

The European Commission's science and knowledge service

Joint Research Centre

Darren McGarry

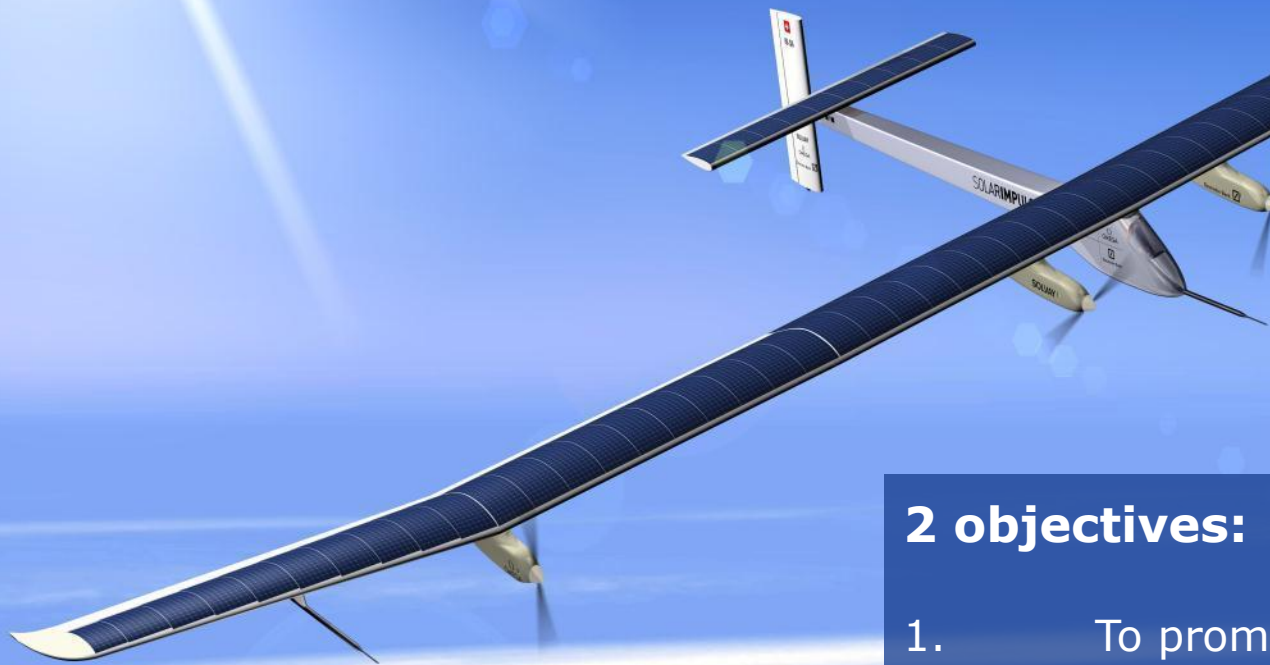
Communication Energy, Transport & Climate

Visualisation Workshop



Solar impulse 2

- Innovative science, pioneering materials
- 5 month journey, No fossil fuel
- 2 pilots will fly 35000 km
- 1700 solar cells, 72 m wing span



2 objectives:

1. To promote pioneering materials
2. To promote clean energy



"The success of the project will not just depend on the spread of its wings but also on the spread of its message"...

