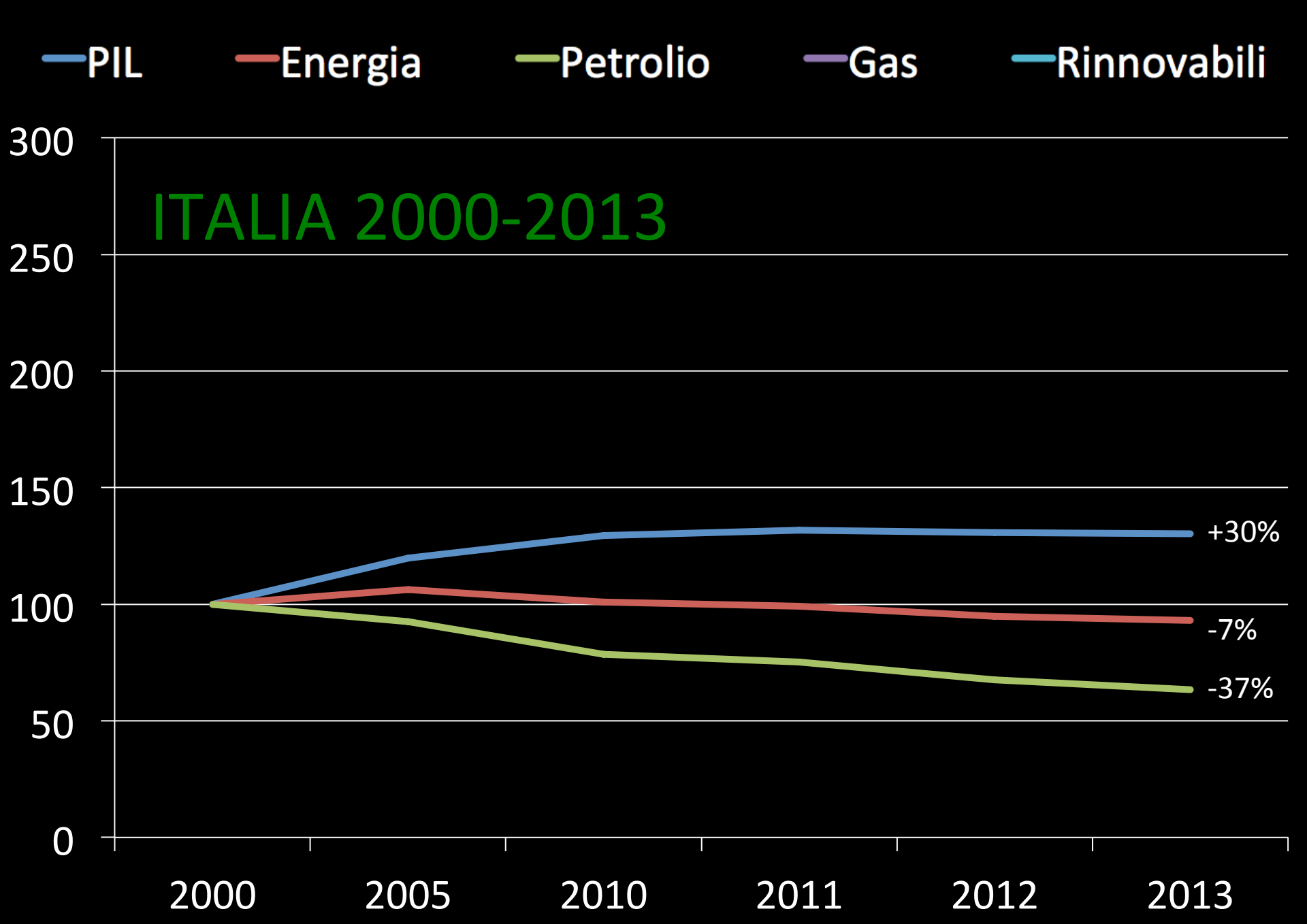

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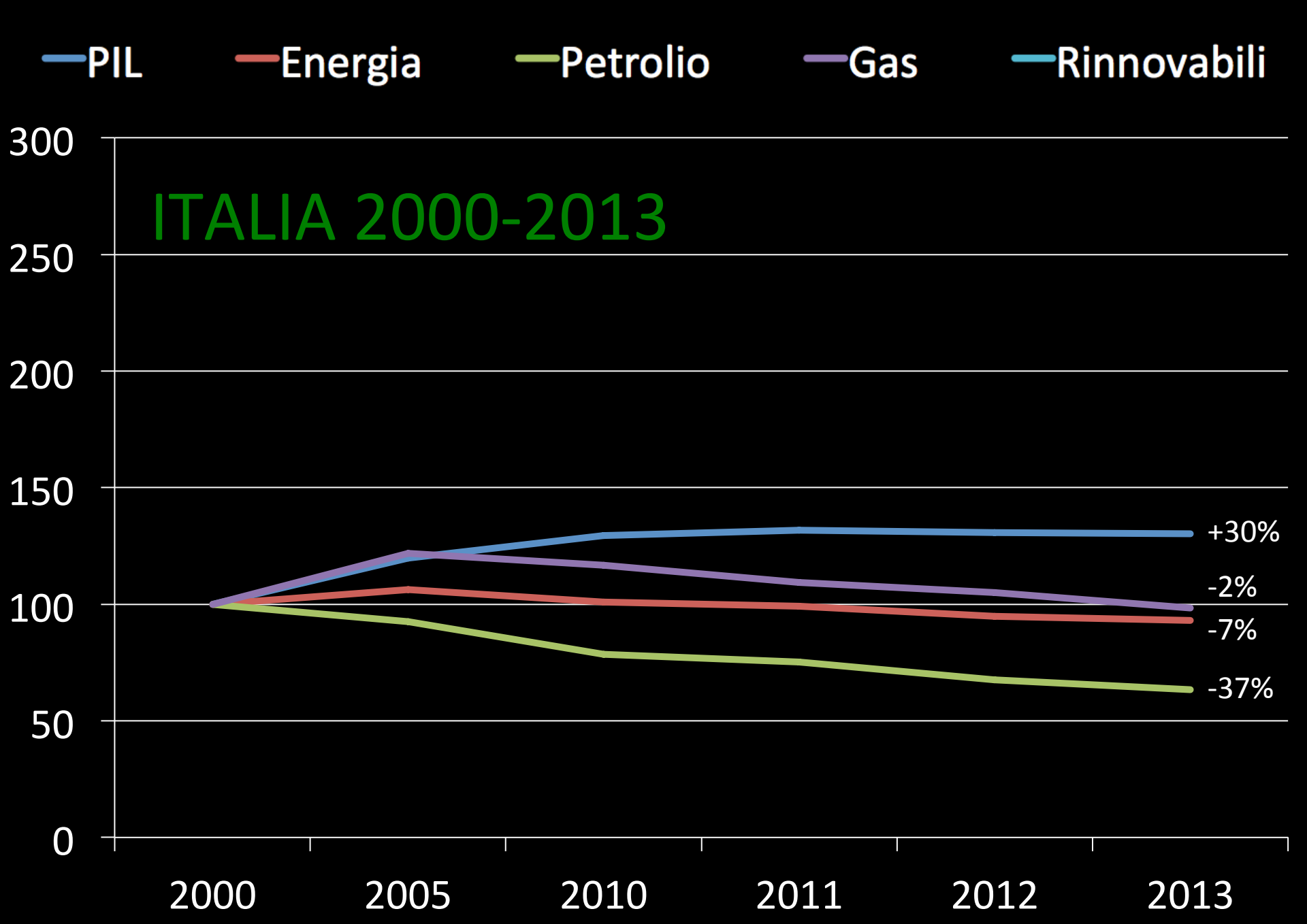

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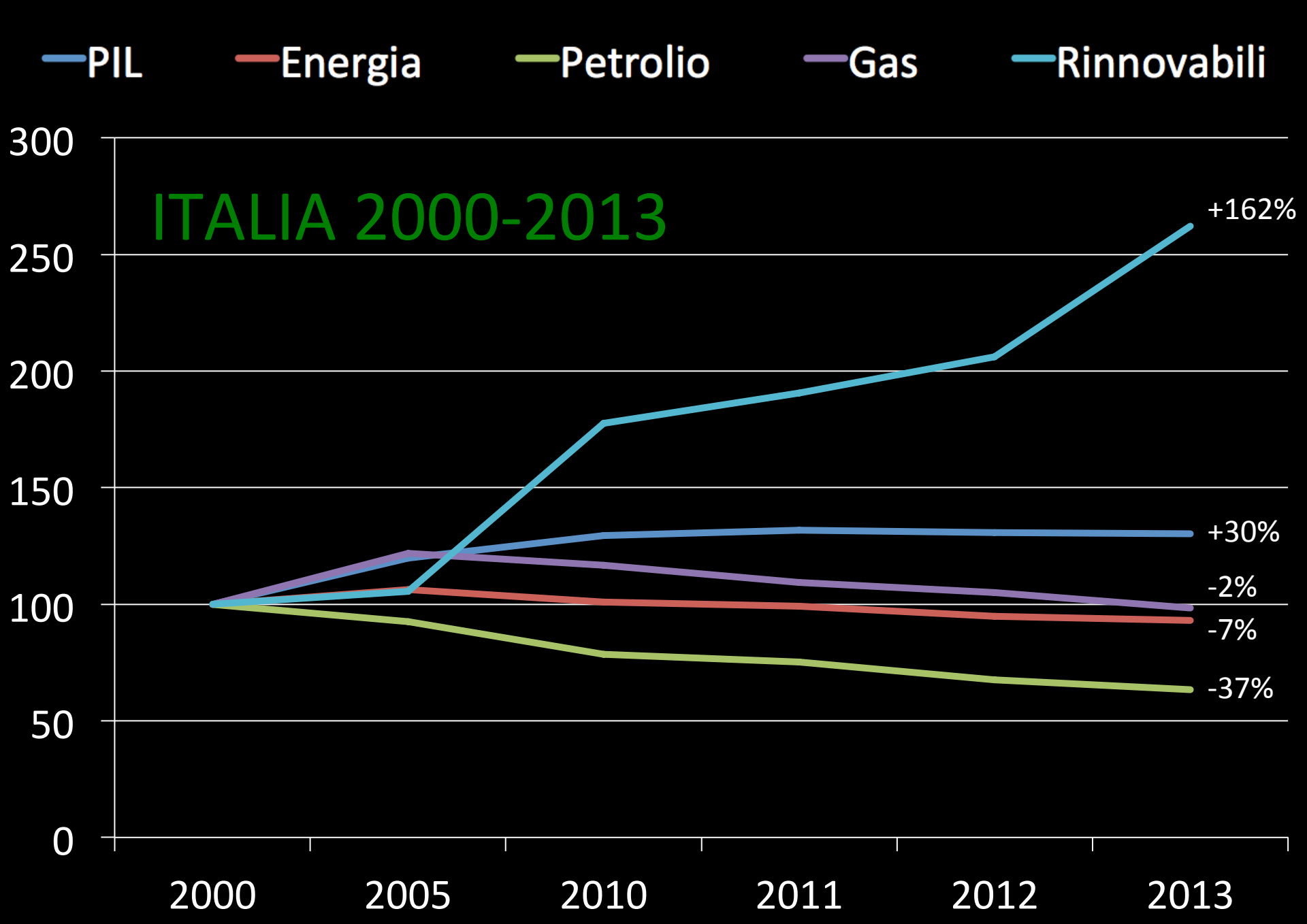

