THE SUPPORTING NETWORK: TECHNOLOGIES AND PEOPLE TOWARD NEW PARADIGMS

FIORENZO GALLI · MUSEO NAZIONALE DELLA SCIENZA E DELLA TECNOLOGIA

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2nd Workshop
Energy for Sustainable Science
at Research Infrastructures

CERN
GENEVA, SWITZERLAND
23 OCTOBER 2013

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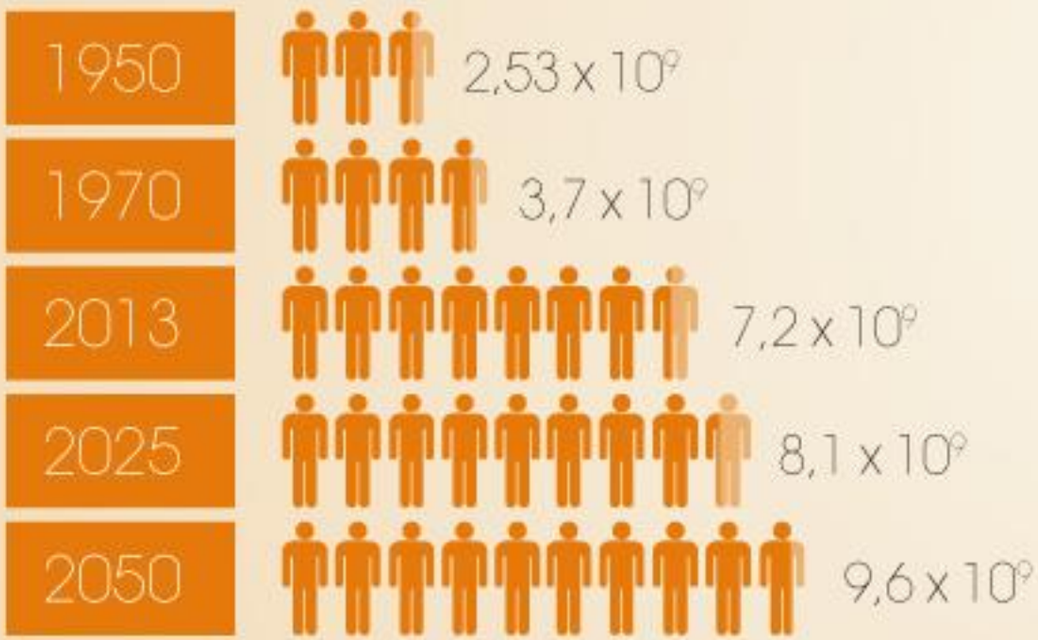
MUSEO NAZIONALE
DELLA SCIENZA E DELLA TECNOLOGIA

POPULATION WORLD

WORLD POPULATION, 1950-2050

Source: UN-DESA (United Nation - Department of Economic and Social Affairs) – World Population Prospect: The 2012 Revision (2013)



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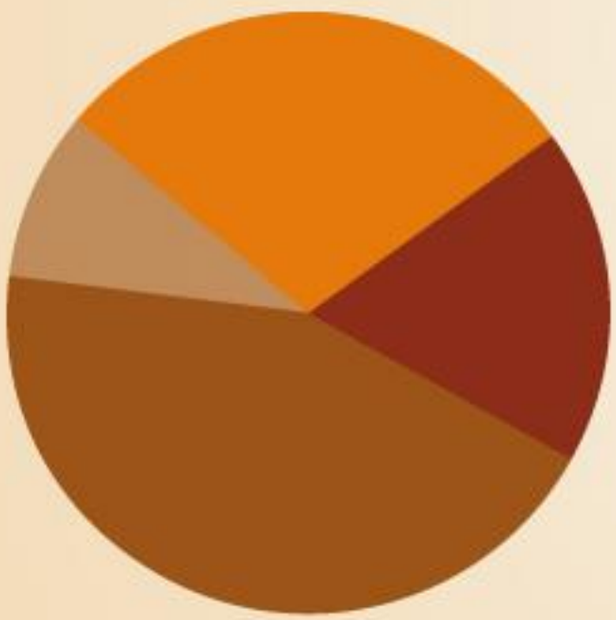
WORLD POPULATION AGE, 2013

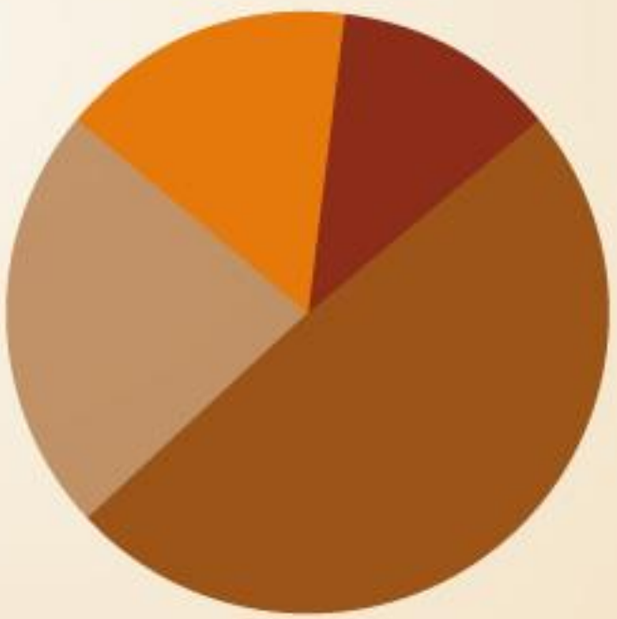
Source: UN-DESA (United Nation - Department of Economic and Social Affairs) – World Population Prospect: The 2012 Revision (2013)

LESS DEVELOPED REGION



29% < 15
18% 15 - 24
44% 25 - 59
09% > 60

MORE DEVELOPED REGION



16% < 15
12% 15 - 24
49% 25 - 59
23% > 60

POPULATION WORLD

WORLD POPULATION AGE, 2013 - 2050

Source: UN-DESA (United Nation - Department of Economic and Social Affairs) – World Population Prospect: The 2012 Revision (2013)

LESS DEVELOPED REGION

0-24	DEPENDING ON FERTILITY EDUCATION PROGRAMS					
25-59	2013	$2,6 \times 10^9$	2050	$3,7 \times 10^9$	2100	$4,1 \times 10^9$
>60	2013	$0,5 \times 10^9$	2050	$1,6 \times 10^9$	2100	$2,5 \times 10^9$

MORE DEVELOPED REGION, 2013 - 2050

0-15	2013	$0,2 \times 10^9$	2050	$0,2 \times 10^9$	2100	$0,2 \times 10^9$
16-24	2013	$0,2 \times 10^9$	2050	$0,1 \times 10^9$	2100	$0,1 \times 10^9$
25-59	2013	$0,6 \times 10^9$	2050	$0,5 \times 10^9$	2100	$0,5 \times 10^9$
>60	2013	$0,3 \times 10^9$	2050	$0,4 \times 10^9$	2100	$0,4 \times 10^9$

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POPULATION
WORLD

URBAN POPULATION OF THE WORLD, 1950-2050

Source: UN-DESA(United Nation - Department of Economic and Social Affairs) World Urbanization Prospect: The 2011Revision (2012)

URBAN

1950	$0,75 \times 10^9$
1970	$1,35 \times 10^9$
2011	$3,63 \times 10^9$
2030	$4,98 \times 10^9$
2050	$6,25 \times 10^9$

RURAL

1950	$1,79 \times 10^9$
1970	$2,34 \times 10^9$
2011	$3,34 \times 10^9$
2030	$3,34 \times 10^9$
2050	$3,05 \times 10^9$

RESOURCES WORLD

WORLD MATERIAL EXTRACTED AND USED, 2007-2030

Source: UNEP (United Nations Environmental Programme) - GEO-5 (Global Environmental Outlook-5) (2012)
Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Material Resources and Waste (2010)

WORLD MATERIAL EXTRACTED AND USED BY CONTINENT, 2007

Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Material Resources and Waste (2010)

RESOURCES
EUROPE

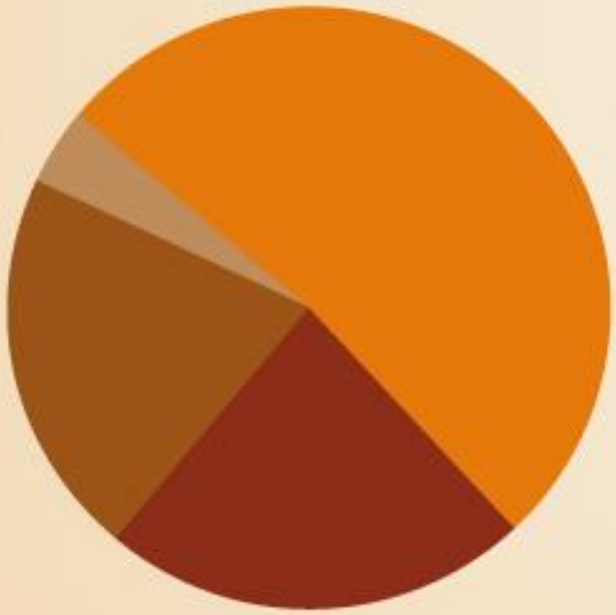
EU MATERIALS CONSUMPTION, 2007

Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Material Resources and Waste (2010)

2007 $8{,}2 \times 10^9$ t/year

EU MATERIALS CONSUMPTION BY TYPOLOGY, 2007

Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Material Resources and Waste (2010)

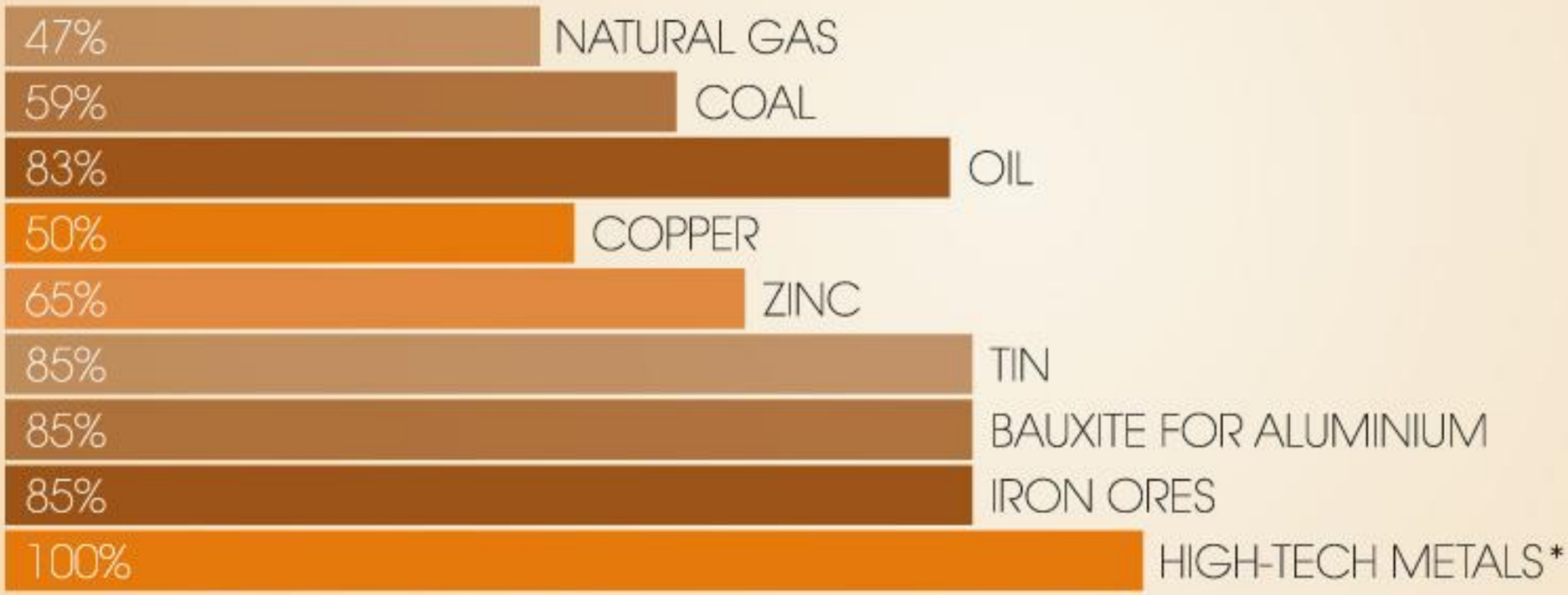


- 52% MINERALS FOR INDUSTRIAL AND CONSTRUCTION USE
- 23% FOSSIL FUELS
- 21% BIOMASS
- 04% METALS

RESOURCES
EUROPE

SHARE OF IMPORTS IN EU CONSUMPTION OF SELECTED MATERIALS, 2000-2007

Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Material Resources and Waste (2010)