BBC world news



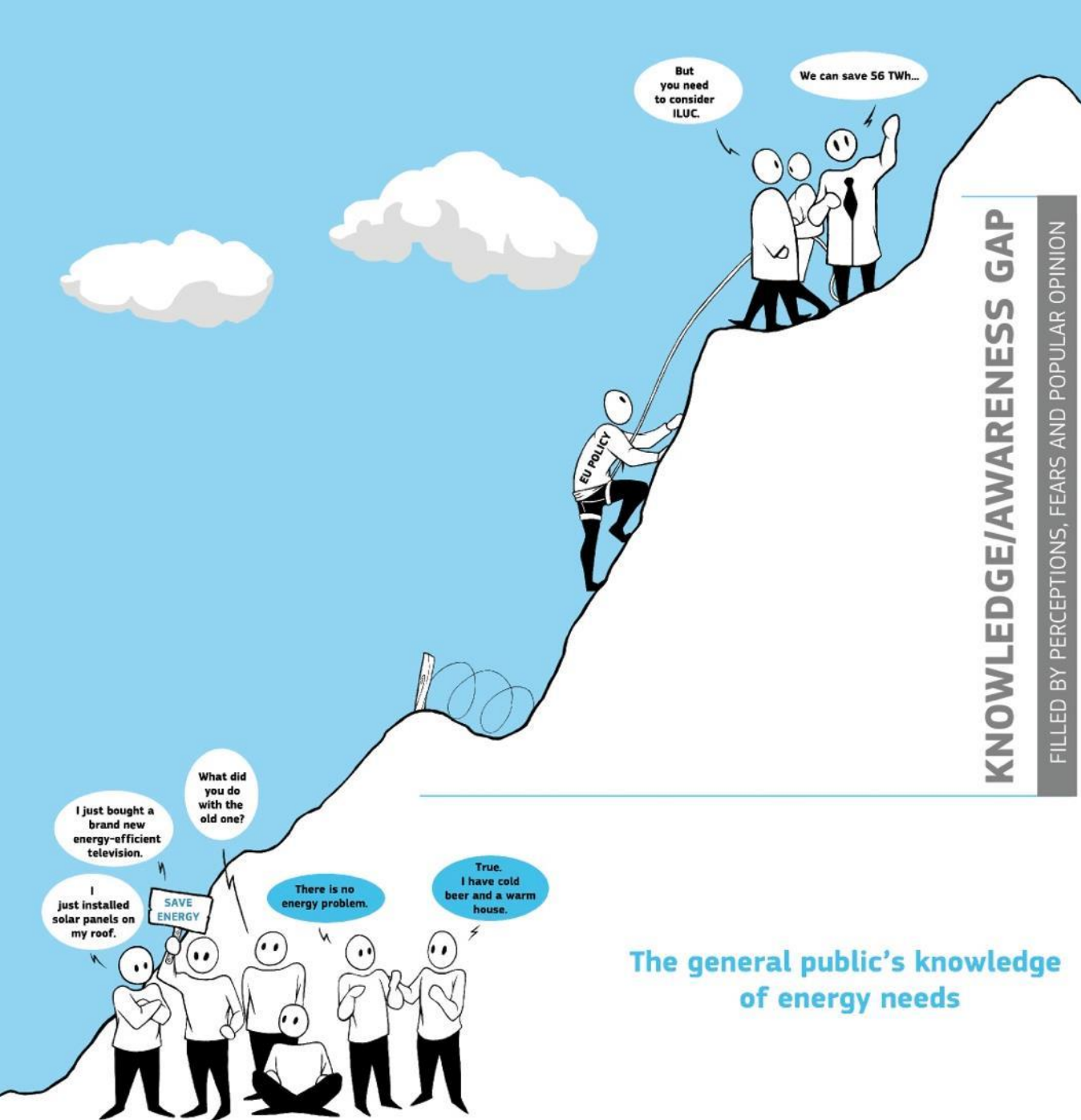
©SolarImpulse/EPEI, 2009

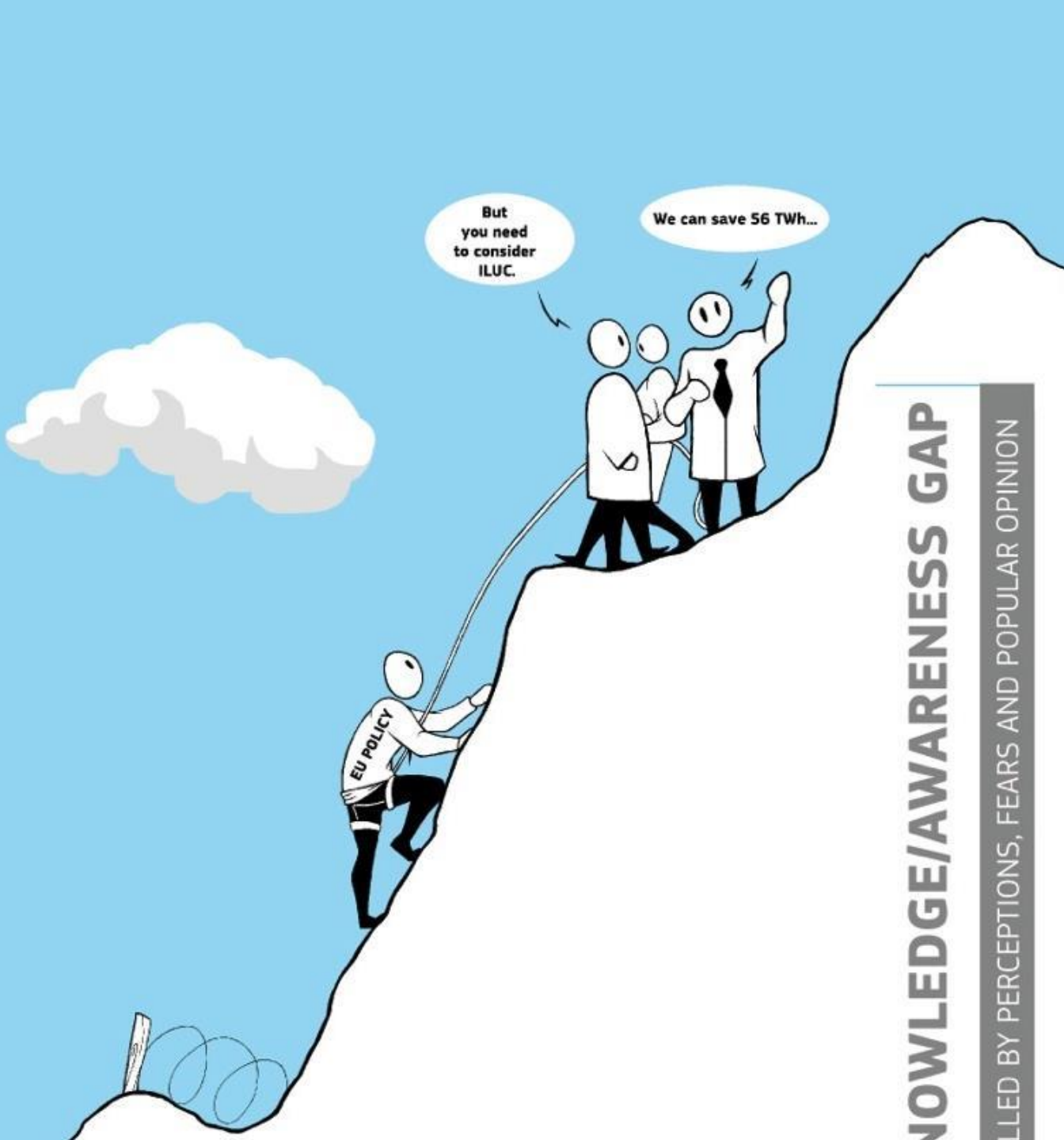


Society is facing many challenges

- From energy to migration, & food to environment

Acceptance & implementation of technologies & policies relies ultimately on support from EU citizens