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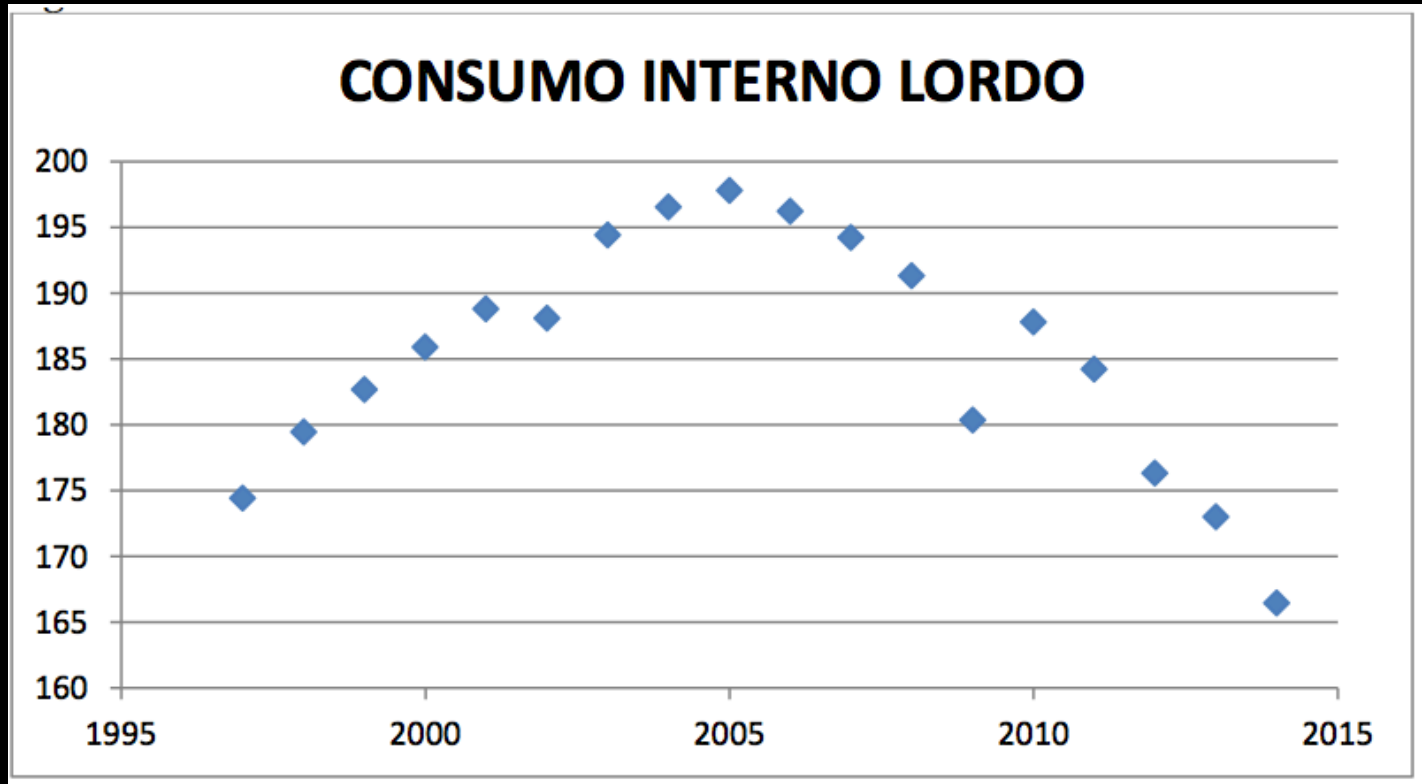
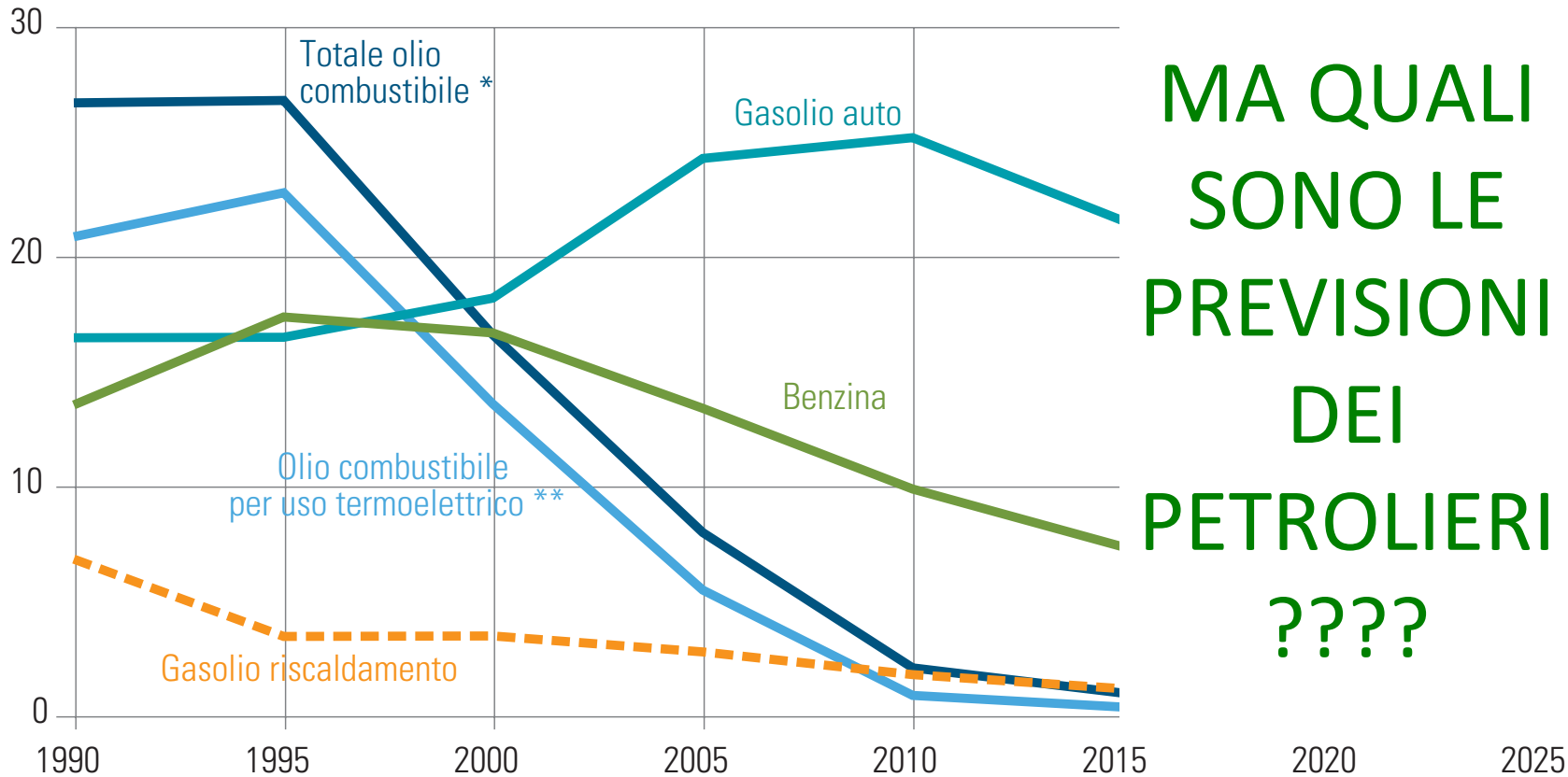


Figura 1 : Fonte: Ministero dello Sviluppo Economico - Il Bilancio Energetico Nazionale- Consumo interno lordo dal 1998 al 2014 - serie storica
(1)Dati provvisori

IN ITALIA I CONSUMI ENERGETICI **CALANO** A PIL COSTANTE
I CONSUMI DI PETROLIO **CALANO** DRASTICAMENTE
LA PRODUZIONE DA RINNOVABILI **CRESCE** VERTIGINOSA

Previsione di domanda interna dei principali prodotti petroliferi *(Milioni di tonnellate)*



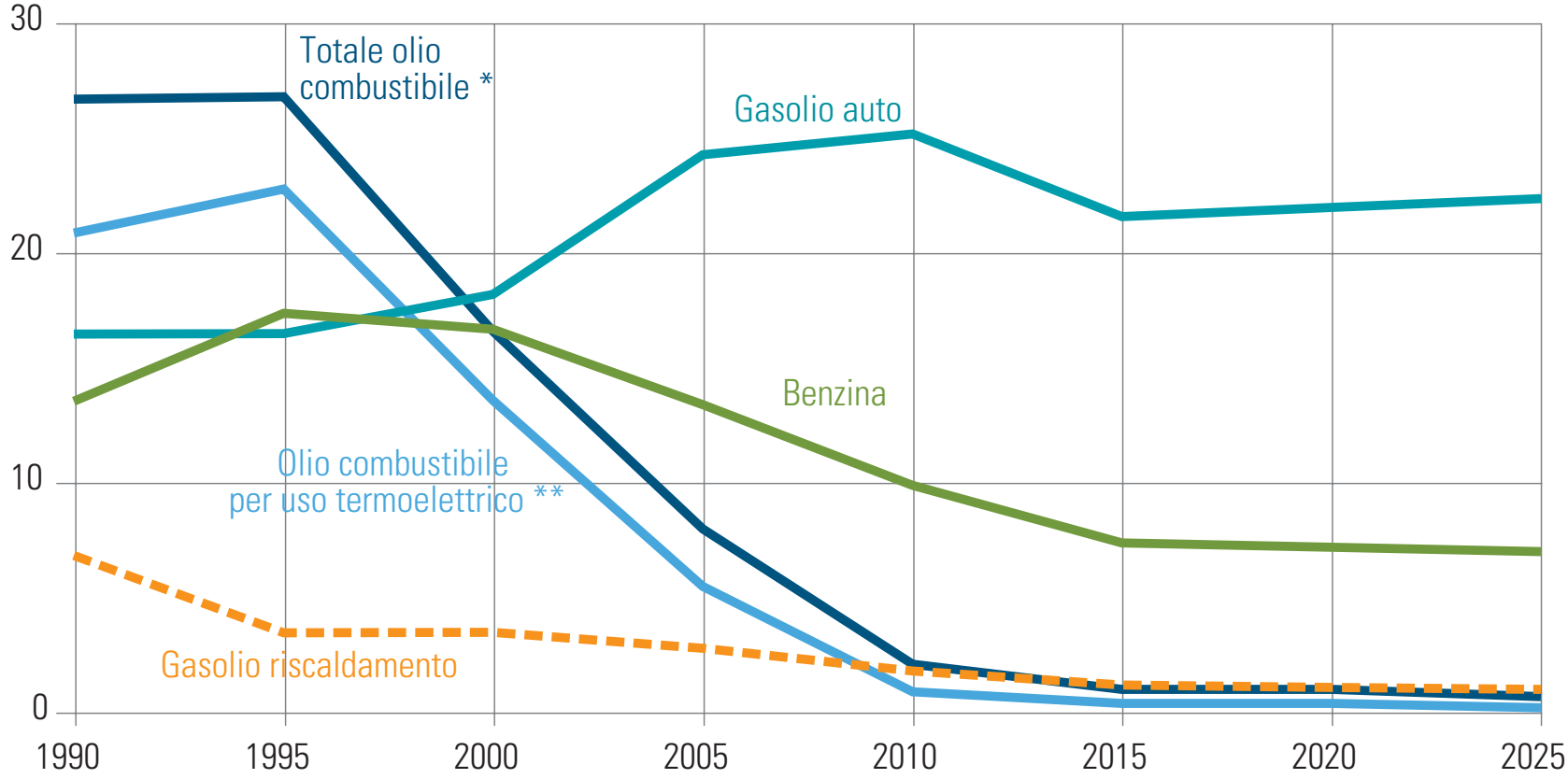
MA QUALI SONO LE PREVISIONI DEI PETROLIERI ????