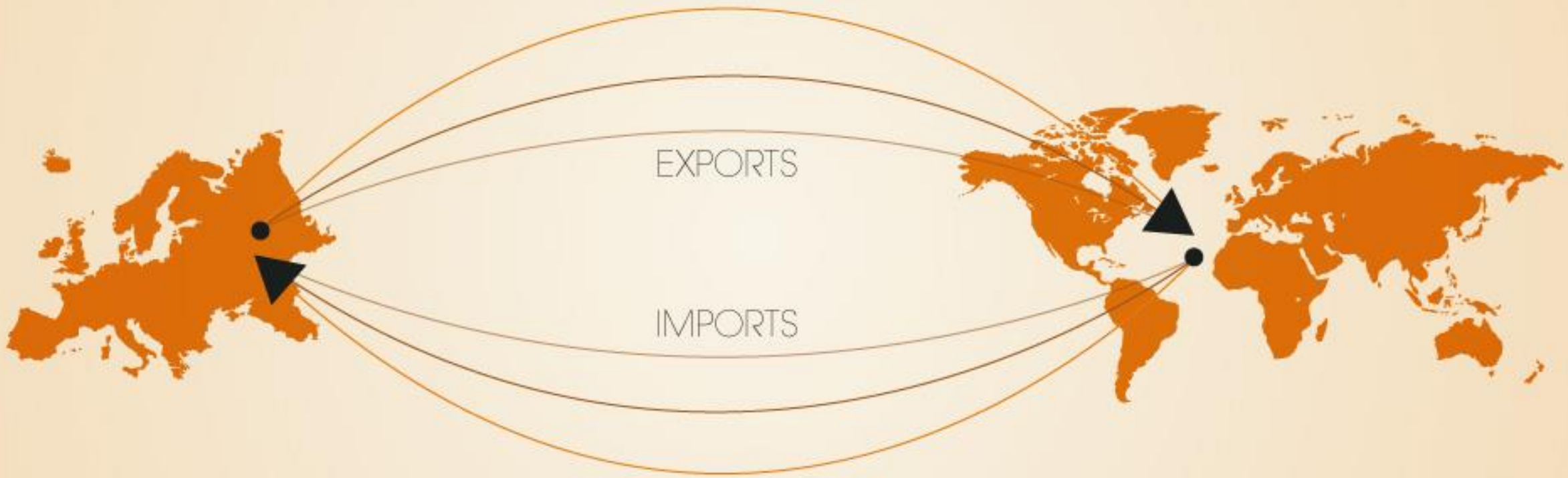


*ANTIMONY, COBALT, MOLYBDENUM, NIOBIUM, PLATINUM, RARE EARTH METALS, TANTALUM, TITANIUM ORE, VANADIUM

RESOURCES
EUROPE

EU PHYSICAL TRADE BALANCE WITH THE REST OF THE WORLD, 2008

Source: EEA (European Environmental Agency) - The European Environment - State and Outlook 2010: Material Resources and Waste (2010)



EXPORTS

BIOMASS 126 X 10^6 t
MANUFACTURES 207 X 10^6 t
FUELS/MINING PRODUCTS 203 X 10^6 t

TOTAL TRADE

FROM EU TO RoW 397 x 10^6 t (1999)
FROM RoW TO EU 1340 x 10^6 t (1999)
FROM EU TO RoW 536 x 10^6 t (2008)
FROM RoW TO EU 1798 x 10^6 t (2008)

IMPORTS

BIOMASS 193 X 10^6 t
MANUFACTURES 221 X 10^6 t
FUELS/MINING PRODUCTS 1384 X 10^6 t

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WASTE
EUROPE

EU WASTE GENERATION, 2006

Source: EEA (European Environmental Agency) - The European Environment - State and Outlook 2010: Material Resources and Waste (2010)

2006 3×10^9 t/year

EU WASTE GENERATION BY SOURCE, 2006

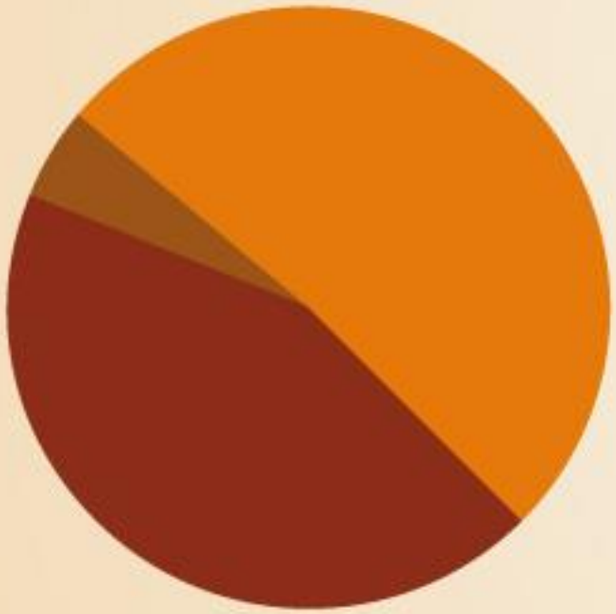
Source: EEA (European Environmental Agency) - The European Environment - State and Outlook 2010: Material Resources and Waste (2010)

- 33% CONSTRUCTION AND DEMOLITION WASTE
- 24% MINING AND QUARRYING WASTE
- 13% MANUFACTURING WASTE
- 08% HOUSHOLDS WASTE
- 22% OTHER WASTES

RESOURCES CONTAINED IN ELECTRIC AND ELECTRONIC EQUIPMENT PUT ON THE MARKET IN 2005:
450×10^3 t OF COPPER
7 t OF GOLD
$1,8 \times 10^3$ t OF CFCs

FINAL DESTINATION OF TOTAL EU WASTE, 2006

Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Material Resources and Waste (2010)



- 51,5% LANDFILL
- 43,6% RECYCLING
- 04,9% INCINERATION

WORLD LAND-USE

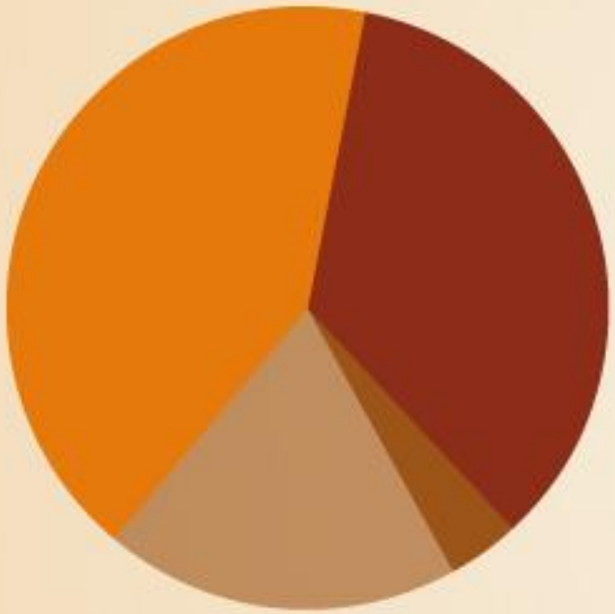
Source: UNEP (United Nations Environmental Programme) - GEO-5 (Global Environmental Outlook-5) (2012)

LAND ADDRESSED TO AGRICULTURE

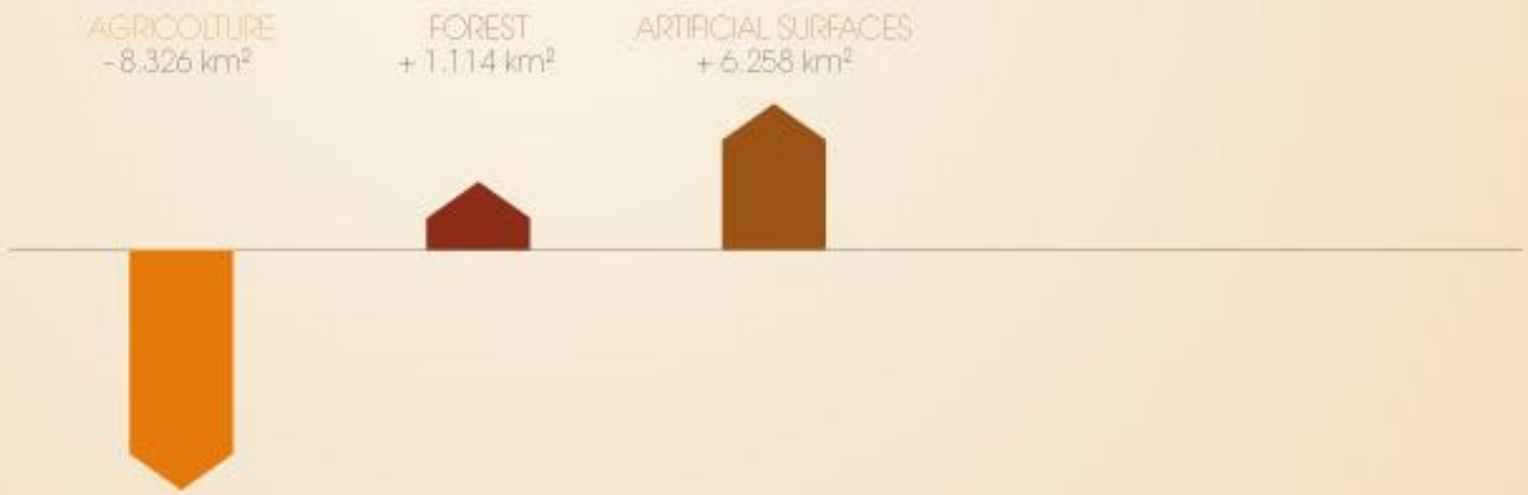
LAND ADDRESSED TO FOREST

EU LAND-USE

Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Land use (2010)

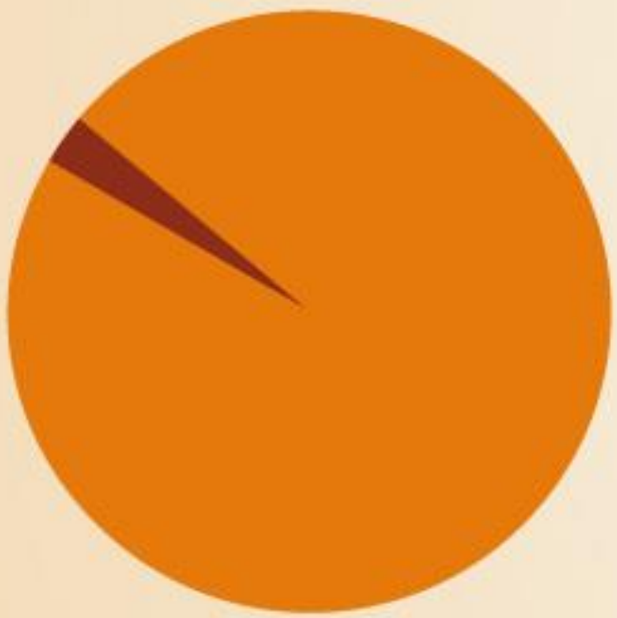


- 42% AGRICOLTURE
- 35% FOREST
- 4,0% ARTIFICIAL SURFACES
- 19% OTHERS



WATER OF THE WORLD

Source: UNEP (United Nations Environmental Programme) - GEO-5 (Global Environmental Outlook-5) (2012)



95,7% SALT WATER

02,5% FRESHWATER

WORLD WATER-USE, 2010

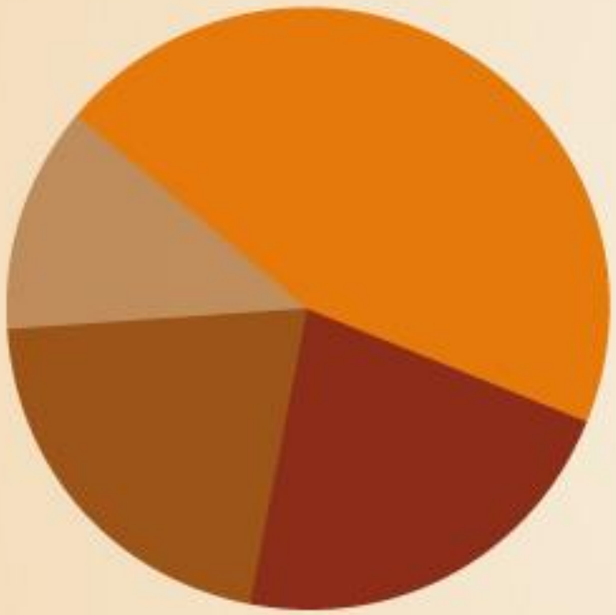
Source: UNEP (United Nations Environmental Programme) - GEO-5 (Global Environmental Outlook-5) (2012)