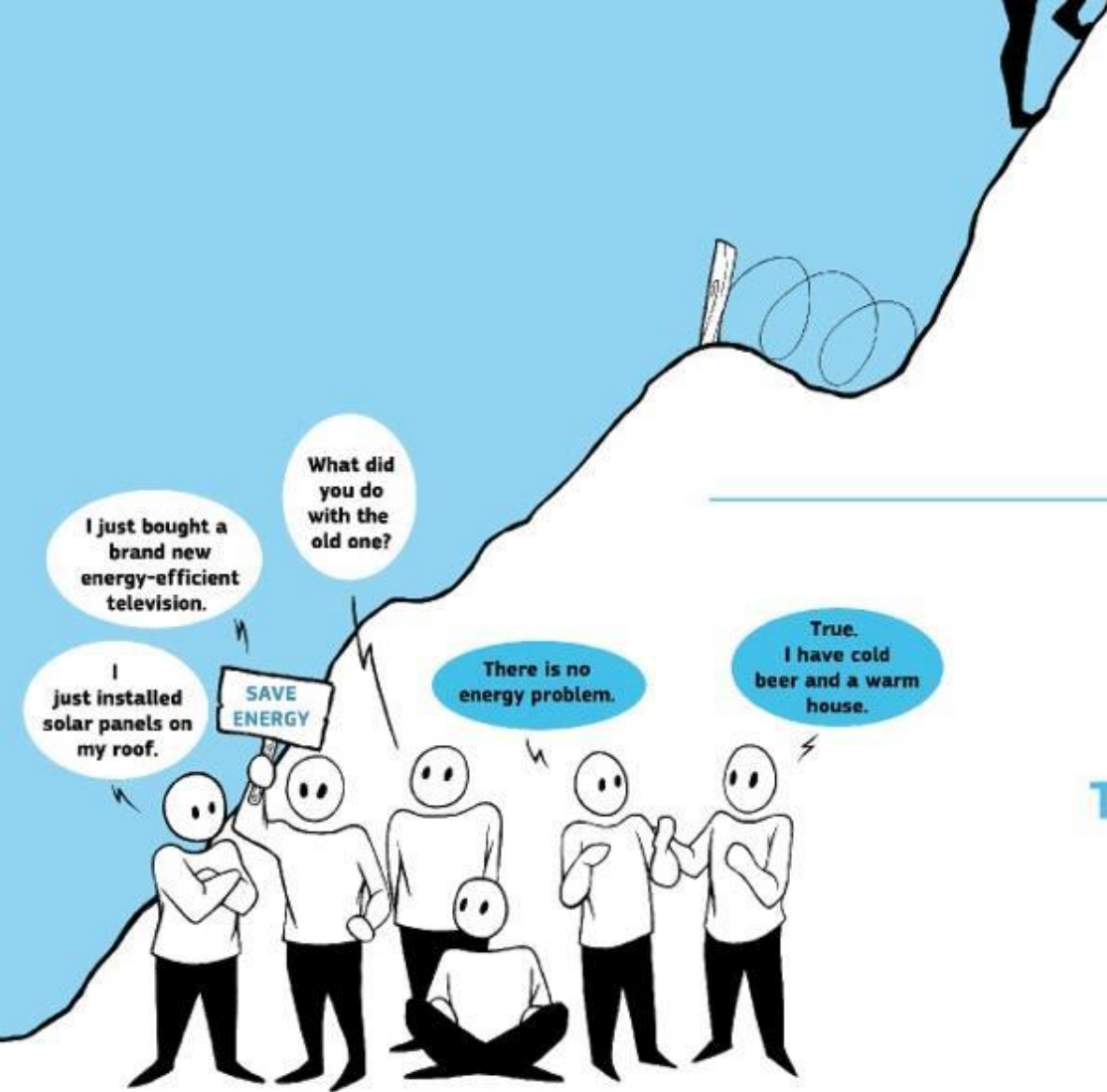


KNOWLEDGE/AWARENESS GAP

DRIVEN BY PERCEPTIONS, FEARS AND POPULAR OPINION



European
Commission



The general public's knowledge of energy needs



WHY..... removing the barriers

Public Awareness & Knowledge