(*) Esclusi bunkeraggi e fabbisogni petrolchimica.
(**) Esclusa autoproduzione da parte dell'industria.

Fonte: UP

72

Previsione di domanda interna dei principali prodotti petroliferi *(Milioni di tonnellate)*



(*) Esclusi bunkeraggi e fabbisogni petrolchimica.
(**) Esclusa autoproduzione da parte dell'industria.

Fonte: UP

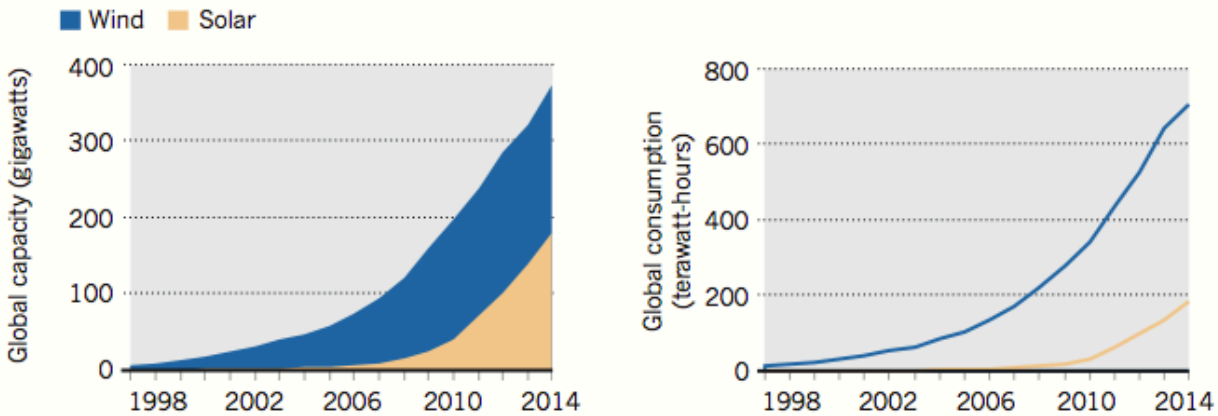
BELLO, BELLO

MA LO SAPPIAMO TUTTI CHE LE RINNOVABILI NON CONVENGONO

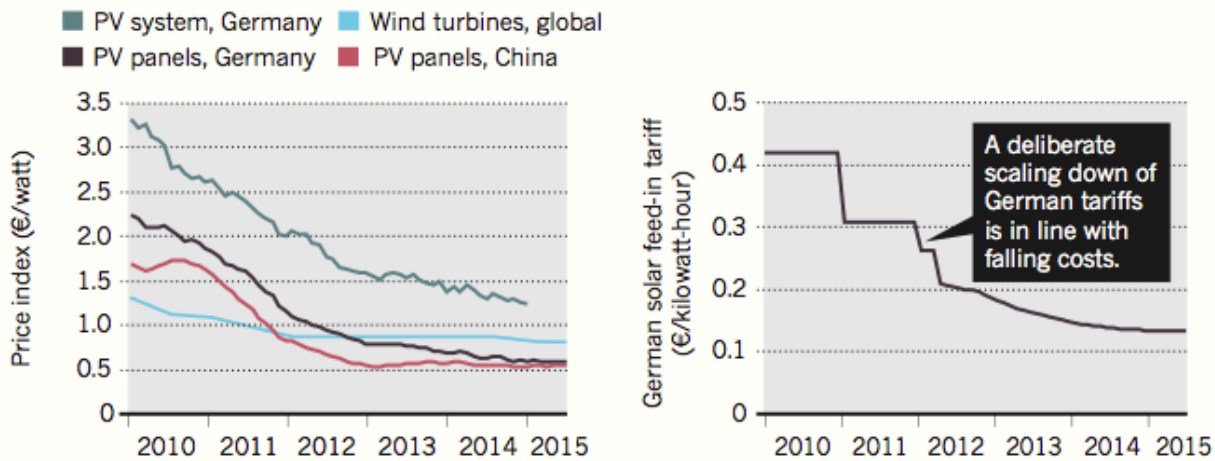
THE RISE OF RENEWABLES

Global wind- and solar-power capacities have grown by 40–50 gigwatts each year since 2008, with consumption also rising (**1**). Meanwhile, prices of photovoltaic (PV) panels and solar energy have fallen steeply since 2010 (**2**), in part driven by climate and energy policies and more-efficient manufacturing.

1 *Consumption and capacity increasing*

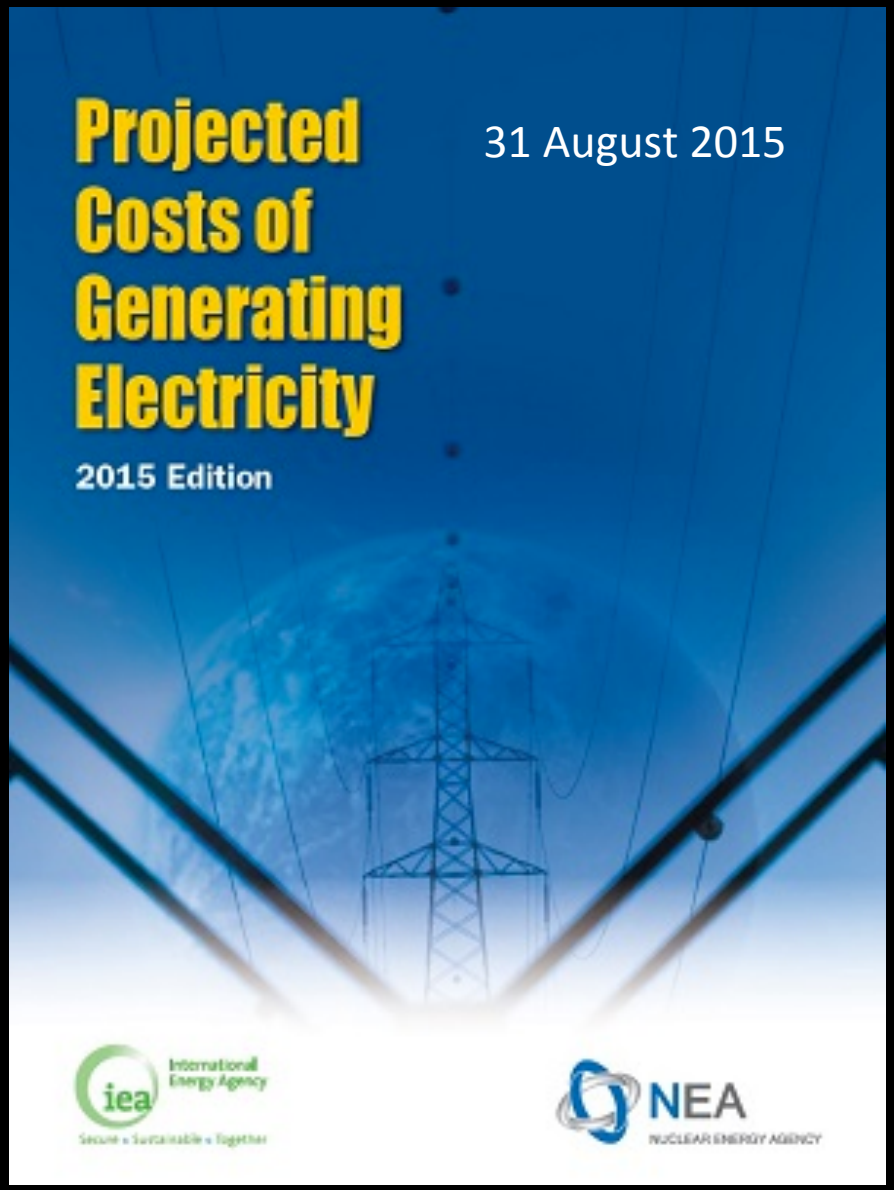


2 *Costs declining rapidly*



SOURCES: **1.** BP STATISTICAL REVIEW OF WORLD ENERGY; **2.** PVXCHANGE (GERMAN, CHINESE PV PANELS); PHOTOVOLTAIK-GUIDE.DE (GERMAN PV SYSTEM); BLOOMBERG NEW ENERGY FINANCE (GLOBAL WIND TURBINE); BUNDESNETZAGENTUR (GERMAN SOLAR FEED-IN TARIFF)

3 September 2015



The cost of producing electricity from renewable sources like wind and solar has been falling for several years.

Now, a new report provides in detail the contrasting costs for different power generation technologies around the world and shows that renewable sources can produce electricity at close to or even below the cost of new fossil fuel-based power stations.

Figure ES.1: LCOE ranges for baseload technologies (at each discount rate)

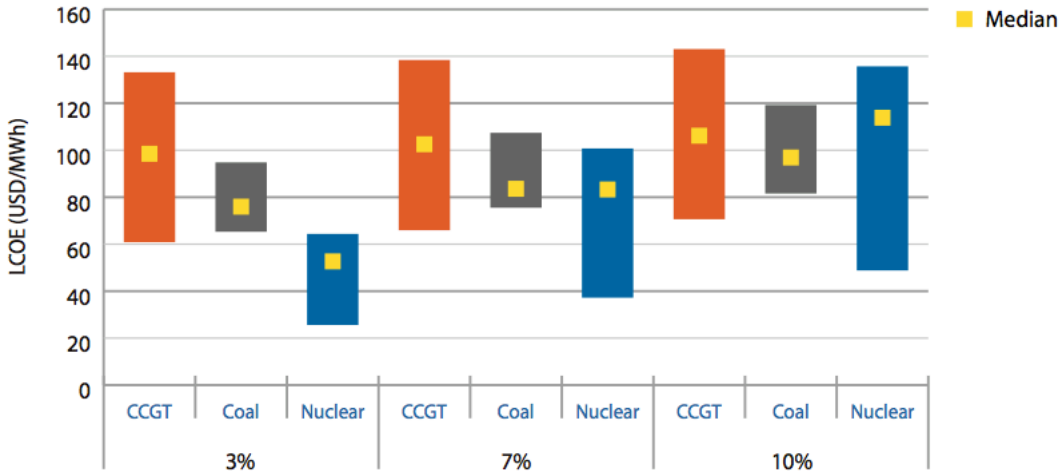
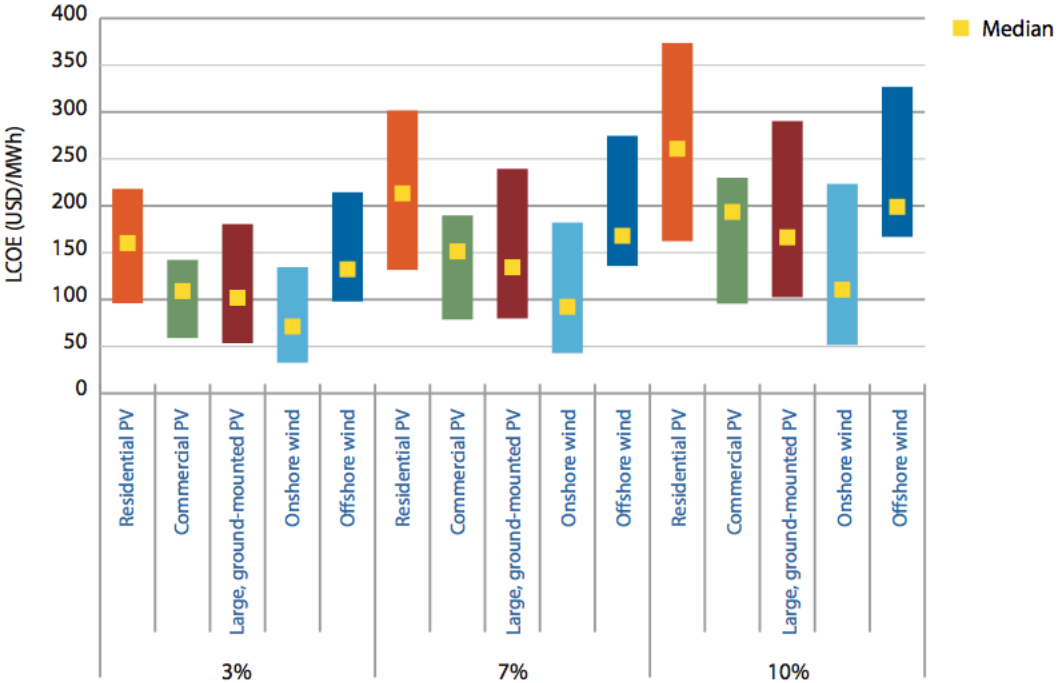