WORLD GLOBAL WATER CONSUMPTION

Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Water resources - quantity and flows (2010)

EU WATER-USE, 2007

Source: EEA (European Environmental Agency) -The European Environment - State and Outlook 2010: Water resources - quantity and flows (2010)



- 45% COOLING IN ENERGY PRODUCTION
- 22% AGRICULTURE
- 21% PUBLIC WATER SUPPLY
- 12% INDUSTRY

SOUTHERN EUROPE → AGRICULTURE ACCOUNTS FOR MORE THAN A HALF

WESTERN EUROPE → COOLING IN ENERGY PRODUCTION ACCOUNTS FOR MORE THAN A HALF

EU REAL AND VIRTUAL WATER-USE, 2007

Source: EEA (European Environmental Agency) –The European Environment - State and Outlook 2010: Water resources - quantity and flows (2010)

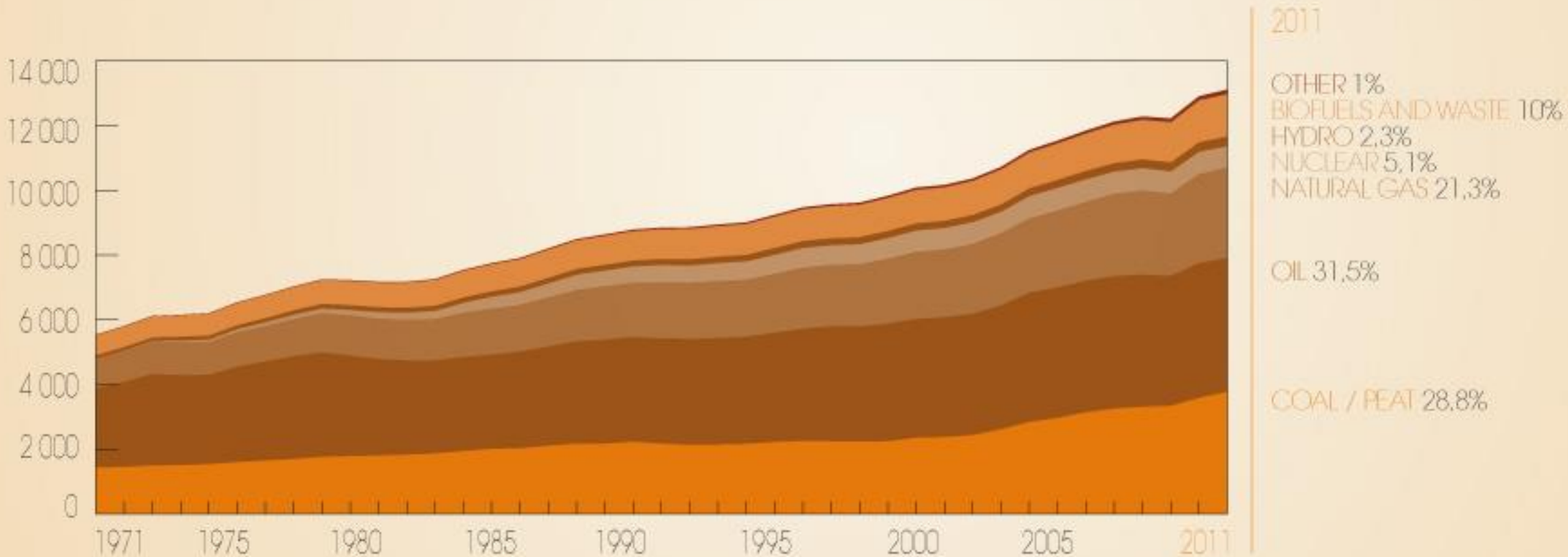
REAL WATER
150 l / day / person

VIRTUAL WATER
1500-3000 l / day / person

TOTAL PRIMARY ENERGY SUPPLY
WORLD

FROM 1971 TO 2011 BY FUEL (Mtoe)

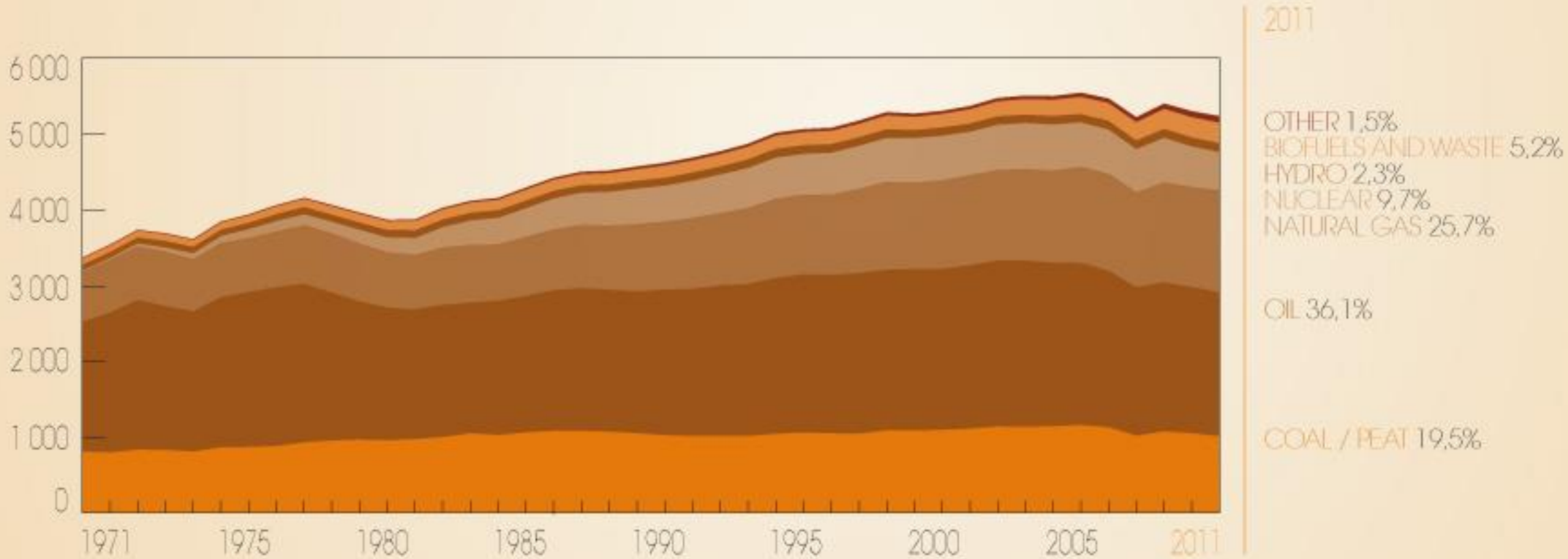
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



TOTAL PRIMARY ENERGY SUPPLY
OECD

FROM 1971 TO 2011 BY FUEL (Mtoe)

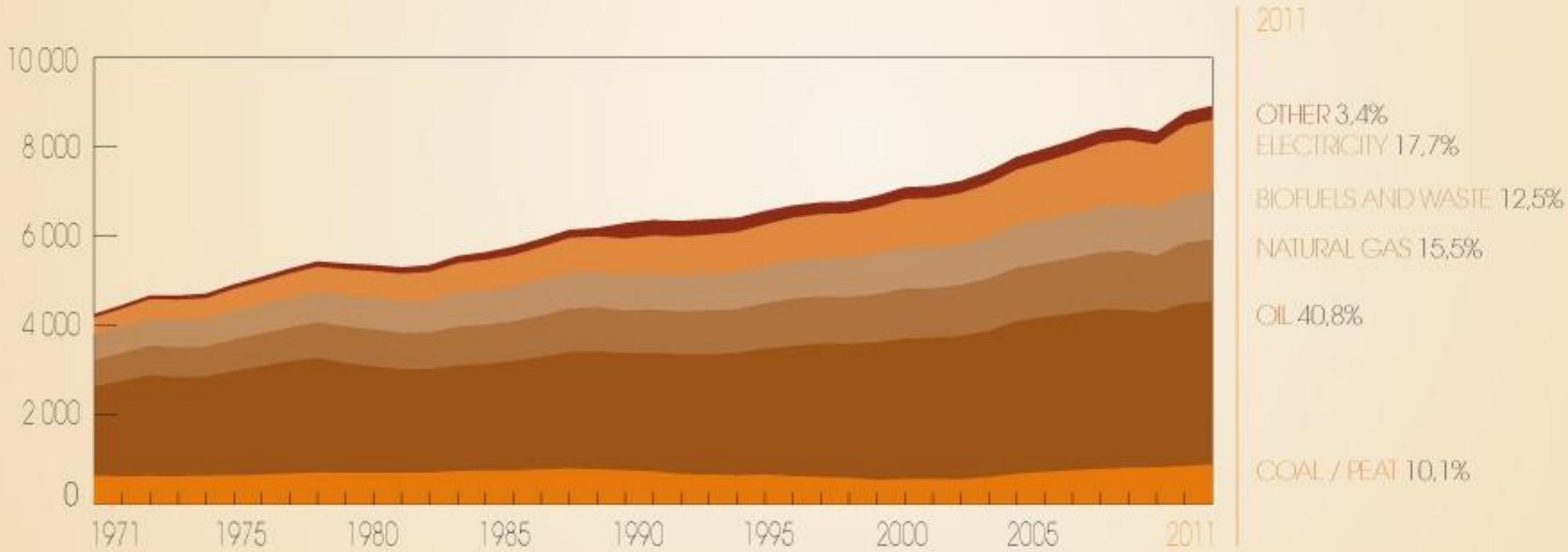
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



TOTAL FINAL ENERGY CONSUMPTION WORLD

FROM 1971 TO 2011 BY FUEL (Mtoe)

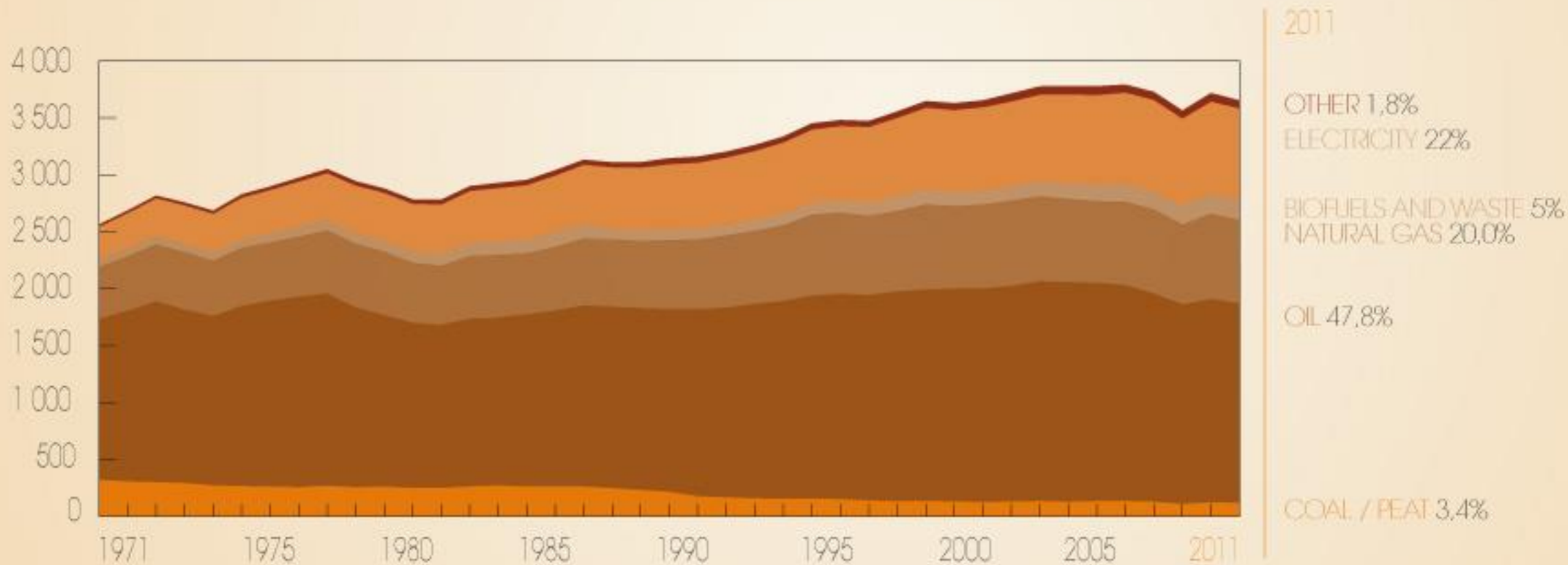
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