If citizens are not aware or do not have the knowledge to make a balanced decision

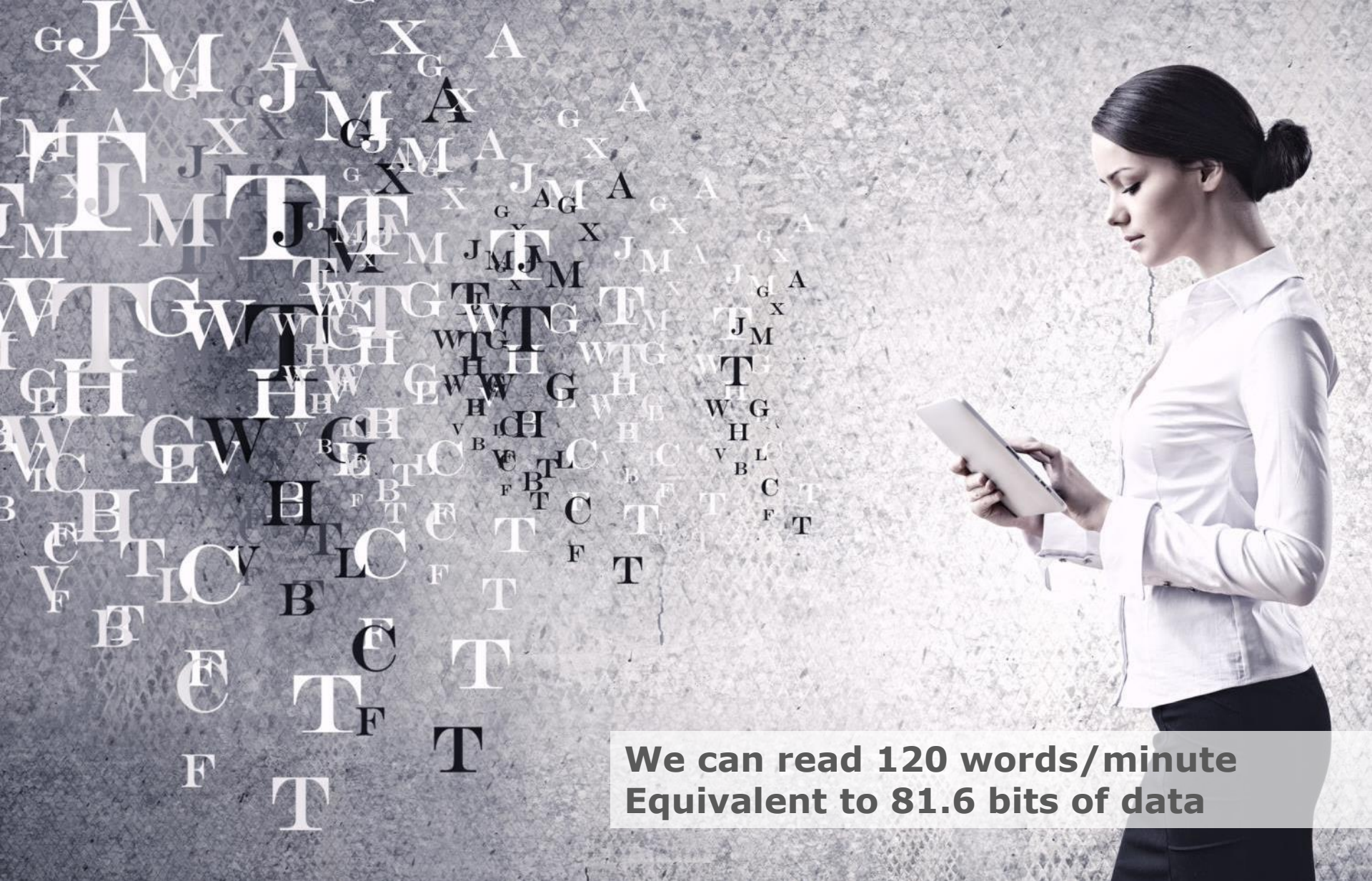
- ❖ Can form major barrier to the implementation of Policy & Technologies
- ❖ Wastes millions of investment, negative climate for investment
- ❖ Results in the escalation of the problem