Figure ES.2: LCOE ranges for solar PV and wind technologies (at each discount rate)



SONO QUASI CONVINTO

PERÒ LE RINNOVABILI PESANO SOLO PER LO ZERO VIRGOLA

Nel 2014 in Italia le rinnovabili hanno prodotto

Il 38% dell'elettricità complessivamente prodotta

Il 33% dell'elettricità complessivamente consumata

Il 21% dell'energia complessivamente consumata

(era il 5,2% nel 2005, l'obiettivo è il 17% al 2020)

SCENARI FOTOVOLTAICO MONDIALE AL 2012
SOLAR GENERATION EPIA - GREENPEACE

Nel 2004 la previsione era 5.870 MW

Nel 2006 la previsione era 8.425 MW

Nel 2012 il risultato reale è stato

16.419 MW

in Italia

100.000 MW nel mondo

NOI FACCIAMO SEMPRE LA NOSTRA PARTE

MA SE POI GLI USA NON FANNO NIENTE…

G+1 51

La rivoluzione sotterranea

di Christian Rocca 20 agosto 2012

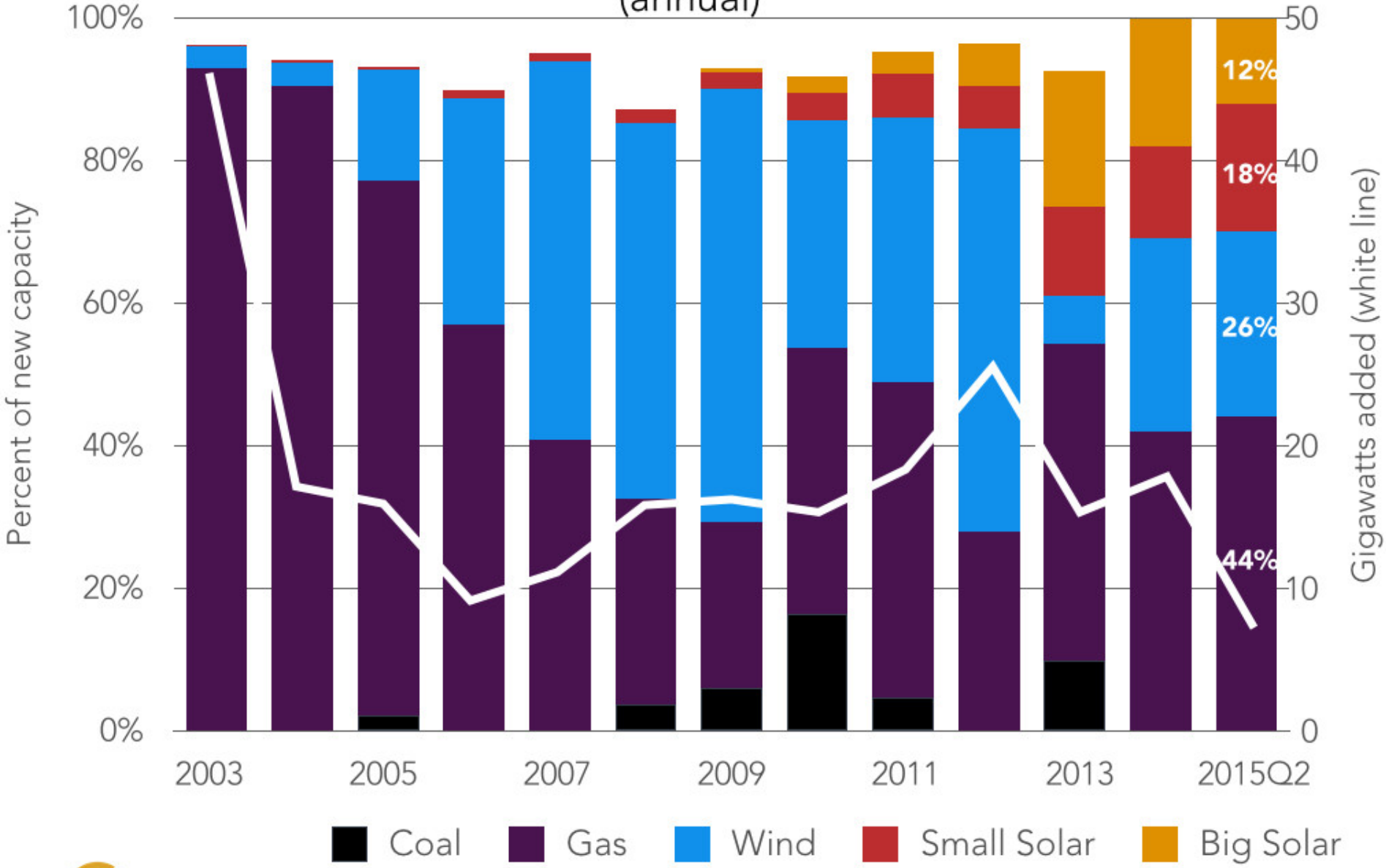
Tweet 6 Consiglia 16 G+1 0 My24

Il petrolio non è finito, e nemmeno il gas. Anzi non ce n'è mai stato così tanto. Le ipotesi apocalittiche sulla fine degli idrocarburi (e quindi della civiltà occidentale) a causa degli eccessi nei consumi, dell'infingardo modello capitalista e dei perfidi cinesi che inspiegabilmente abbandonano la bici per spostarsi in automobile con aria condizionata si è rivelata una bufala. Una delle più grosse.

La notizia, piuttosto, è che abbiamo varcato la frontiera di una nuova era, un'era d'oro, degli idrocarburi. L'America è a un passo dall'indipendenza energetica grazie al gas "unconventional", volgarmente detto "shale", un idrocarburo più costoso da estrarre dalle rocce argillose in cui è trattenuto, ma oggi sufficientemente conveniente da portare in superficie grazie alle nuove tecnologie e al prezzo alto del greggio e del gas tradizionale. La Cina si sta muovendo su questa scia, così come il Canada, il Messico, l'Australia e molti Paesi africani.

U.S. POWER PLANT CAPACITY ADDITIONS

(annual)



DEMOCRATIC ENERGY INITIATIVE

September 11, 2015

Renewable energy The Eco audit

Obama's clean power plan will hit shale gas share of electricity

Karl Mathiesen

Monday 3 August 2015
18.10 BST

The frackers are furious over the incentives given to solar and wind that provide them with a fighting chance to compete as coal is phased out

GLI USA HANNO AVUTO UN VANTAGGIO COMPETITIVO ENORME DALLO SHALE GAS E OIL

MA LO STANNO USANDO PER FAVORIRE LA TRANSIZIONE ALLE RINNOVABILI, NON PER RITARDARLA

NOI FACCIAMO SEMPRE LA NOSTRA PARTE

E LA CINA?!

ANNUAL INVESTMENT / NET CAPACITY ADDITIONS / PRODUCTION IN 2013

	1	2	3	4	5
Investment in renewable power and fuels	**China**	United States	Japan	United Kingdom	Germany
Share of GDP 2012 (USD) invested[1]	**Uruguay**	Mauritius	Costa Rica	South Africa	Nicaragua
Geothermal power capacity	**New Zealand**	Turkey	United States	Kenya	Philippines
Hydropower capacity	**China**	Turkey	Brazil	Vietnam	India
Solar PV capacity	**China**	Japan	United States	Germany	United Kingdom
CSP capacity	**United States**	Spain	United Arab Emirates	India	China
Wind power capacity	**China**	Germany	United Kingdom	India	Canada
Solar water heating capacity[2]	**China**	Turkey	India	Brazil	Germany
Biodiesel production	**United States**	Germany	Brazil	Argentina	France
Fuel ethanol production	**United States**	Brazil	China	Canada	France

REN21 - RENEWABLES 2014 GLOBAL STATUS REPORT

TOTAL CAPACITY OR GENERATION[6] AS OF END-2013

	1	2	3	4	5
POWER					
Renewable power (incl. hydro)	**China**	United States	Brazil	Canada	Germany
Renewable power (not incl. hydro)	**China**	United States	Germany	Spain / Italy	India
Renewable power capacity *per capita* (not incl. hydro)[3]	**Denmark**	Germany	Portugal	Spain / Sweden	Austria
Biopower generation	**United States**	Germany	China	Brazil	India
Geothermal power	**United States**	Philippines	Indonesia	Mexico	Italy
Hydropower[4]	**China**	Brazil	United States	Canada	Russia
Hydropower generation[4]	**China**	Brazil	Canada	United States	Russia
Concentrating solar thermal power (CSP)	**Spain**	United States	United Arab Emirates	India	Algeria
Solar PV	**Germany**	China	Italy	Japan	United States
Solar PV capacity *per capita*	**Germany**	Italy	Belgium	Greece	Czech Republic
Wind power	**China**	United States	Germany	Spain	India
Wind power capacity *per capita*	**Denmark**	Sweden	Spain	Portugal	Ireland
HEAT					
Solar water heating[2]	**China**	United States	Germany	Turkey	Brazil
Solar water heating capacity *per capita*[2]	**Cyprus**	Austria	Israel	Barbados	Greece
Geothermal heat[5]	**China**	Turkey	Iceland	Japan	Italy

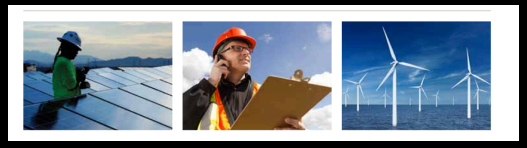
PRIMA IL LAVORO!

SE CHIUDIAMO LE CENTRALI
POI COSA FACCIAMO?