TOTAL FINAL ENERGY CONSUMPTION 20
OECD

FROM 1971 TO 2011 BY FUEL (Mtoe)

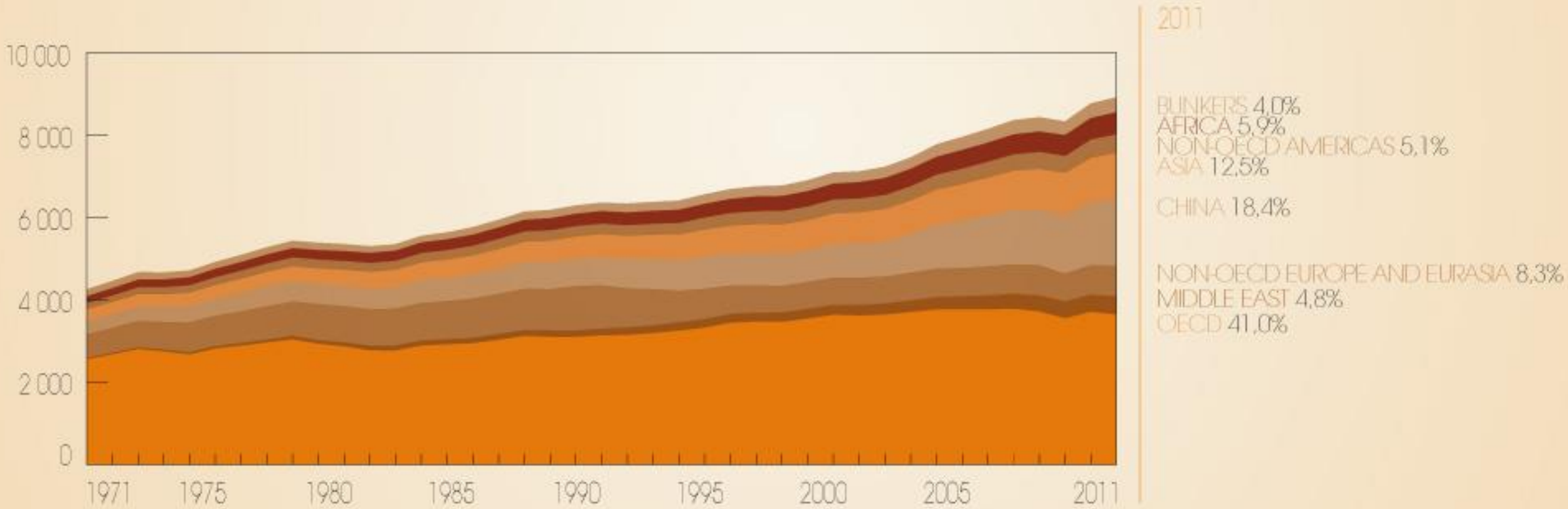
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



TOTAL FINAL ENERGY CONSUMPTION 21
WORLD

FROM 1971 TO 2011 BY REGION (Mtoe)

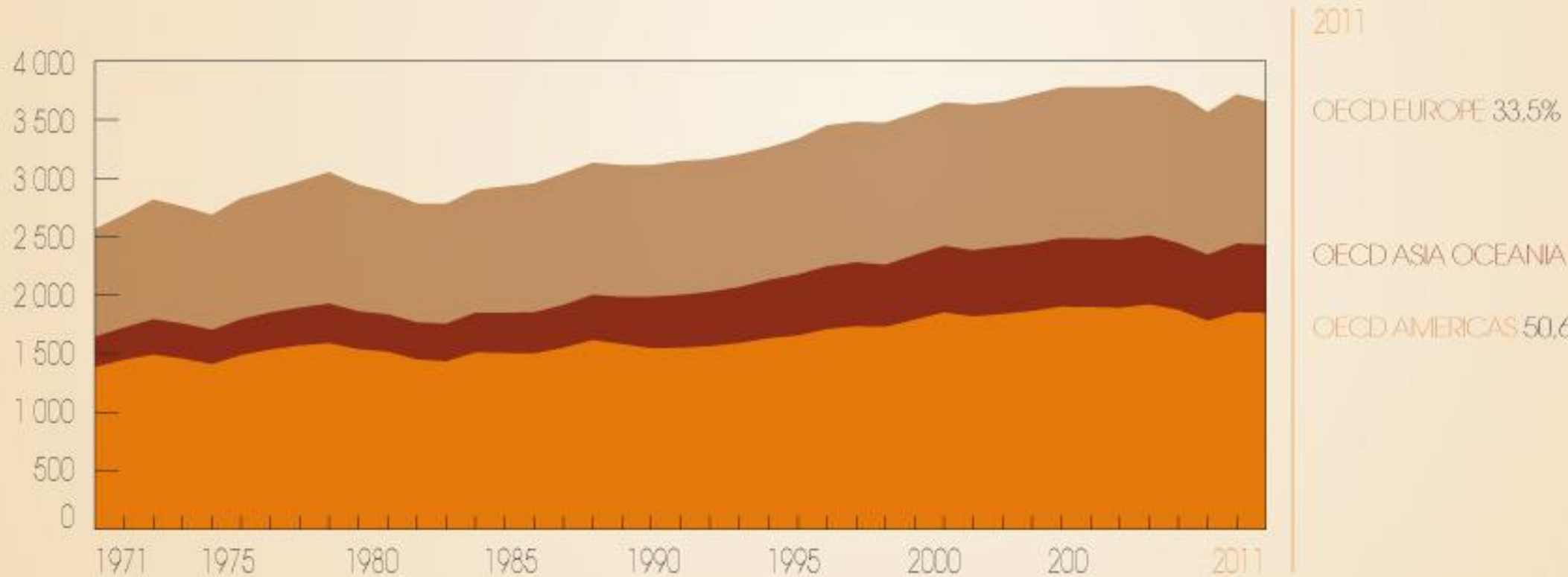
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



TOTAL FINAL ENERGY CONSUMPTION 22
OECD

FROM 1971 TO 2011 BY REGION (Mtoe)

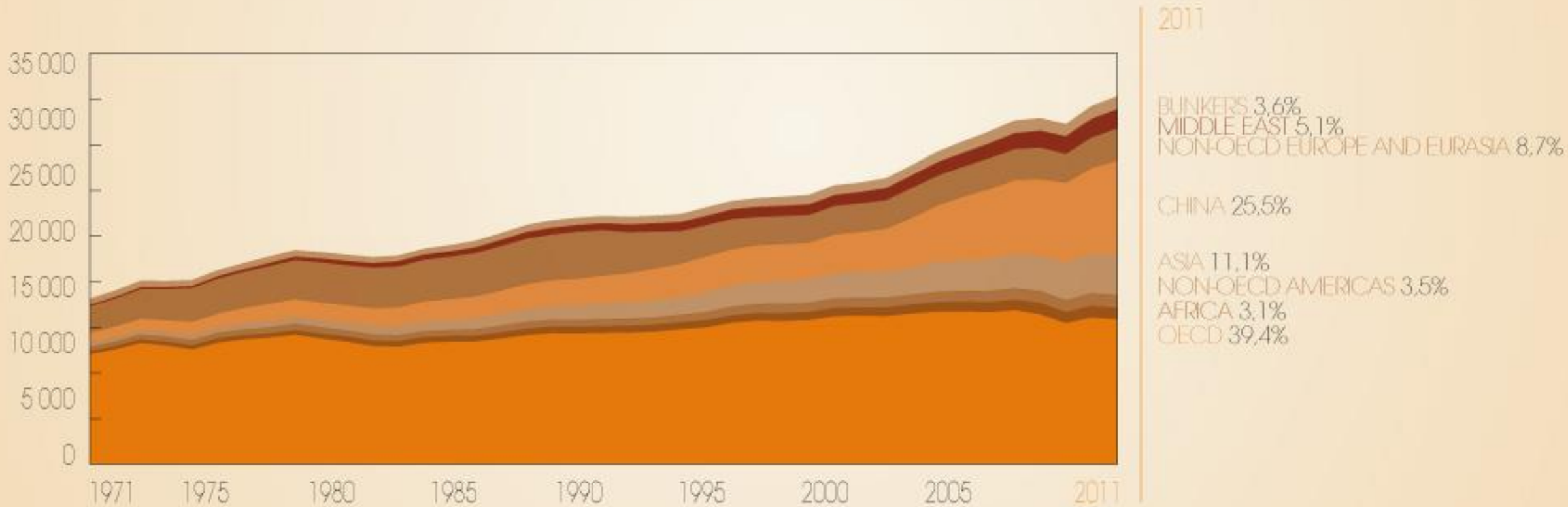
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



CO_2 EMISSIONS
WORLD

FROM 1971 TO 2011 BY REGION (Mt of CO_2)

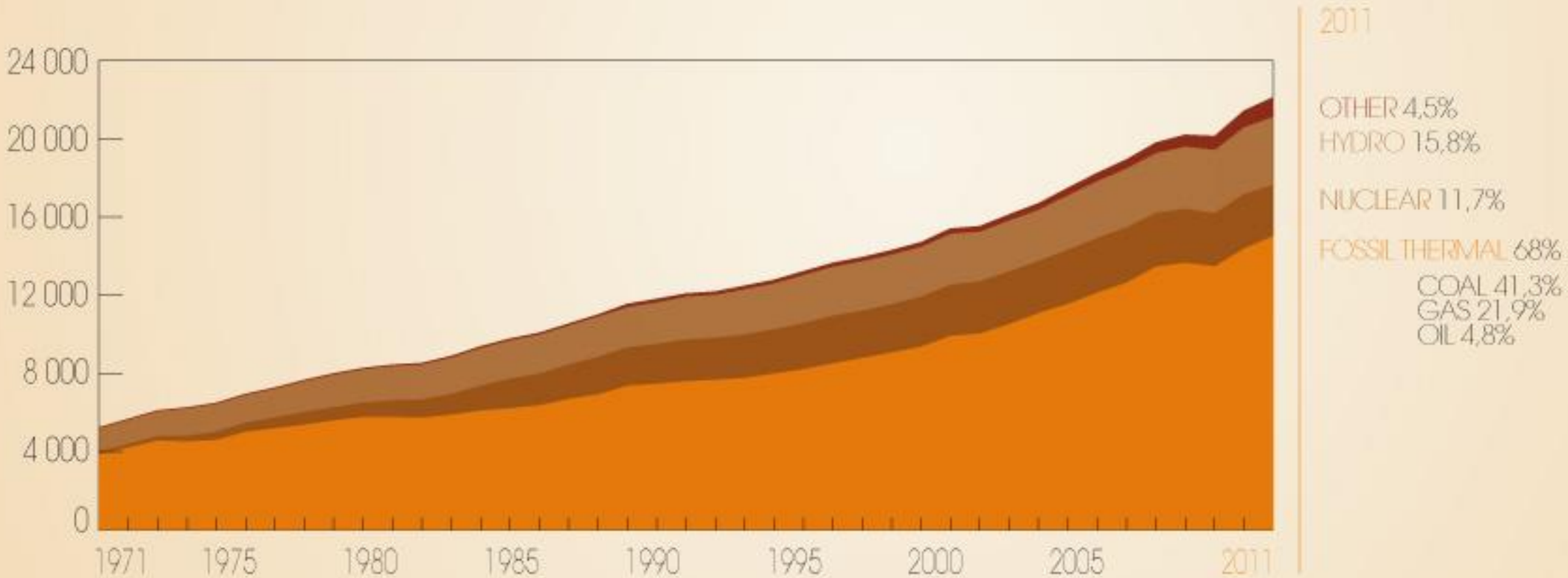
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



ELECTRICITY GENERATION
WORLD

FROM 1971 TO 2011 BY FUEL (TWh)