Need to get messages across



Brain receives 8.96 megabytes of data from eye /second

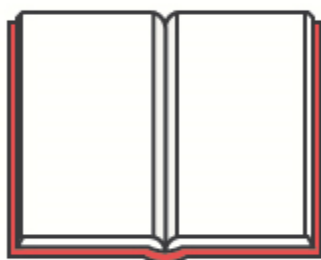


**We can read 120 words/minute
Equivalent to 81.6 bits of data**

Visual Communication is in our DNA

- ❖ Your data/information is only as good as your ability to communicate
- ❖ Choose the correct means to visualise
- ❖ There is a need to identify key messages
- ❖ Create a story

THE HUGE INCREASE IN VISUALIZED INFORMATION...



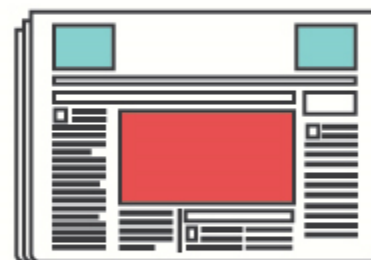
400%

in literature
(since 1990)



9900%

on the internet
(since 2007)



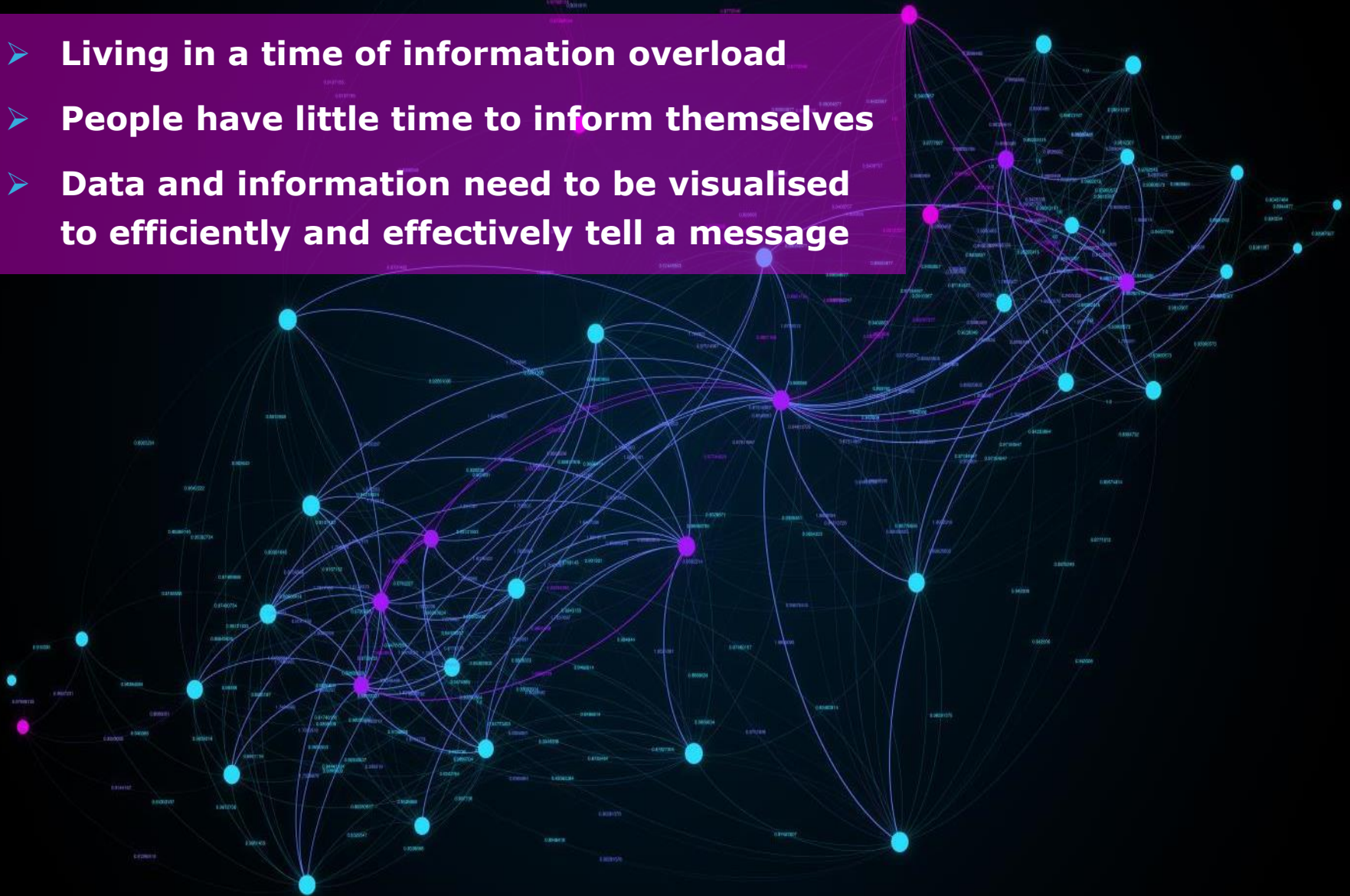
142%

in newspapers
(between 1985 & 1994)



European
Commission

- **Living in a time of information overload**
- **People have little time to inform themselves**
- **Data and information need to be visualised to efficiently and effectively tell a message**





➤ **Fantastic tool**

➤ **We visualise fast**

➤ **Visualisation helps to analyse, see trend, patterns**

➤ **Make choices / decisions**

➤ **Discover**

➤ **To create / support a story**

➤ **Teach**



Fundamental Building Blocks

- Environment, perceptions, culture and education, style of language.
- Target young people (students of today voters of tomorrow).
- Education, training and communication a strategic activity, not an afterthought.