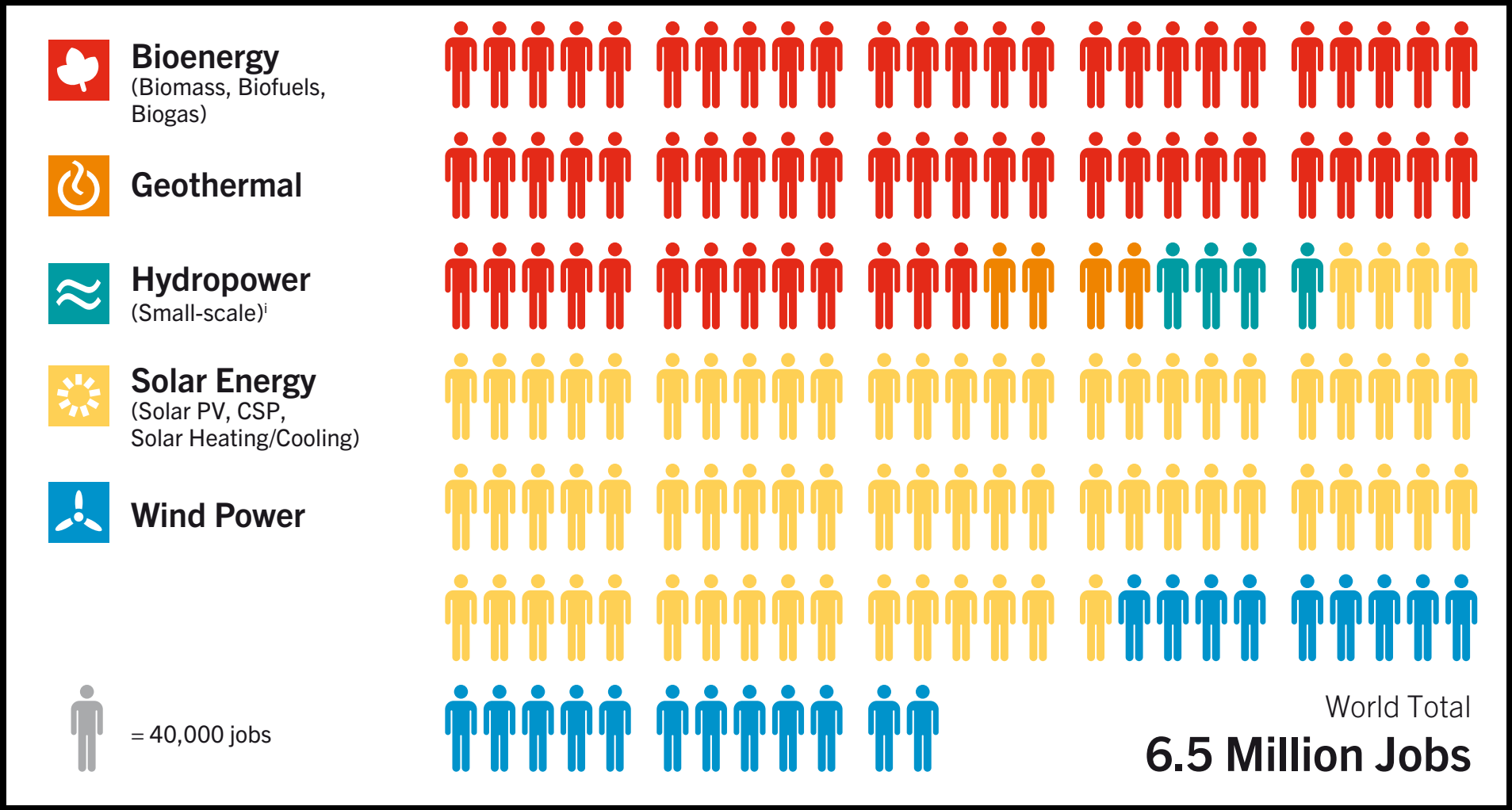
Quanti posti di lavoro servono per produrre un gigawattora elettrico?

UKERC
UK Energy Research Centre

A report for UKERC by
UKERC Technology & Policy Assessment Function



Low carbon jobs:
The evidence for net job creation from policy support for energy efficiency and renewable energy

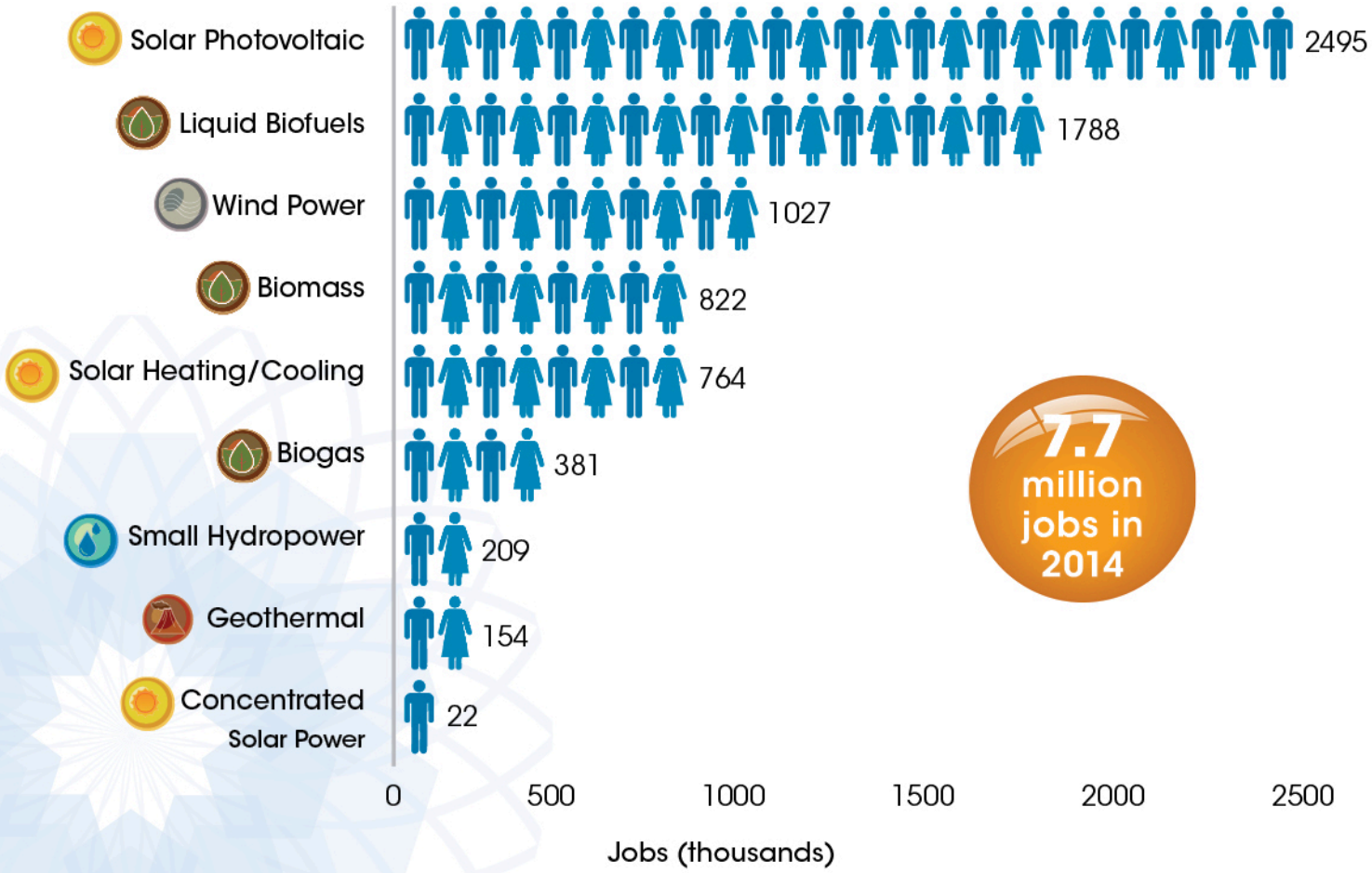

Bioenergy
(Biomass, Biofuels, Biogas)
Geothermal
Hydropower
(Small-scale)[i]
Solar Energy
(Solar PV, CSP, Solar Heating/Cooling)
Wind Power
= 40,000 jobs
World Total
6.5 Million Jobs

Renewable Energy and Jobs
Annual Review 2015

IRENA
International Renewable Energy Agency

#rejobs

Renewable energy employment by technology



MA NON STARETE
MICA PER CASO DICENDO

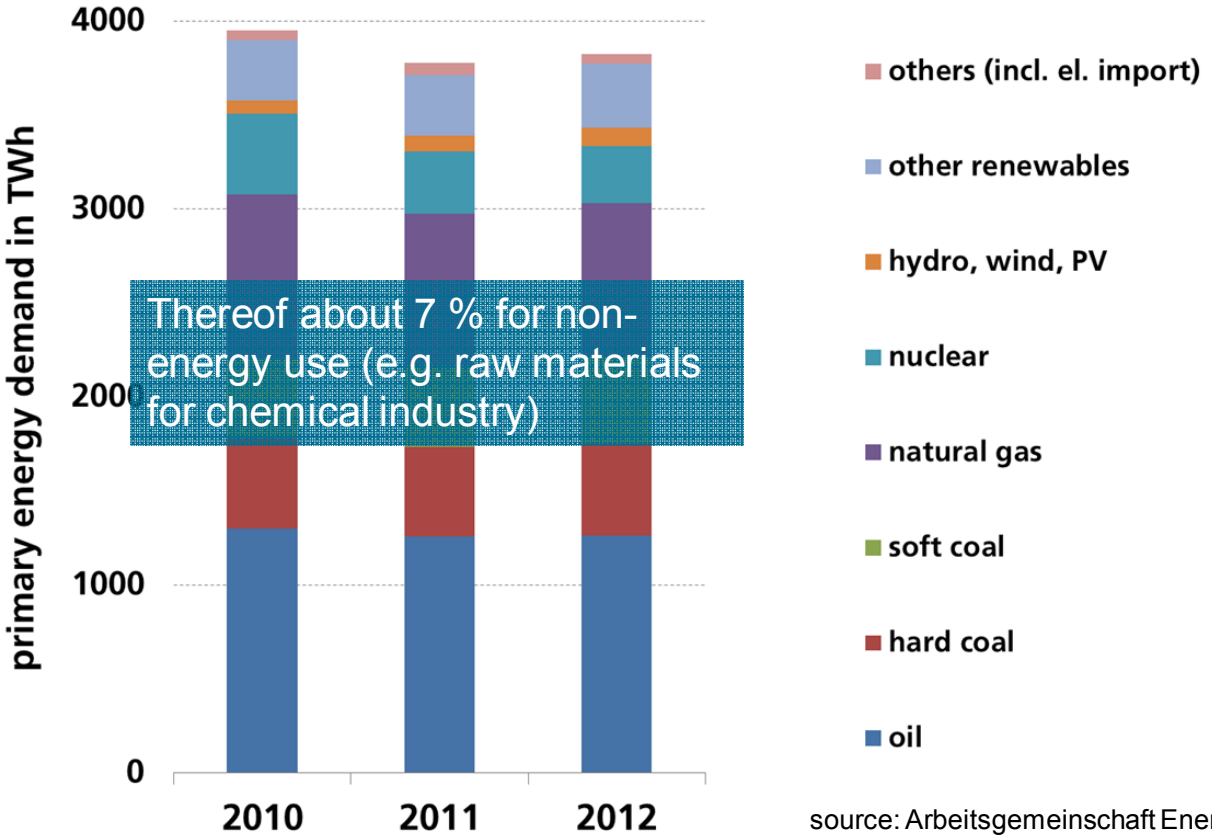
CHE DAVVERO

SOLAR SOUND SYSTEM

DAL PICCOLO AL GRANDE

DA UN GIOCO
AL PIÙ GRANDE PAESE
EUROPEO

Primary energy demand today



Thereof about 7 % for non-energy use (e.g. raw materials for chemical industry)