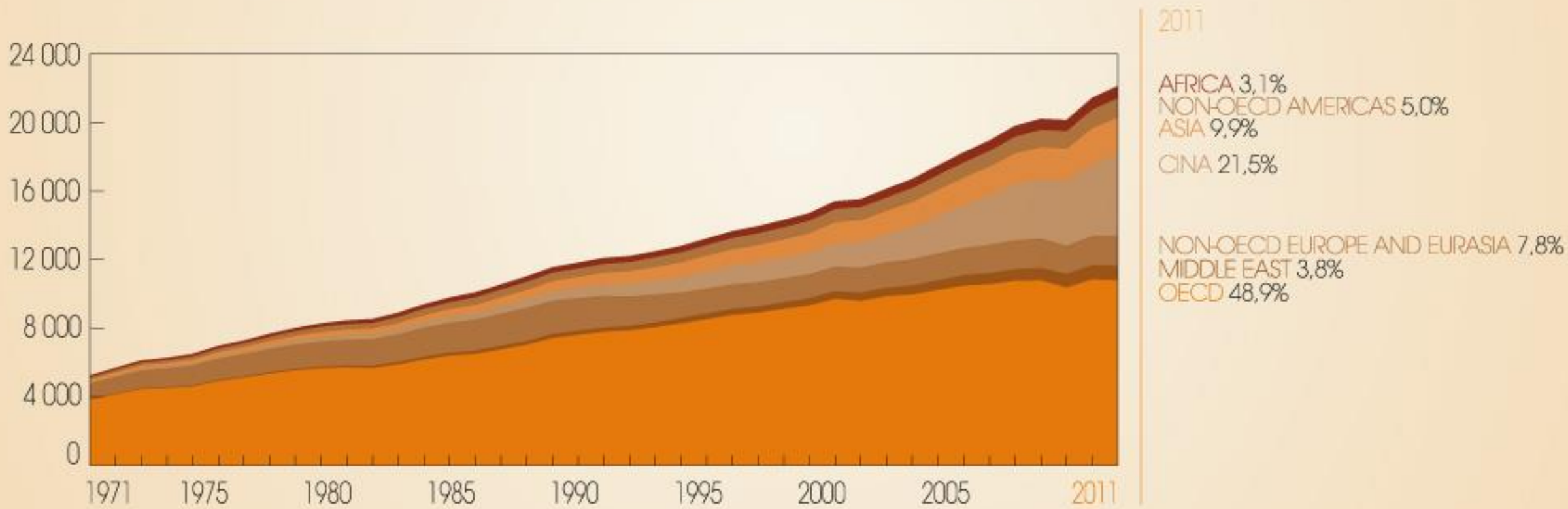
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



ELECTRICITY GENERATION
WORLD

FROM 1971 TO 2011 BY REGION

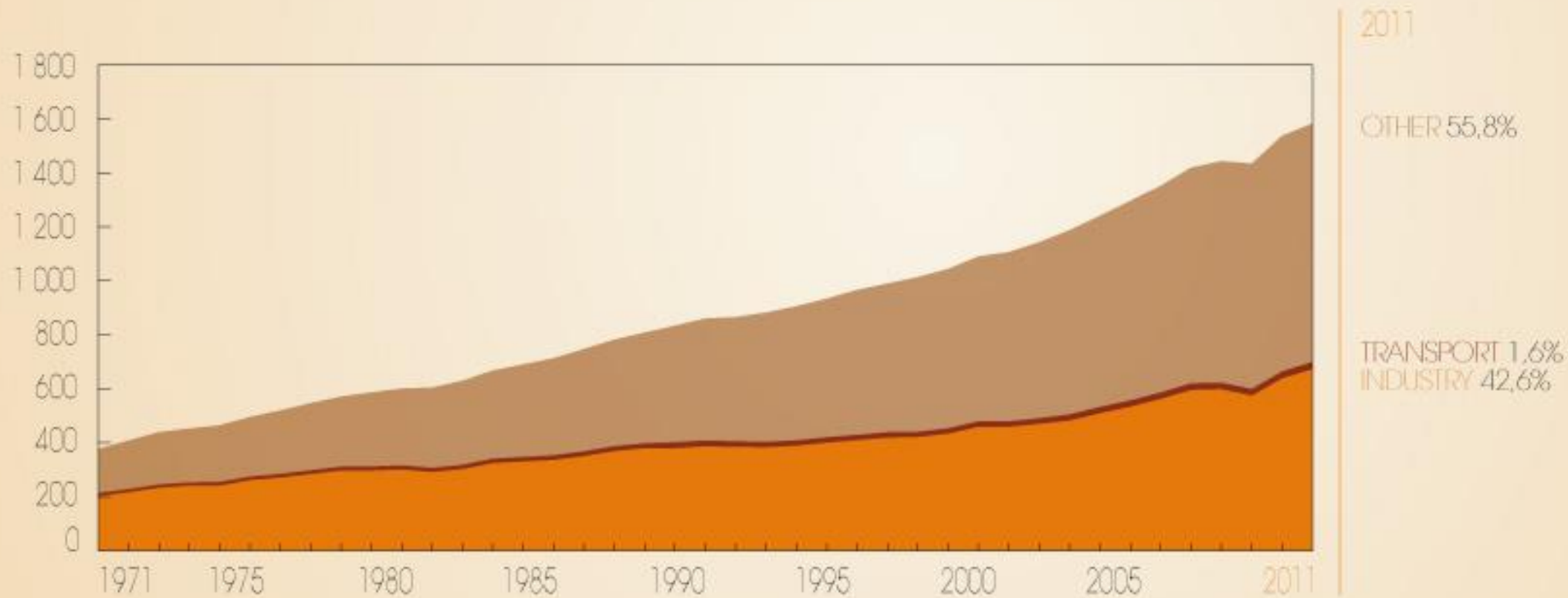
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



TOTAL FINAL ELECTRICITY CONSUMPTION 26
WORLD

FROM 1971 TO 2011 BY SECTOR (Mtoe)

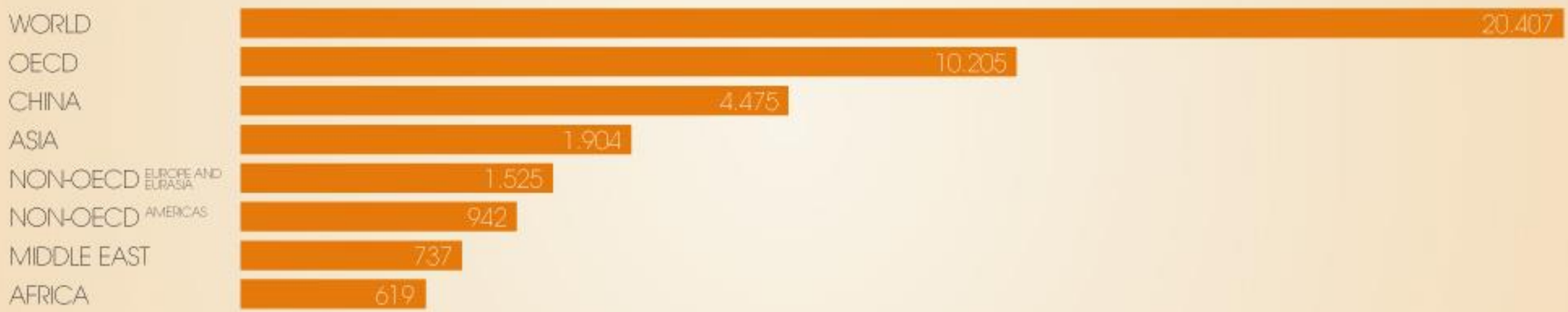
Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



TOTAL FINAL ELECTRICITY CONSUMPTION WORLD

2011 BY REGION (TWh)

Source: IEA (International Energy Agency) - Key World Energy STATISTICS - 2013



ICT DEVELOPMENT INDEX (IDI)
WORLD

ICT TRENDS – ICT DEVELOPMENTS ARE MATURING IN ALL PARTS OF THE WORLD

Source: Measuring the Information Society, MIS2013

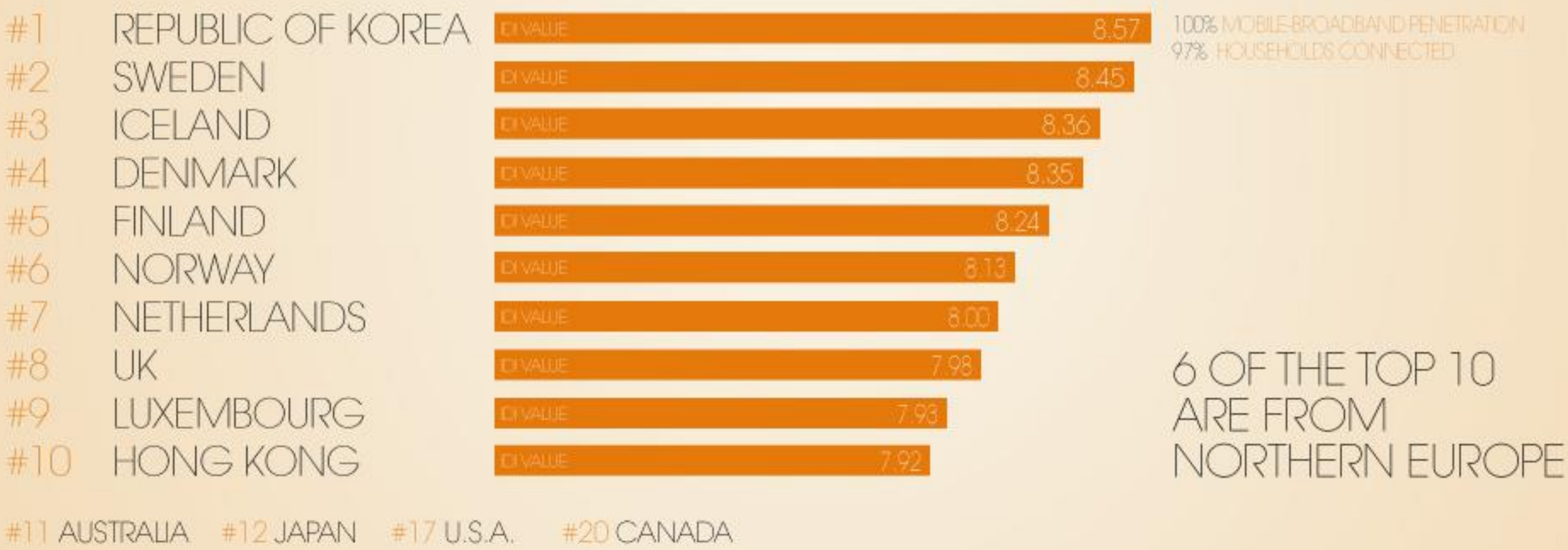
750 MILLION HOUSEHOLDS CONNECTED
6.8 BILLION MOBILE-CELLULAR SUBSCRIPTIONS
50% OF WORLD POPULATION LIVES WITHIN REACH OF A 3G NETWORK
2 BILLION MOBILE-BROADBAND SUBSCRIPTIONS
2.7 BILLION PEOPLE ONLINE

40%

ICT DEVELOPMENT INDEX (IDI)
WORLD

IDI TOP TEN – ECONOMIES WITH THE HIGHEST 2012 IDI VALUE

Source: Measuring the Information Society, MIS2013



ICT DEVELOPMENT INDEX (IDI)
WORLD

IDI DYNAMIC COUNTRIES – ECONOMIES WITH THE GREATEST 2011-2012 IDI RANK/VALUE INCREASE

Source: Measuring the Information Society, MIS2013

ESTONIA +6% GROWTH

75% HOUSEHOLDS WITH COMPUTER AND INTERNET ACCESS AT HOME

LEBANON +136% GROWTH

12% FIXED-BROADBAND PENETRATION

ALBANIA +109% GROWTH

18% WIRELESS-BROADBAND PENETRATION

UAE WENT UP 12 PLACES FROM RANK 45 TO RANK 33

ICT DEVELOPMENT INDEX (IDI)
WORLD

LEAST CONNECTED COUNTRIES (LCCs) – ECONOMIES WITH THE LOWEST IDI VALUES

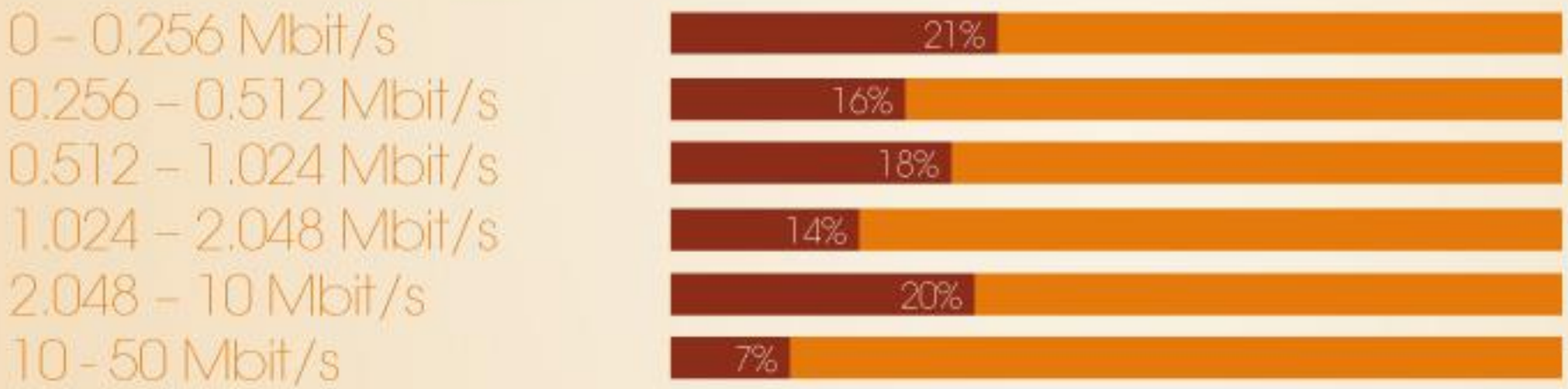
Source: Measuring the Information Society, MIS2013