**IAEA / EU / nuclear ind. /nuc.
Medical ind.**

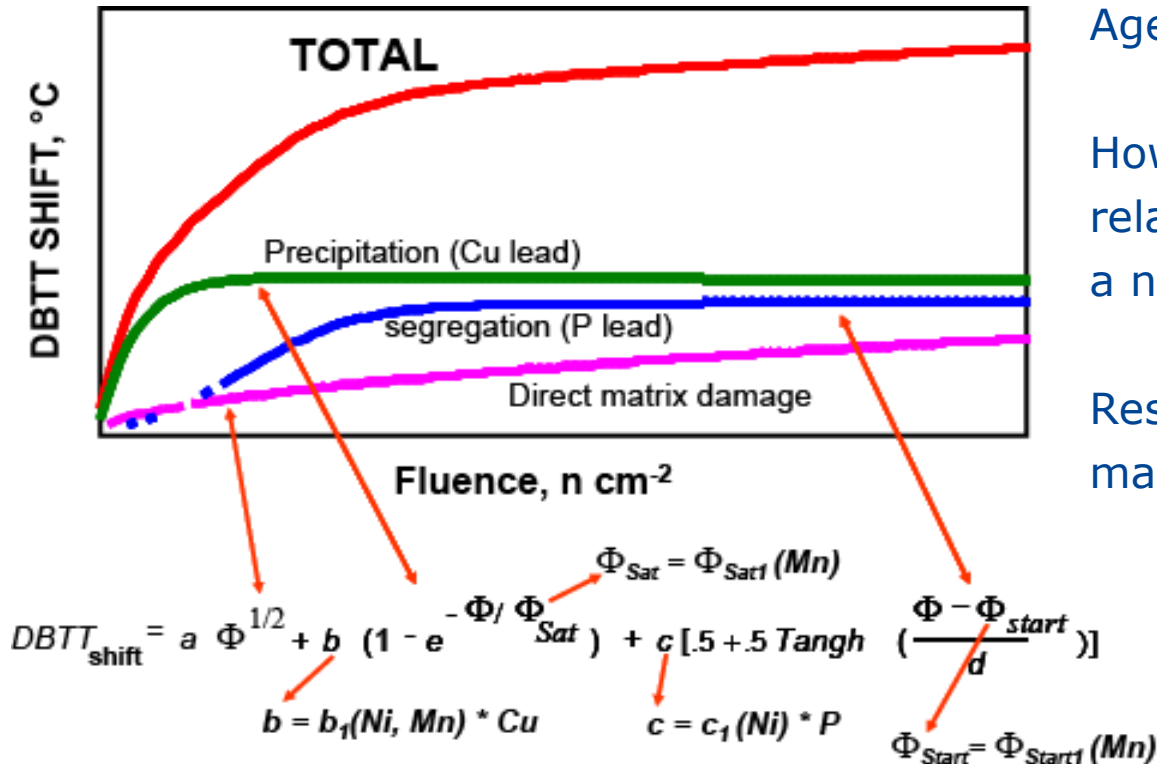


EU and IAEA review nuclear cooperation
9 February 2015





Exercise - Communication Innovation

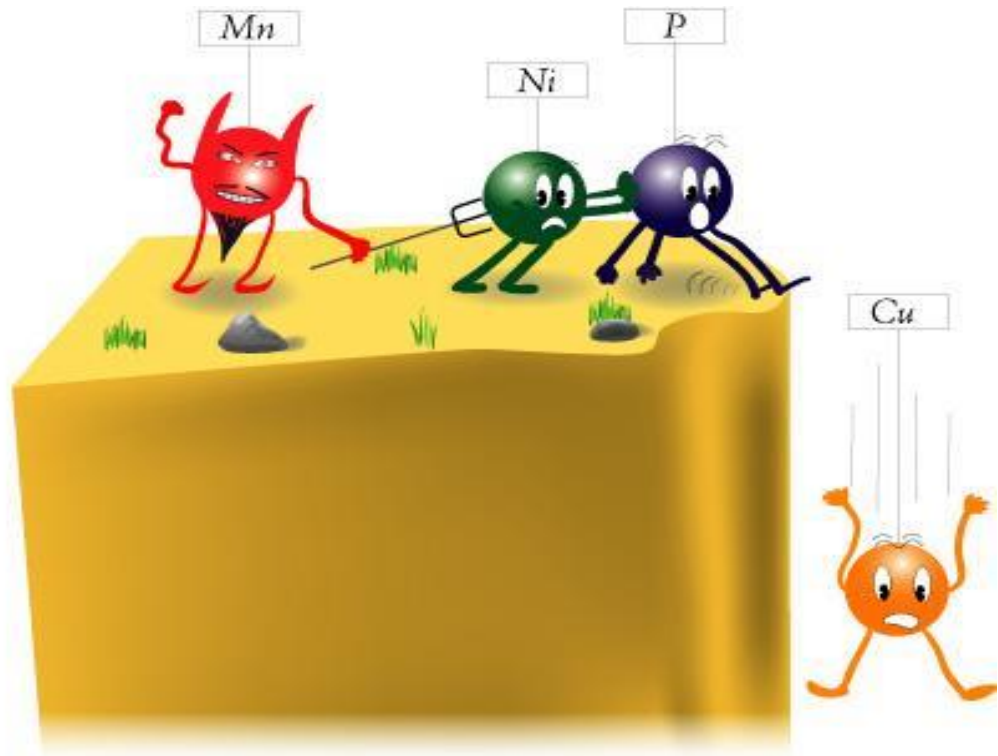


Ageing Nuclear power plants

How is it possible to present relatively complex information to a non-technical audience ?

Research Reactor located near to many agricultural companies

Getting the message across





What is the key message?

KEY FINDINGS FROM WEU'S O&M RESEARCH

5.9 GW of
combined
wind
capacity

Collected
in Europe
between 1993
and 2009

About 180,000
years of
operational
projects

Analyzed using
WindRAT
software by
Sciensus

FINDING 1

Electrical components are the leading
cause of lost days per year:

50%
of instances of
turbine failure



60%
of days lost
per year



- However electrical components failures have a relatively low duration, they are fixed really quickly, causing on average outages of less than one day.