source: Arbeitsgemeinschaft Energiebilanzen, 2013

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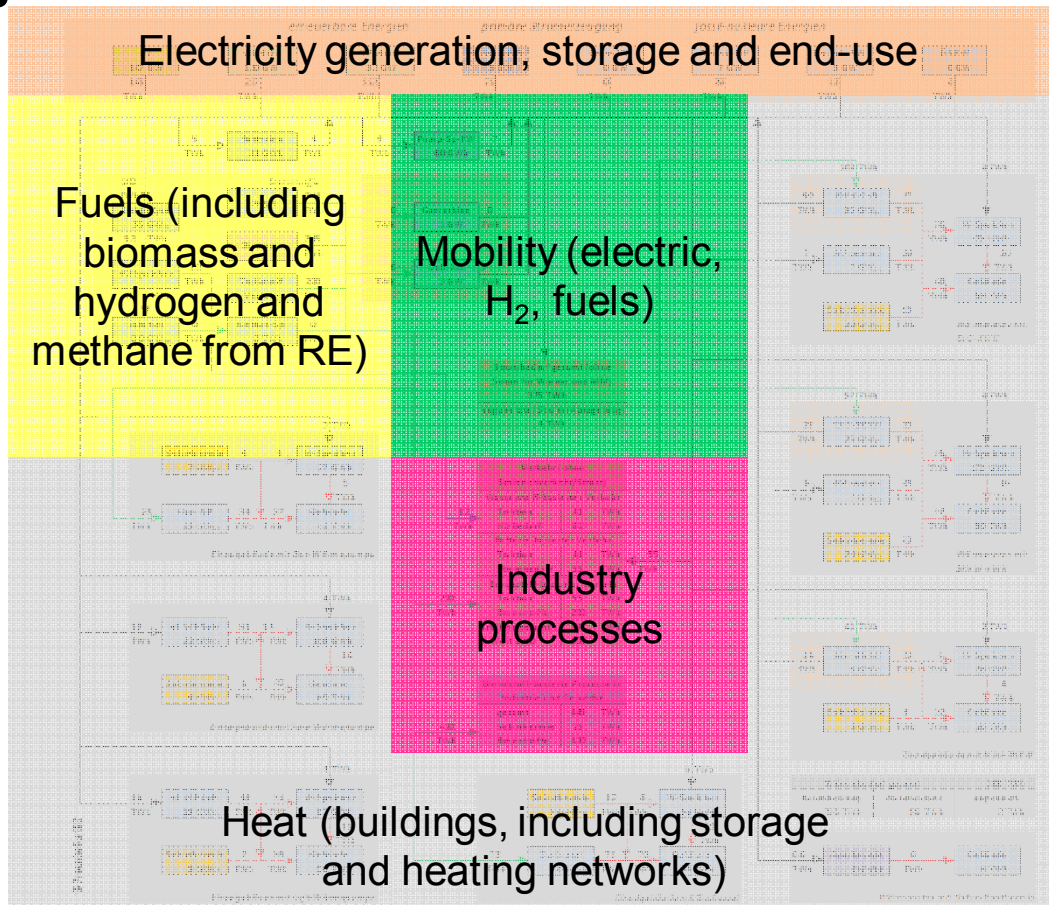
Optimization of the German future energy system based on hourly modeling



REMod-D

Renewable Energy Model – Deutschland

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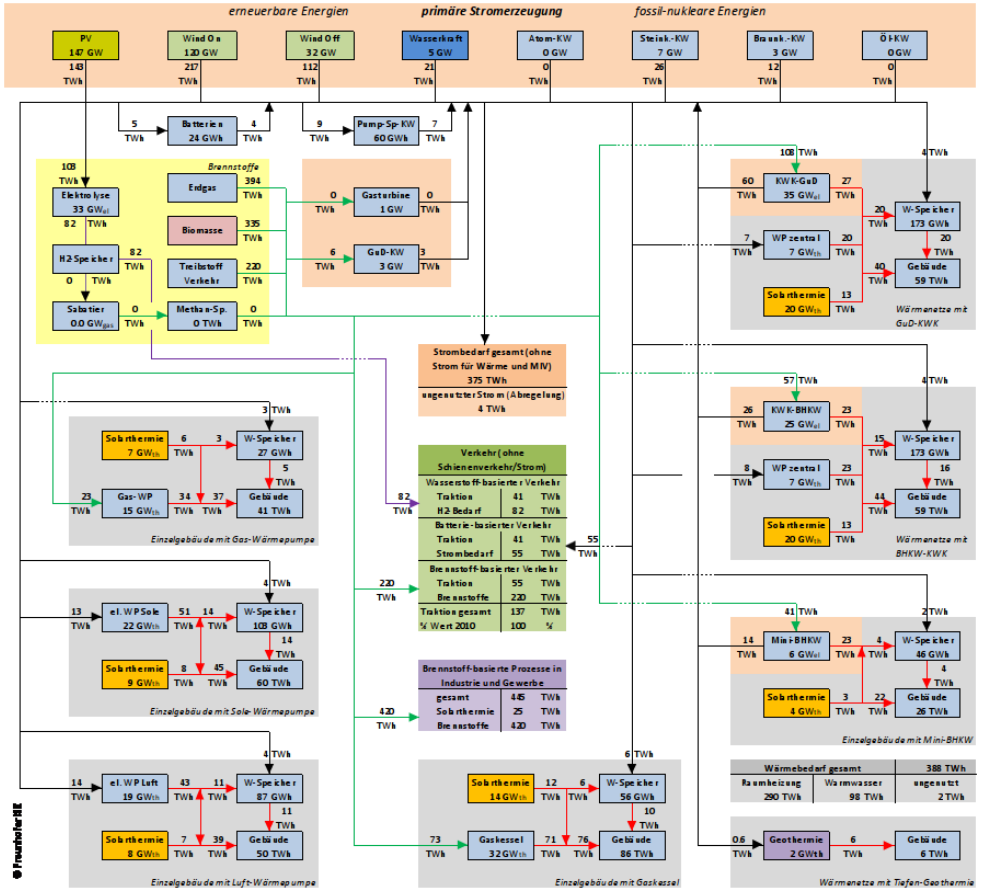
Optimization of the German future energy system based on hourly modeling



REMod-D

Renewable Energy Model – Deutschland

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Electricity production

Renewables

Wind onshore

Wind offshore

Photo-voltaics

Hydropower

Complementary electricity production

Conventional power plants

Combined heat and power (different sizes)

Combined cycle power plants

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Heat supply

Using electricity

Electric heat pumps

Direct heating (only surplus electricity)

Using fuel

(Condensing) boilers

Gas heat pumps

Solar thermal (decentralized or disctrict heating grids)

Combined heat and power (different sizes)

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Long-term mobility concepts (individual cars)

Battery

+ High efficiency
– Short range
– No long-term storage

Hydrogen

+ Long range
+ Long-term storage option
– Lower Efficiency

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Energy storage

Electricity

Pumped hydro

Batteries

Chemical (power-to-gas)

Hydrogen

Methane

Heat

Large hot water (district heating network)

Small buffers in buildings

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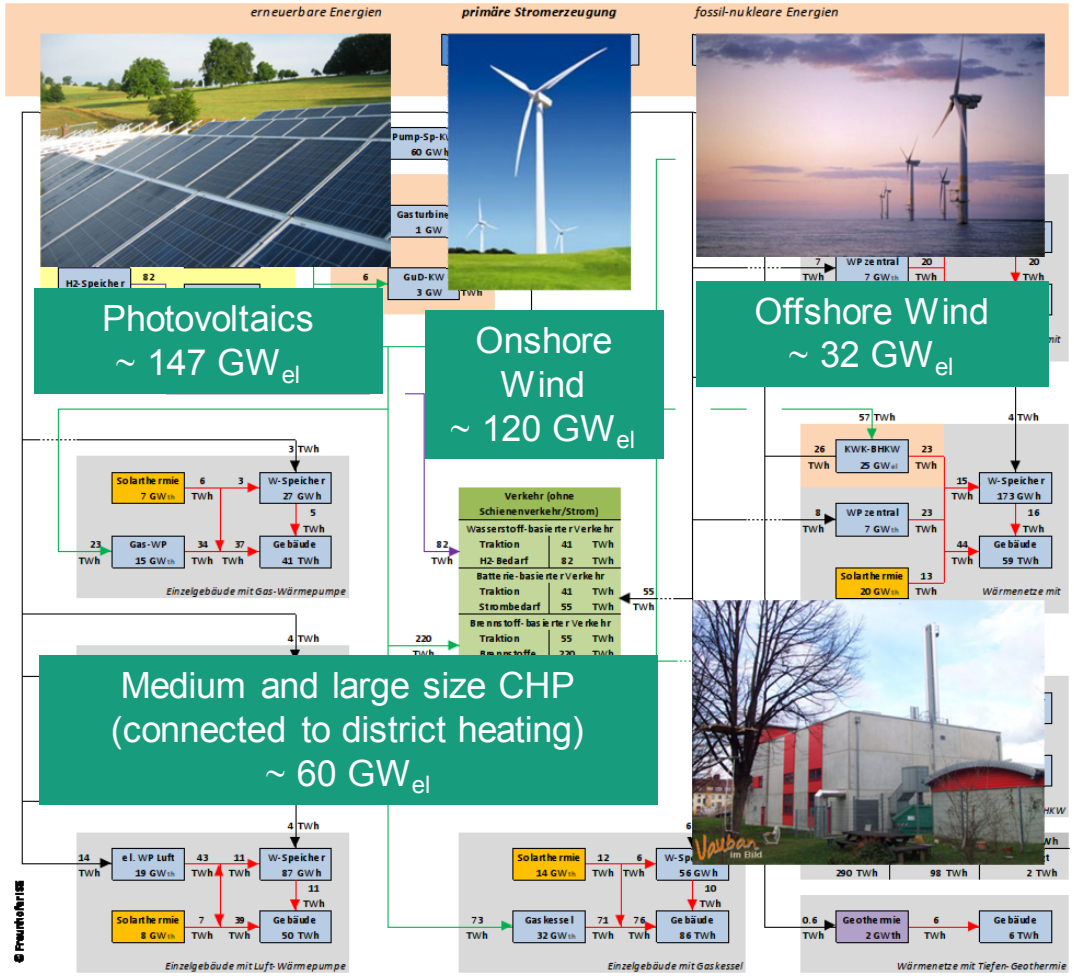
Strom-erzeugung