THE 39 LCCs REPRESENT A TOTAL POPULATION OF 2.4 BILLION WHICH IS MORE THAN A THIRD OF THE TOTAL WORLD POPULATION

FIXED BROADBAND – PRICES GOING DOWN, MINIMUM SPEEDS GOING UP

Source: Measuring the Information Society, MIS2013

MINIMUM ADVERTISED SPEED IN 2012, PERCENTAGE OF COUNTRIES:



FROM 2008 TO 2012 FIXED-BROADBAND PRICES DROPPED: 82%

FROM 2008 TO 2012 SPEEDS HAVE GONE UP: FROM 9% TO 27%
COUNTRIES OFFERING MINIMUM FIXED-BROADBAND SPEED OF 2 Mbit/s OR ABOVE

MEASURING THE COST AND AFFORDABILITY OF BROADBAND WORLD

FIXED-BROADBAND PRICE DIVIDE – LARGE REGIONAL DIFFERENCES PERSIST

Source: Measuring the Information Society, MIS2013

FIXED-BROADBAND PRICES AS A PERCENTAGE OF GNI PER CAPITA, 2012:

MOST AFFORDABLE, EUROPE 1.5% OF GNI P.C.
WORLD AVERAGE, WORLD 22.1% OF GNI P.C.
LEAST AFFORDABLE, AFRICA 64.3% OF GNI P.C.

U.S.A. HAS ONE OF THE MOST AFFORDABLE FIXED-BROADBAND PRICES IN THE WORLD 0.4% OF GNI P.C.
CUBA HAS THE LEAST AFFORDABLE FIXED-BROADBAND PRICE IN THE WORLD 386.9% OF GNI P.C.

MEASURING THE WORLD'S DIGITAL NATIVES

WHO ARE THE DIGITAL NATIVES?

Source: Measuring the Information Society, MIS2013

OUT OF A WORLD POPULATION OF 7 BILLION, 363 MILLION ARE DIGITAL NATIVES WHICH CORRESPONDS TO ONLY 5.2% OF THE WORLD POPULATION

30% OF THE WORLD'S YOUTH (15-24 YEAR OLDS) HAVE BEEN ONLINE FOR AT LEAST FIVE YEARS

5.2%

MEASURING THE WORLD'S DIGITAL NATIVES

DIGITAL NATIVES TOP FIVE

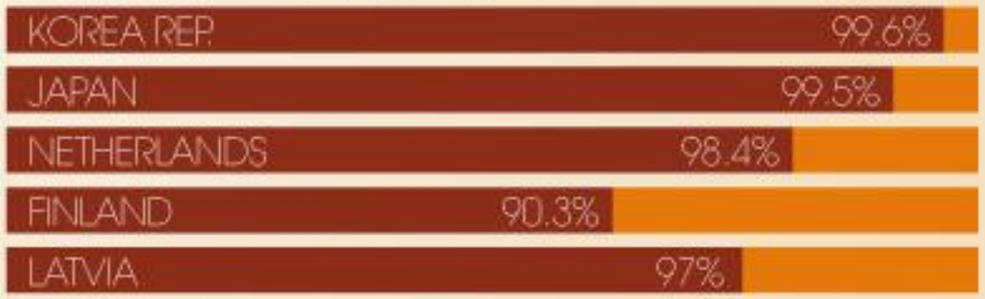
TOP 5 COUNTRIES WITH THE LARGEST NUMBER/PERCENTAGE OF DIGITAL NATIVES

Source: Measuring the Information Society, MIS2013

LARGEST NUMBER OF DIGITAL NATIVES (DN)

DN AS A % OF TOTAL POPULATION

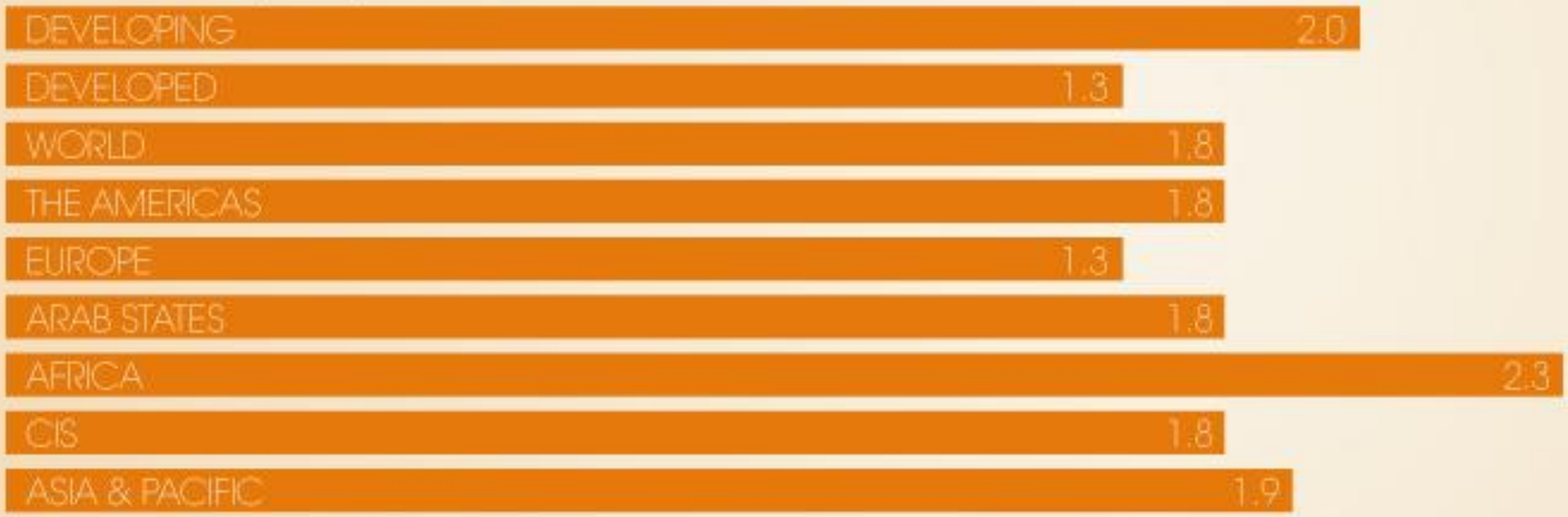
DN AS A % OF YOUTH POPULATION



YOUNG AND CONNECTED
YOUTH ARE MORE CONNECTED ESPECIALLY IN DEVELOPING COUNTRIES

Source: Measuring the Information Society, MIS2013

RATIO OF YOUTH (15-24) INTERNET USAGE TO OVERALL INTERNET USAGE:



MEASURING THE WORLD'S DIGITAL NATIVES

FUTURE TRENDS – THE NUMBER OF DIGITAL NATIVES IS ON THE RISE

Source: Measuring the Information Society, MIS2013

TODAY, GLOBALLY, 56% OF YOUNG INTERNET USERS ARE DIGITAL NATIVES
IN DEVELOPING COUNTRIES LESS THAN ONE IN TWO YOUNG INTERNET USERS ARE DIGITAL NATIVE (47%)
IN DEVELOPED COUNTRIES 86% OF YOUNG INTERNET USERS ARE DIGITAL NATIVE
OVER THE LAST FIVE YEARS THE PERCENTAGE OF INTERNET USERS HAS DOUBLED;
OVER THE NEXT FIVE YEARS THE NUMBER OF DIGITAL NATIVES WILL MORE THAN DOUBLE

56%

THE SUPPORTING NETWORK: TECHNOLOGIES AND PEOPLE TOWARD NEW PARADIGMS

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2nd Workshop
Energy for Sustainable Science
at Research Infrastructures

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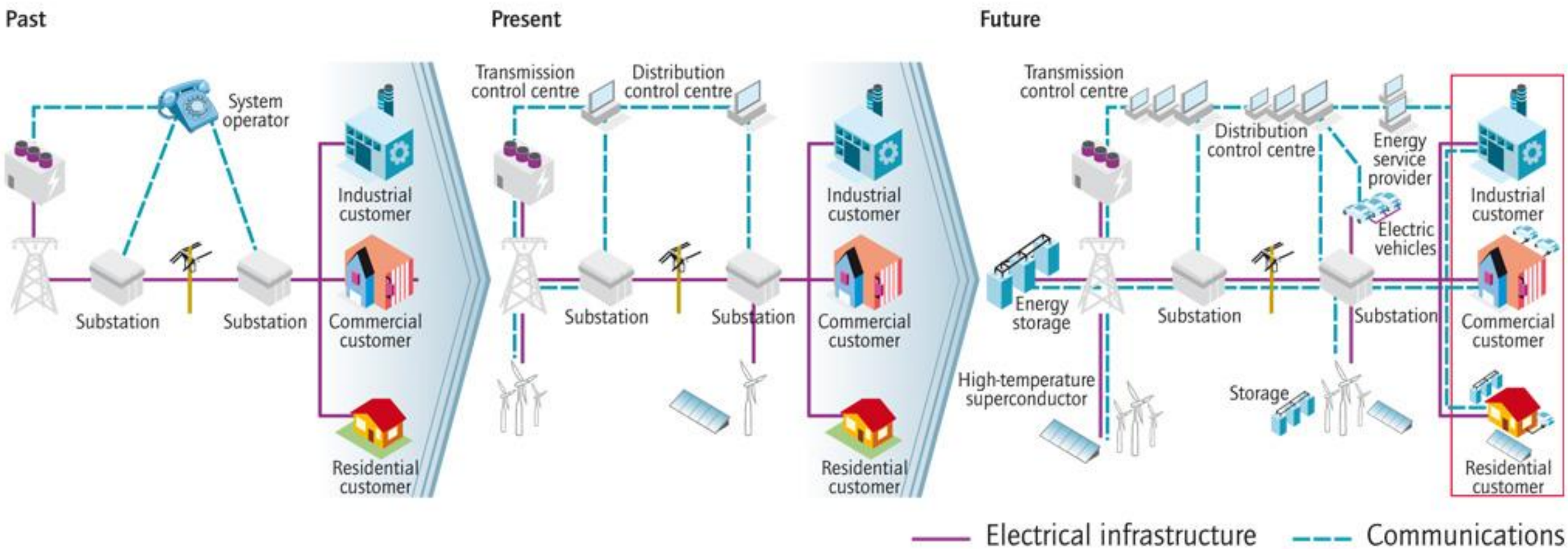
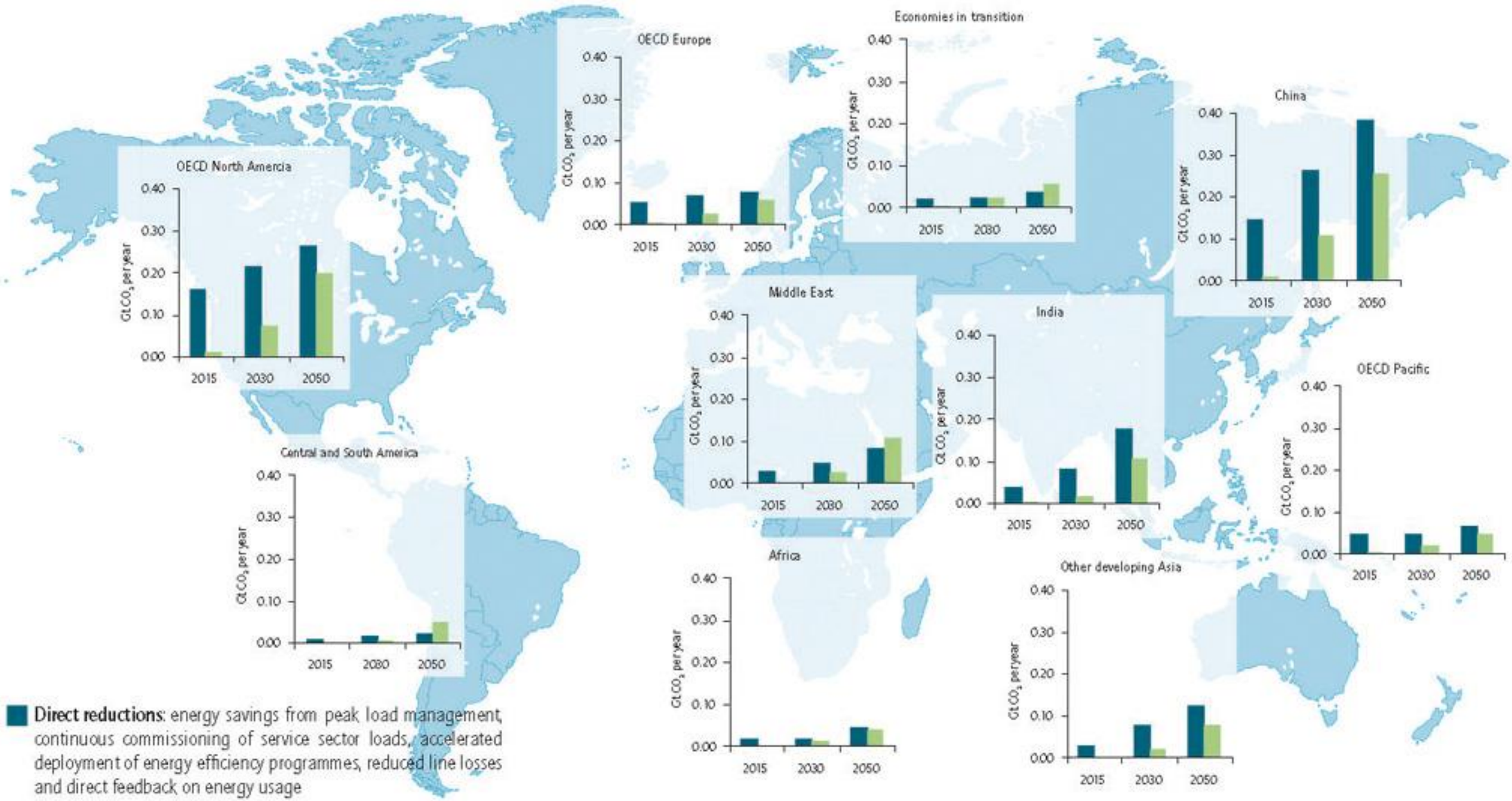
MUSEO NAZIONALE
DELLA SCIENZA E DELLA TECNOLOGIA