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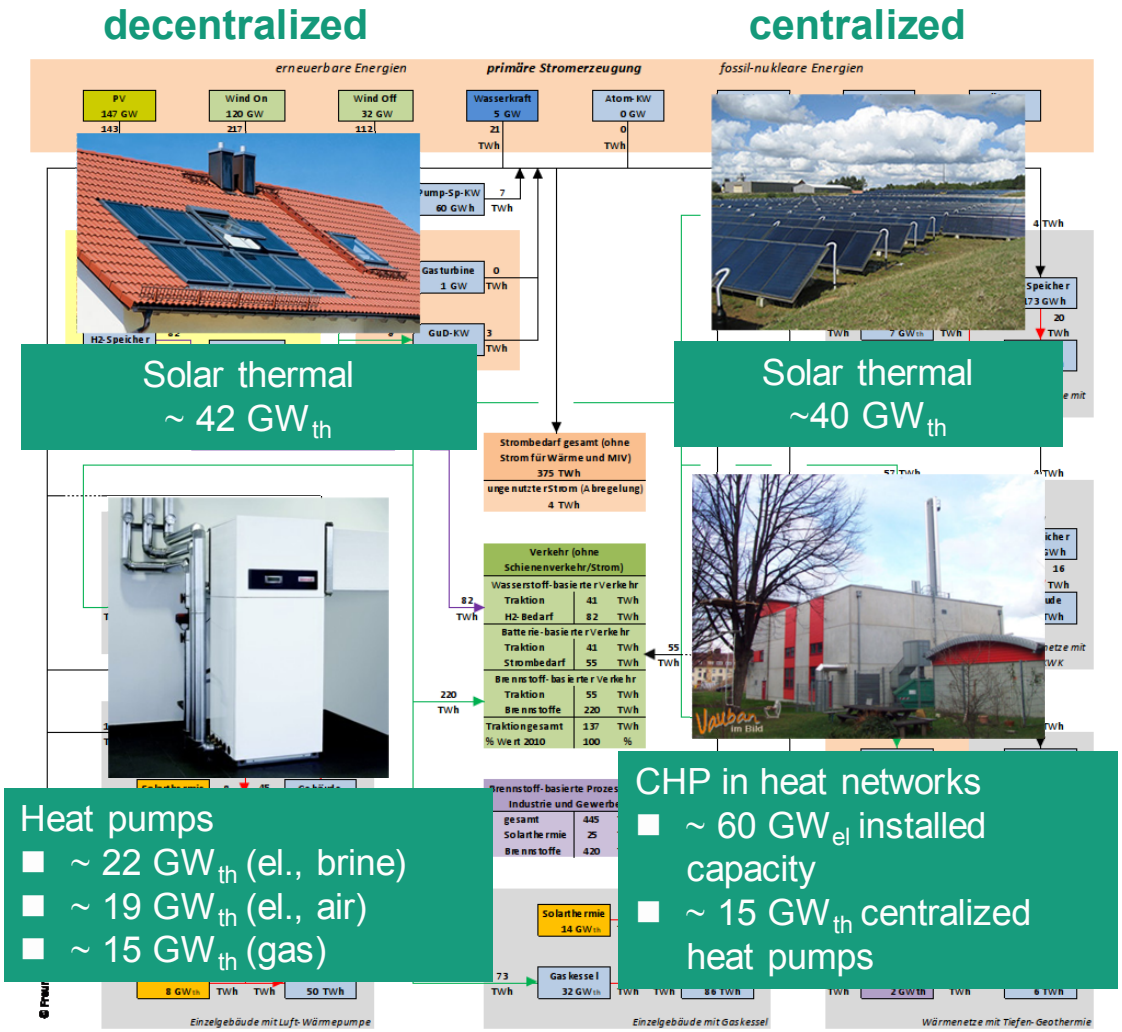
HOLISTIC MODELING AND ANALYSIS OF A FUTURE GERMAN ENERGY SYSTEM
Hans-Martin Henning and Andreas Palzer
Fraunhofer Institute for Solar Energy Systems ISE,

Heat



Solar thermal
~ 42 GW_{th}

Solar thermal
~40 GW_{th}

Heat pumps
- ~ 22 GW_{th} (el., brine)
- ~ 19 GW_{th} (el., air)
- ~ 15 GW_{th} (gas)

CHP in heat networks
- ~ 60 GW_{el} installed capacity
- ~ 15 GW_{th} centralized heat pumps

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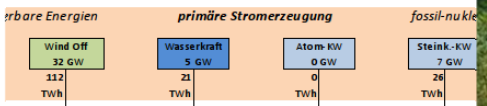
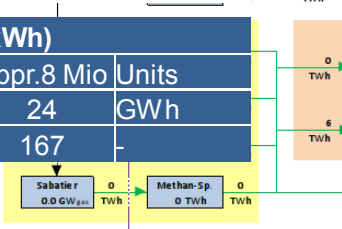
Storage



Battery storage (3 kWh)		
Number	Appr.8 Mio	Units
Total capacity	24	GWh
Equ. full cycles	167	-



Pumped storage power plants		
Number	42	Units
Total capacity	60	GWh
Equ. full cycles	117	-

Electrolysers		
Total capacity	33	GW_{el}
Full load hours	2485	h
Only needed for mobility (not for electricity and heat sector)		

Decentralized heat storage (800 Liter)		
Number	Appr.7 Mio	Units
Total capacity	319	GWh
Equ. full cycles	138	-

Centralized heat storage (50.000 m³)		
Number	Appr.150	Units
Total capacity	346	GWh
Equ. full cycles	104	-

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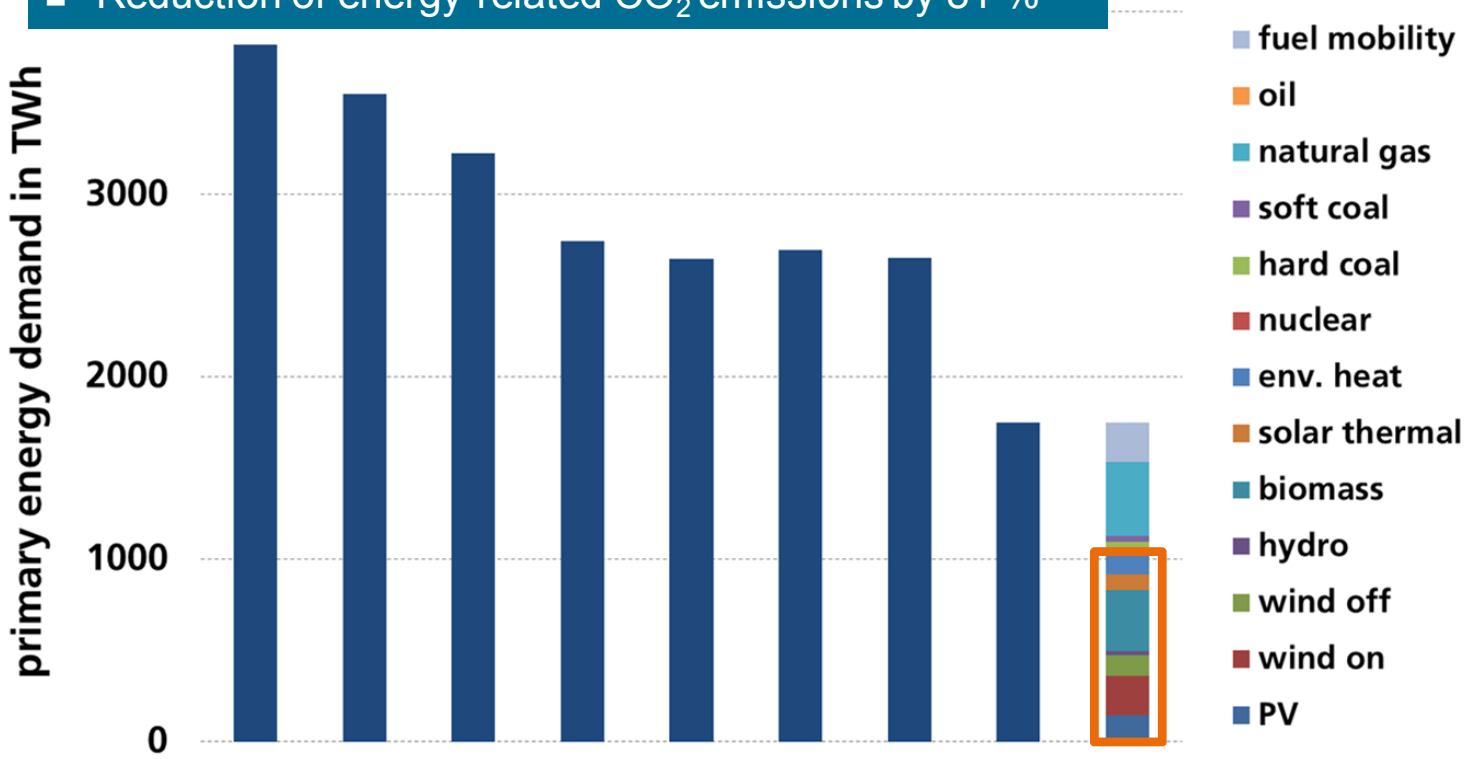
Composition of primary energy in selected 2050 system

- Primary energy demand about half of today
- RE fraction of primary energy demand about 60 %
- Reduction of energy-related CO_2 emissions by 81 %



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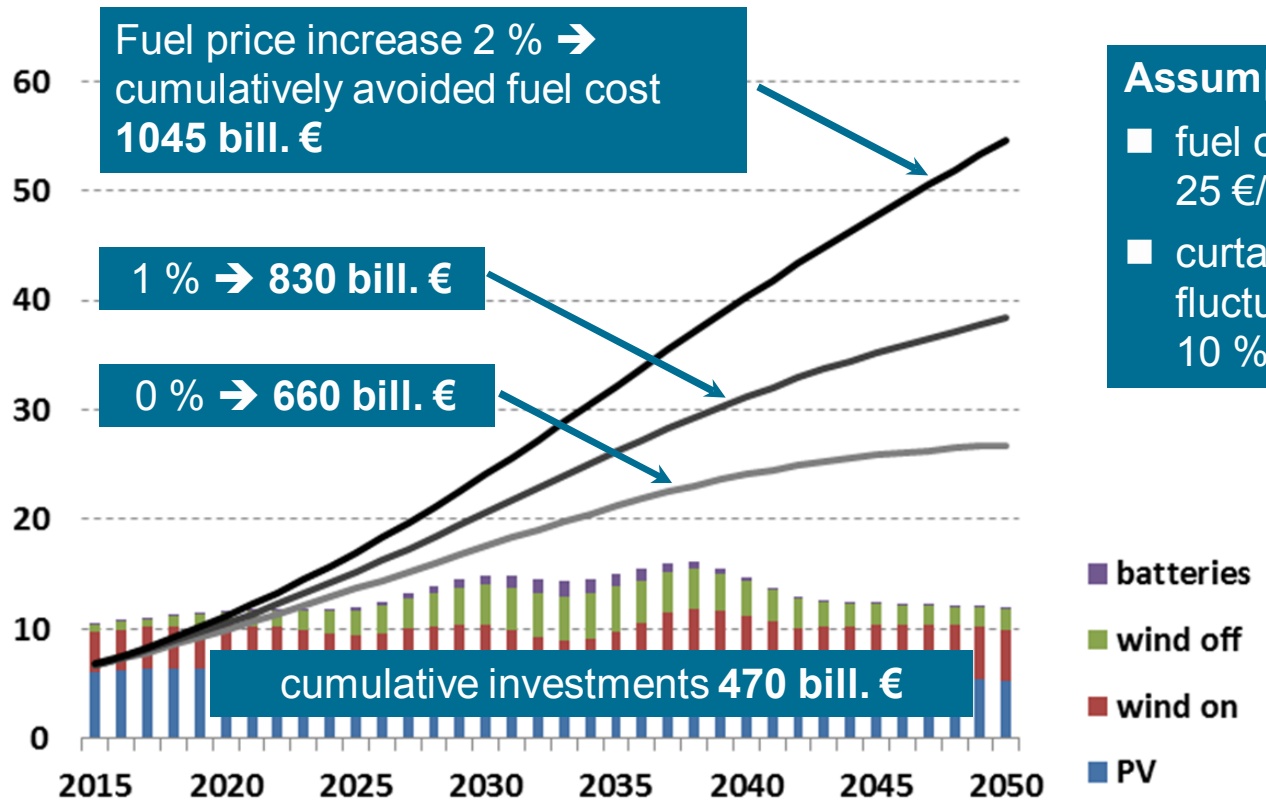
Investments vs. saved fuel cost in bill. € p.a.