Source: Unless otherwise indicated, all material derives from IEA data and analysis.

Future Network Vision



Direct reductions: energy savings from peak load management, continuous commissioning of service sector loads, accelerated deployment of energy efficiency programmes, reduced line losses and direct feedback on energy usage

Enabled reductions: greater integration of renewables and facilitation of EV and PHEV deployment

THE SUPPORTING NETWORK: TECHNOLOGIES AND PEOPLE TOWARD NEW PARADIGMS

FIORENZO GALLI · MUSEO NAZIONALE DELLA SCIENZA E DELLA TECNOLOGIA

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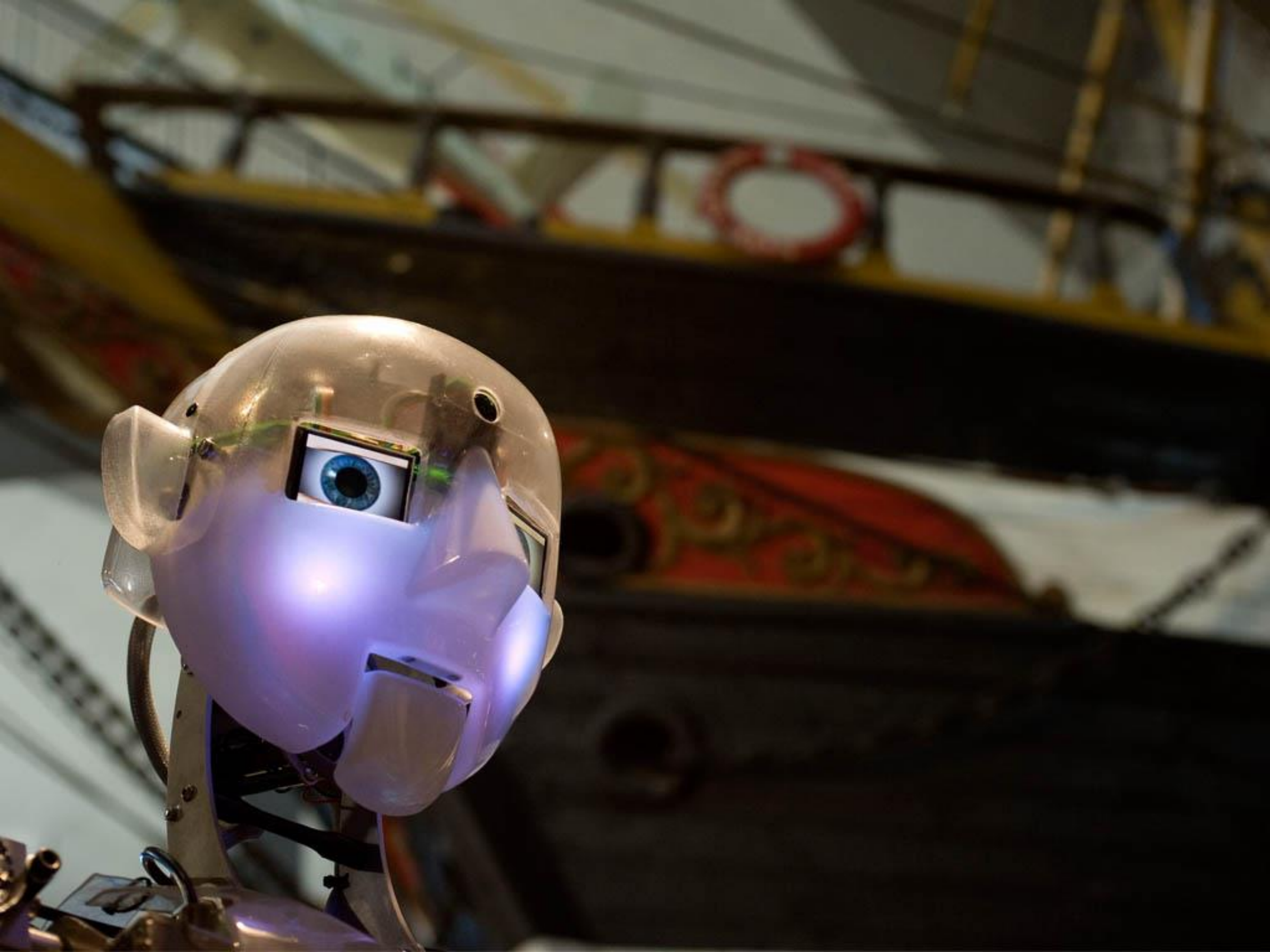
2nd Workshop
Energy for Sustainable Science
at Research Infrastructures

CERN
GENEVA, SWITZERLAND
23 OCTOBER 2013

FIORENZO GALLI
MUSEO NAZIONALE
DELLA SCIENZA E DELLA TECNOLOGIA

CLEVER
INTERACTIVE
STAFF



GALLI
Italy

STAFF

ECSITE
ANNUAL
CONFERENCE
MILAN
2009
ECSITE
ANNUAL
CONFERENCE
MILAN
2009

ECSITE
ANNUAL
CONFERENCE
MILAN
2009
RED ROOM
9.00 – 10.30
BIRTH AND FUTURE OF A NEW MODEL: CAN THIS BE THE "MUSEUM CENTRE"?

the rules
Where
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Not w thin a conce t
1+ 6+5+2=

[STAFF]

中國科學技術館
CHINA SCIENCE AND TECHNOLOGY MUSEUM

Un ta la toccare?
Qui trovi d agini e curio
per sa
nenti trascinandoli fu
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me un libro
-mail
table?
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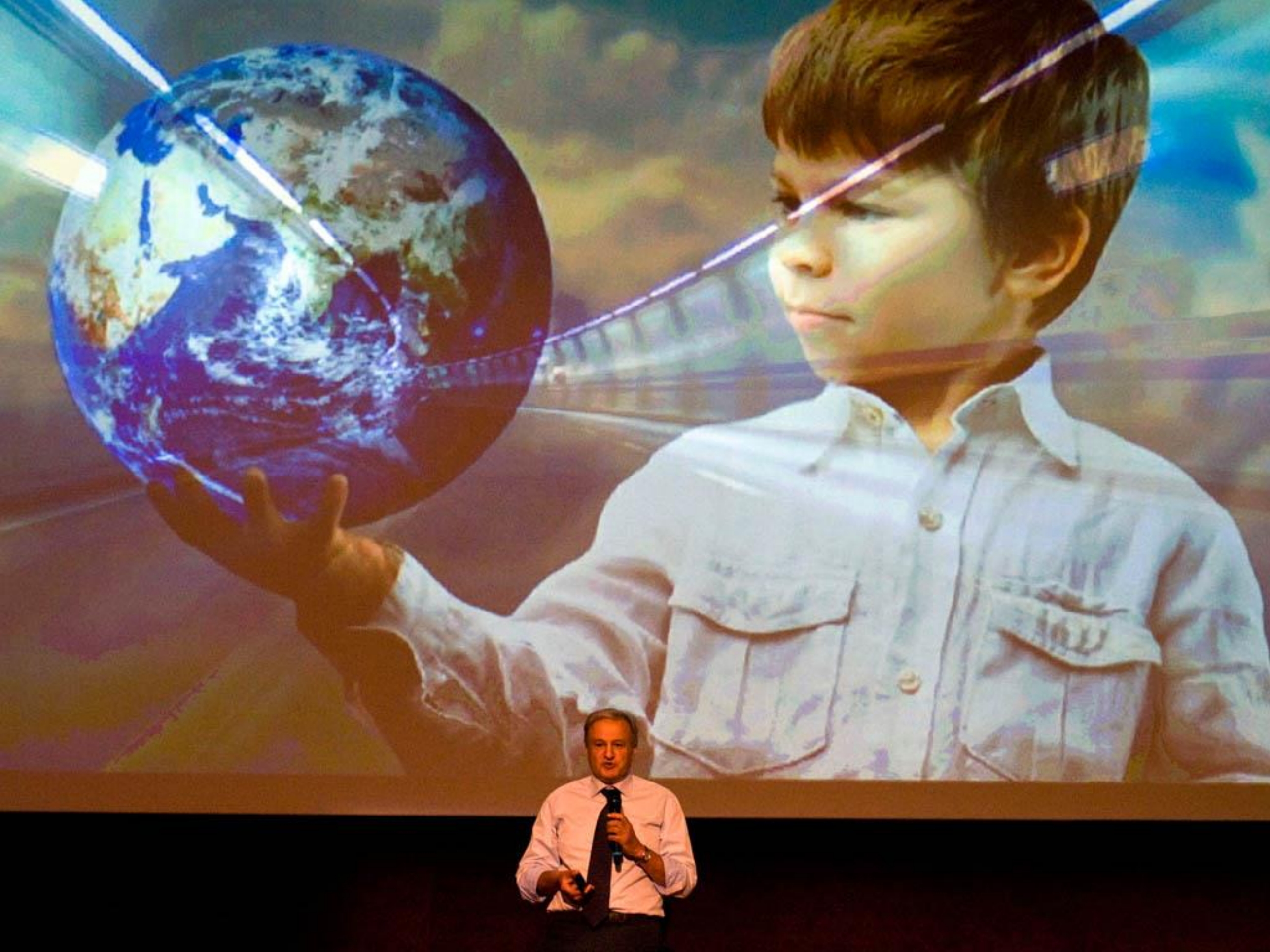
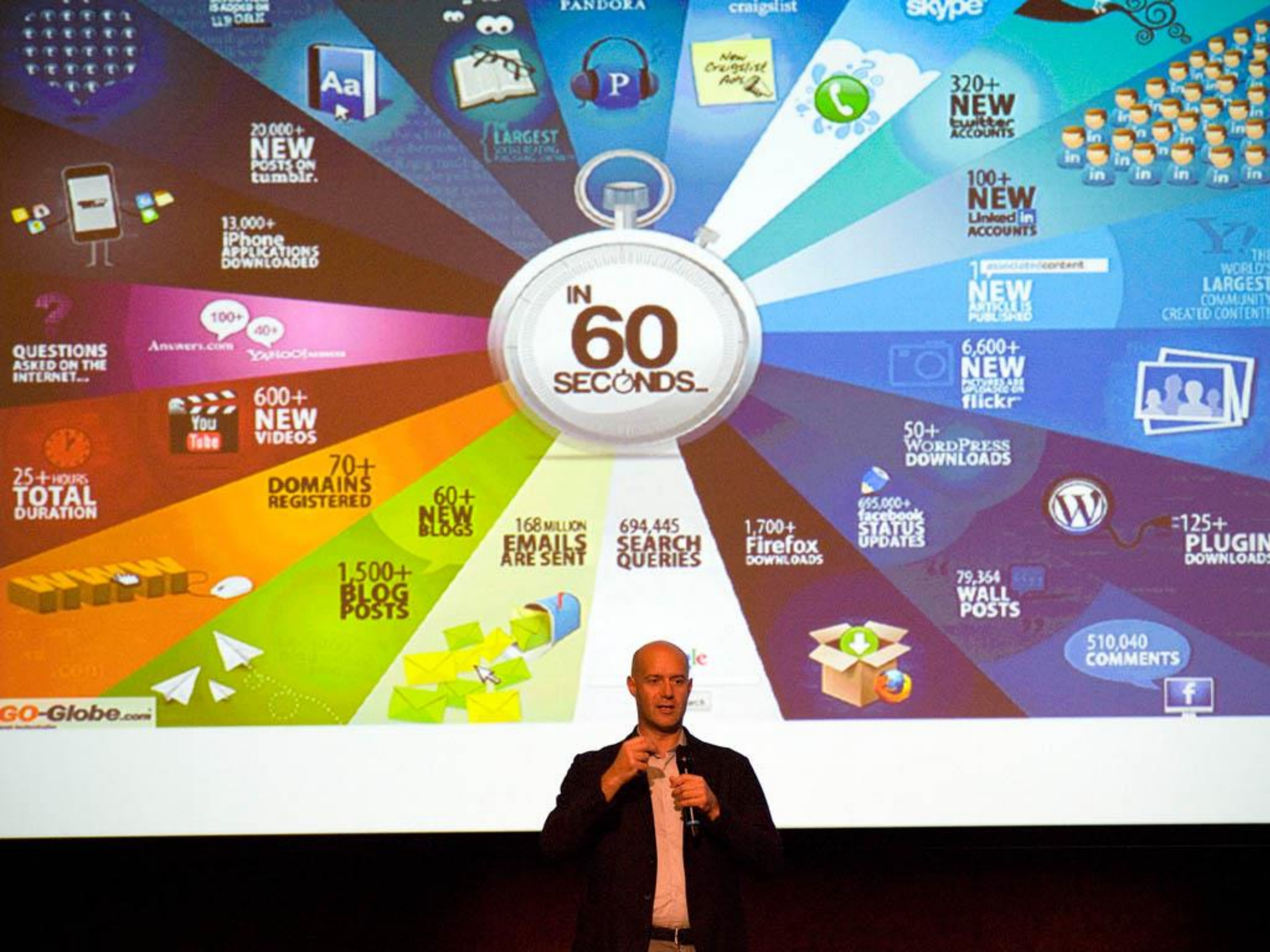
the documents with your fingers
ver