Assumptions

- fuel cost today 25 €/MWh
- curtailment of fluctuating RE 10 % of energy

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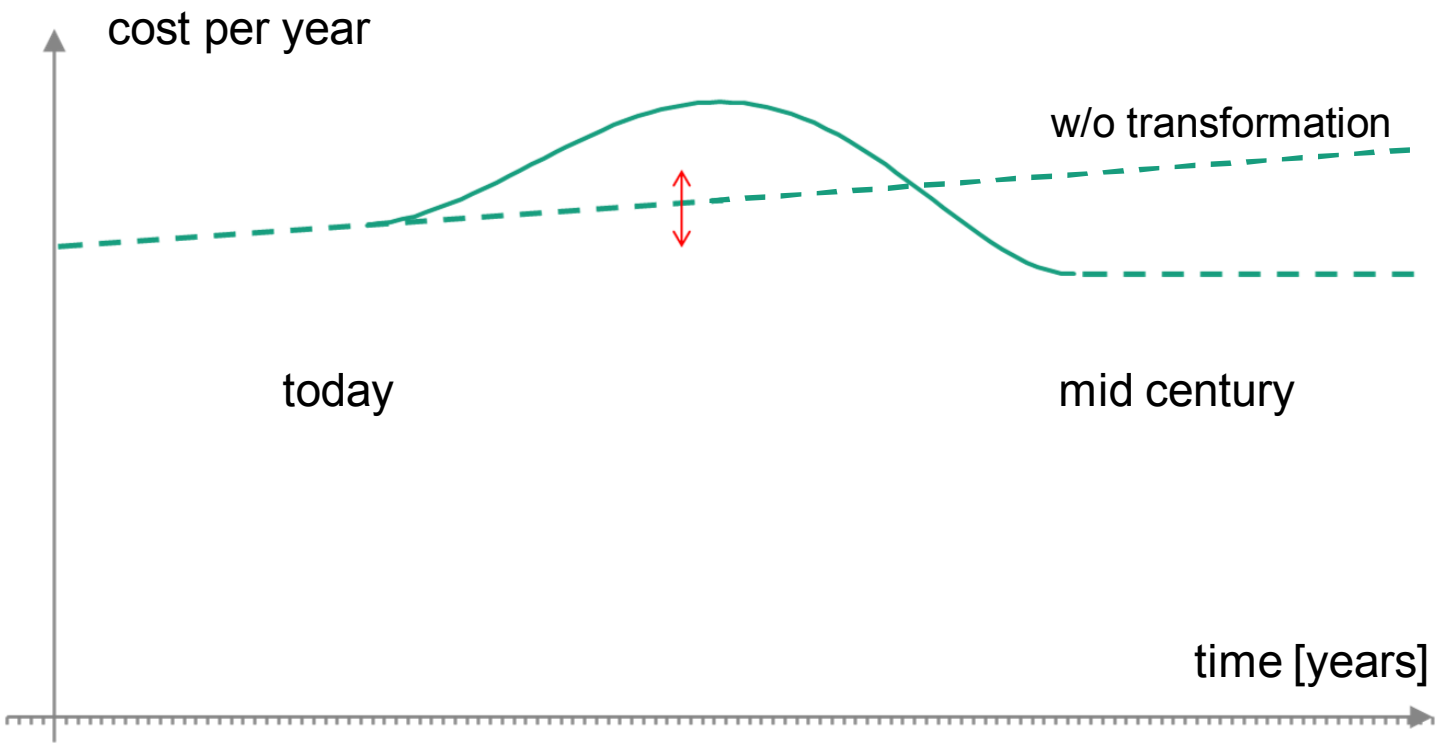
Transformation of the energy system
Qualitative trend of total annual cost



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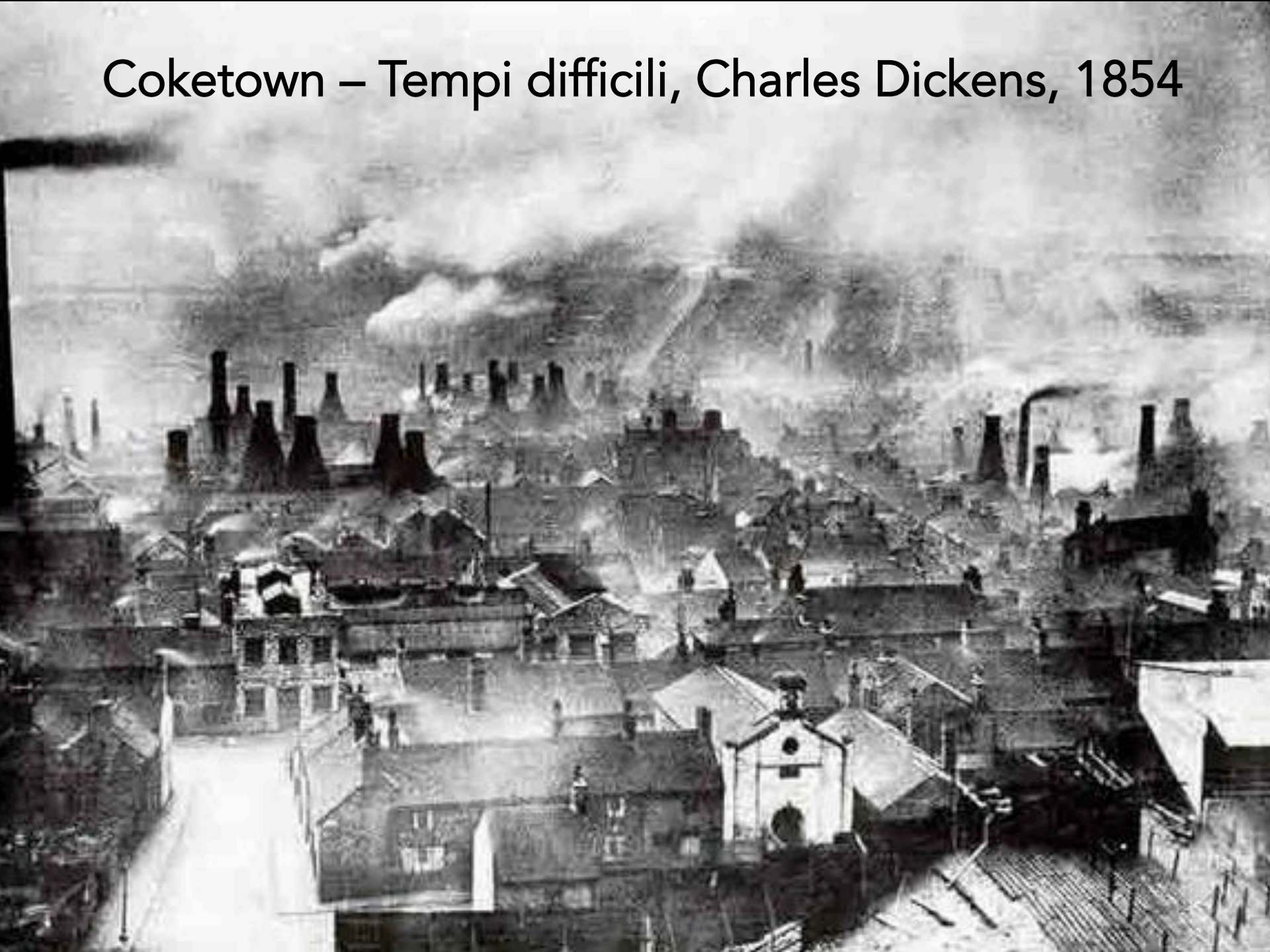
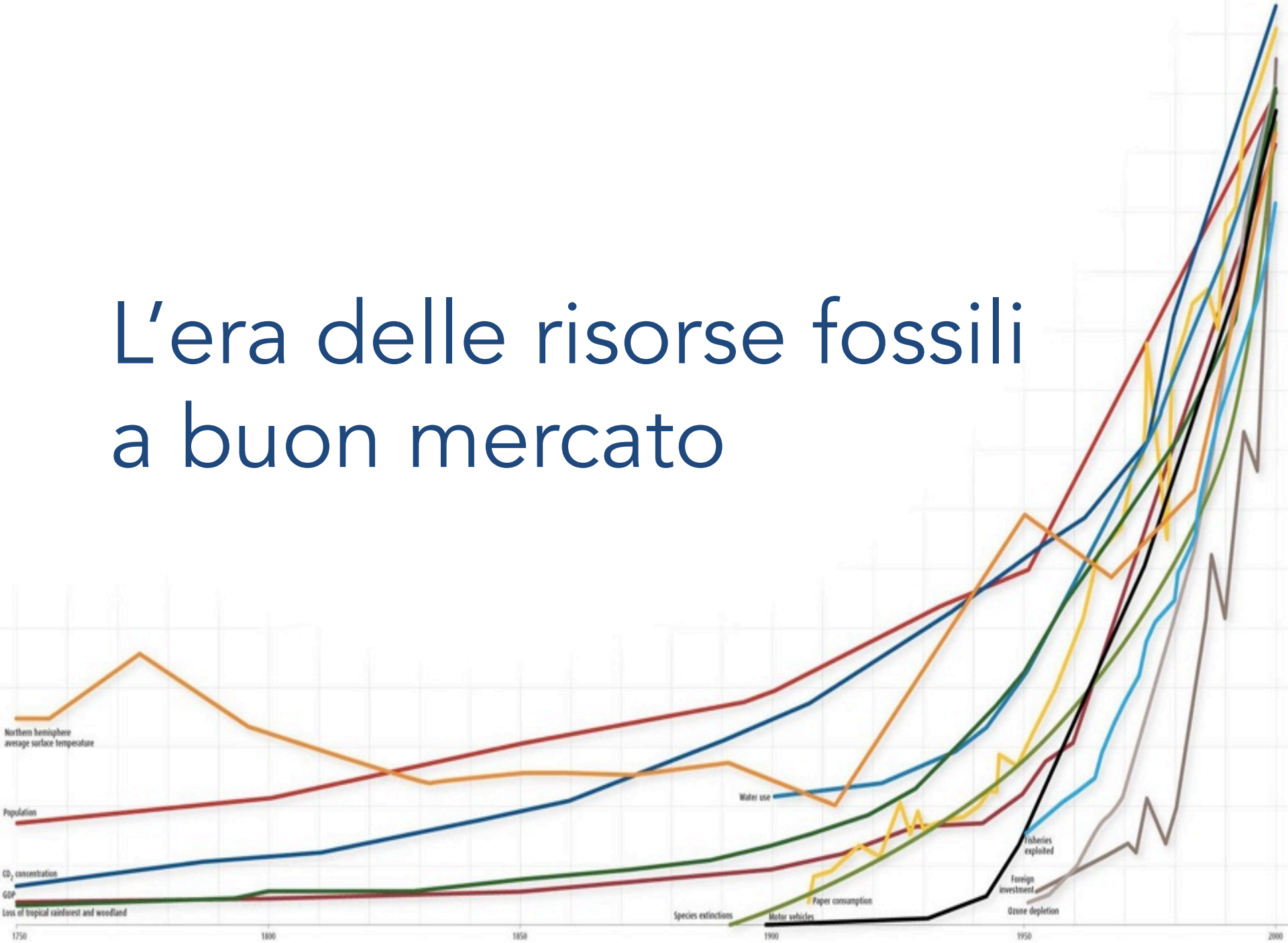
MA QUALE MODELLO ECONOMICO VIENE SUGGERITO?

Coketown – Tempi difficili, Charles Dickens, 1854



Motown – Berry Gordy, 1959

L’era delle risorse fossili a buon mercato



Solarsiedlung - Rolf Disch, 2000

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