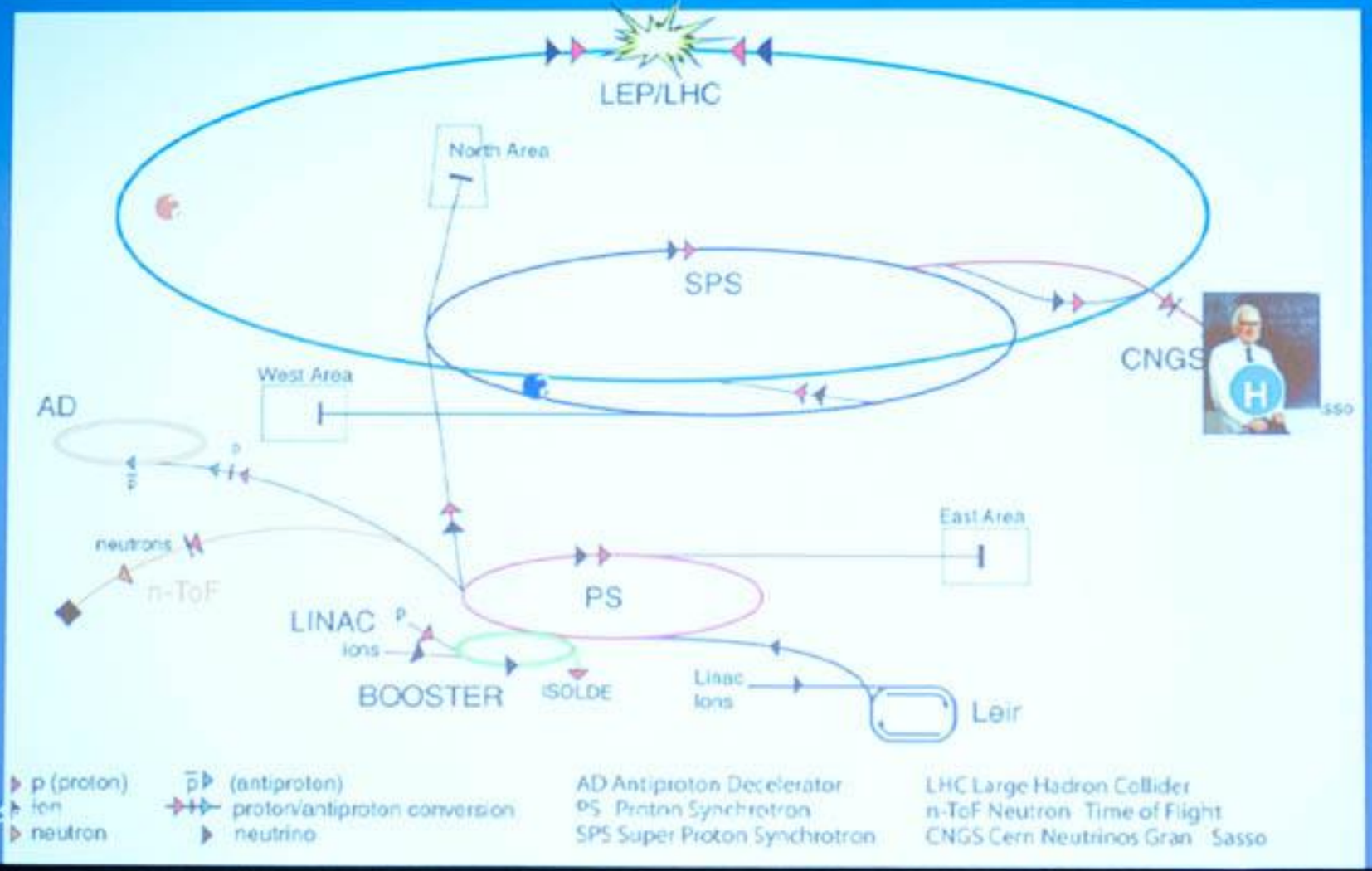
POLITECNICO
DI MILANO
POLITECNICO
DI MILANO

QUANTO
SEI
NANO?
ROBOTICS


PANDORA
craigslist
skype
20,000+ NEW POSTS ON tumblr.
LARGEST
320+ NEW twitter ACCOUNTS
100+ NEW LinkedIn ACCOUNTS
13,000+ iPhone APPLICATIONS DOWNLOADED
IN 60 SECONDS...
NEW ARTICLES PUBLISHED
THE WORLD'S LARGEST COMMUNITY CREATED CONTENT
QUESTIONS ASKED ON THE INTERNET...
Answers.com
100+
40+
6,600+ NEW flickr
600+ NEW VIDEOS
50+ WordPress DOWNLOADS
25+ HOURS TOTAL DURATION
70+ DOMAINS REGISTERED
60+ NEW BLOGS
168 MILLION EMAILS ARE SENT
694,445 SEARCH QUERIES
1,700+ Firefox DOWNLOADS
665,000+ facebook STATUS UPDATES
125+ PLUGIN DOWNLOADS
1,500+ BLOG POSTS
79,364 WALL POSTS
510,040 COMMENTS
GO-Globe.com

Il peperoncino aiuta a proteggere le arterie
VERO
Il peperoncino ha proprietà vasodilatatorie che stimolano la circolazione ed equilibrano la pressione arteriosa
contains more calories than sugar
1g of alcoho
while 1g
has 3.

CERN: la catena di acceleratori, valorizzando il passato (la tradizione)



LEONARDO
E IL CANTIERE
DEL DUOMO
DI MILANO
What do Leonardo da Vinci
and the Cathedral of Milan have in common?

GLI OGGETTI | MAPPA DEL PERCORSO

1 CENTRALE TERMOELETTRICA REGINA MARGHERITA

Torna alla presentazione del percorso

1895

Chi vi dà il benvenuto fin dal vostro arrivo al Museo?

Il fascino della Regina Margherita è legato alla sua imponenza e storia. Utilizzata nel setificio Gavazzi di Desio per azionare elettricamente 1800 telai e illuminare i locali, viene inaugurata alla presenza della famiglia reale e racconta di un'epoca in cui l'industria italiana andava gradualmente elettrificandosi. La sua motrice rappresenta un'eccellenza nella storia dell'industria meccanica: le Officine Franco Tosi di Legnano. Un mondo tecnico animato da affetti come il legame tra il fondatore del Museo Guido Ucelli e la moglie Carla Tosi.

00:51

Visualizza l'oggetto sulla mappa

Approfondisci sul sito del Museo

Consiglia 11 Tweet 3

2 RIVELATORE UA1

3 LEONARDO DA VINCI: LA COLLEZIONE DI MODELLI

IL MUSEO
DA NON PERDERE
60

INFN
Istituto Nazionale
di Fisica Nucleare

Interattoma
rete di inte
Yeast protei

A MENTE FREDDA
NEL RISCALDAMENTO GLOBALE
Un'intera giornata dedicata ai cambiamenti climatici per distinguere
tra fatti ed effetti, dati e interpretazioni, conclusioni scientifiche e posizioni etiche,
cambiamenti e catastrofi, strategie globali e azioni locali.
lunedì 30 marzo 2009
MITSUBISHI ELECTRIC
museo nazionale della scienza e della tecnologia leonardo da vinci

LEONARDO DA VINCI AND THE TRADITION OF MANUFACTURING SPIRIT
Fiorenzo Galli
Director General
Museo Nazionale della Scienza e della Tecnologia Leonardo da Vinci
Milan - Italy
Sakai – Chamber of Commerce and Industry – October 3rd 2013
MUSEO NAZIONALE DELLA SCIENZA E DELLA TECNOLOGIA LEONARDO DA VINCI

NEWS
NEWS
Migliorare la rete
mmenti
del Museo.
i punti
na giungla
erte.
guardare
Listen to the news and comments
chosen by Museum visitors.
The sources are reliable but not
everyone thinks alike: it is a jungle
of open questions and opinions.
If you don't just want to watch,
make your TV news programme
using the station behind you.

Trace the energy flow
from your home back
to the source of
VIO DI
ERGIA!
We need
energy!

ndo

OVIMENTO
OLAZIONE
CITÀ

area pedonale
1907

MUSEO
NAZIONALE
DELLA SCIENZA
E DELLA
TECNOLOGIA
LEONARDO
DA VINCI
OPEN
NIGHT

TYPHOON
BASI
LAUGE
BASE
ACIDI

per favore disturbami.

I nanotecnologi sono al Museo per studiare le proprietà dei materiali nanostrutturati e per confrontarsi con te. Hai qualche curiosità sulle nanotecnologie? **Chiedi ai ricercatori.**

please disturb.

Nanotechnologists are here to study the properties of nanostructured materials and to talk with you. Interested in nanotechnologies? **Ask the researchers.**

AREA NANOTECNOLOGIE
NANOTECHNOLOGY AREA
TYPHOON

DOVE È
STATA PURTROPPO
SU CHE VALORI
SI REGGEVA?

19.30 - 20.30
DIETRO LE QUINTE:
COMUNICARE LA RICERCA
IN TV E SUI GIORNALI
OPEN NIGHT

20.30 - 21.30
SPAZIO:
IN VIAGGIO VERSO MARTE
Mauro Massari, Dip. Scienze e Tecnologie Aerospaziali, Politecnico di Milano
Cesare Lobascio, Head of Space Flight, Environment and Habitat,
Thales Alenia Space Italia
MODERA: Giovanni Caprara, Resp. pagine scientifiche, Corriere della Sera
OPEN NIGHT
NOTTE DEI RICERCATORI
MUSEO NAZIONALE DELLA SCIENZA E DELLA TECNOLOGIA LEONARDO DA VINCI

Node 3
Cupola
50% habitable volu
designed & integra

sciencemuseum

scienza e
cultura
ORARI DI APERTURA
OPENING TIMES
MARTEDÌ - VENERDÌ
9.30 - 17.00
SABATO E FESTIVI
9.30 - 18.30

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