Failure rates by sub-component for global turbine peer group

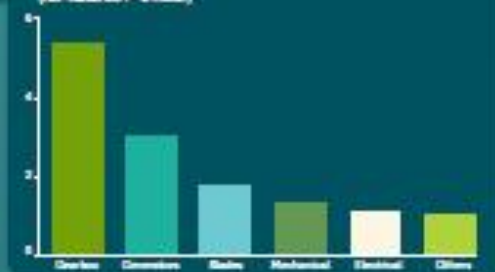


FINDING 2

Gearboxes fail rarely but when they do they cause the longest outages:

- Gearboxes stand on the other side of the spectrum. Although gearbox failures account for less than 5% of total failures, they cause the longest outages. The average gearbox outage in our research group lasts 5.4 days, compared to just under one day for the average electrical failure.
- This is due to the greater difficulties in repairing turbines at greater heights and also the inherent complexity of this component.
- However, electrical components fail more often and account for 2.11 days lost over the turbine lifetime, the highest number of days lost per component group.

Average component outage duration per turbine (for failures > 1 hour)

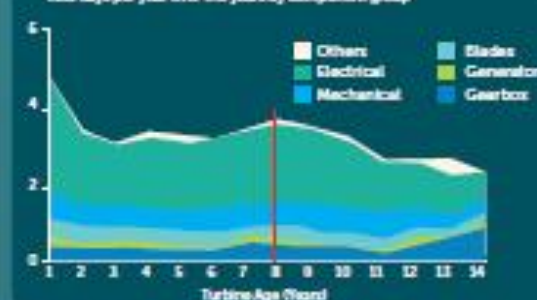


The average gearbox outage in our research group lasts 5.4 days

FINDING 3

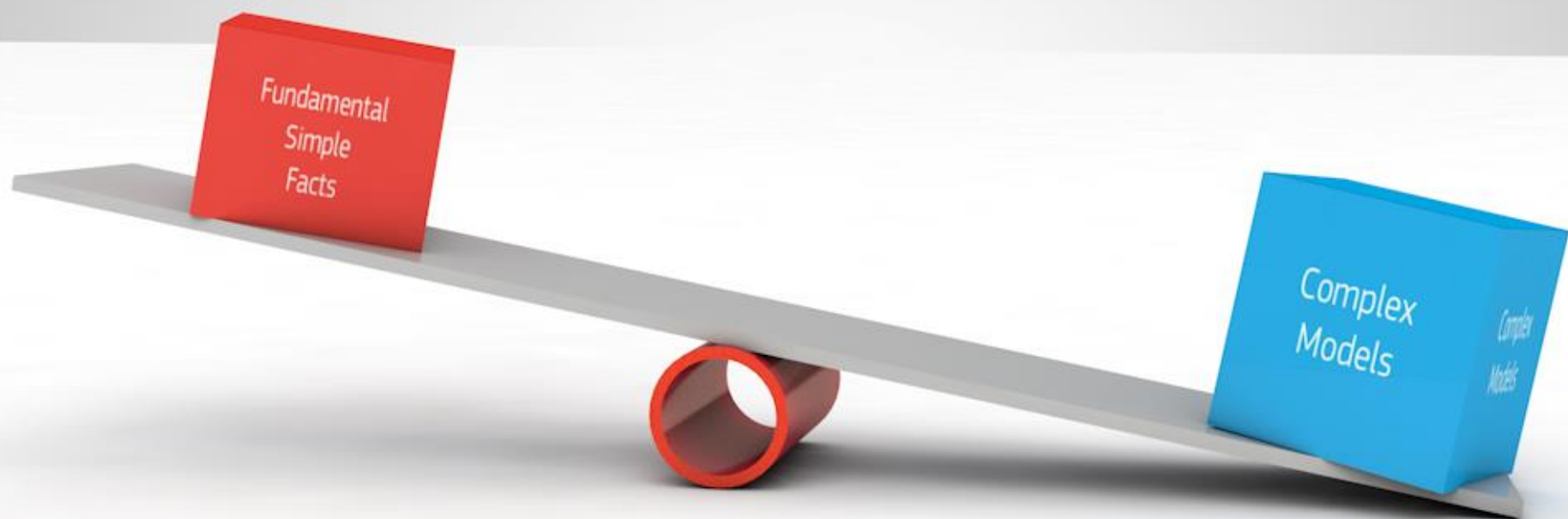
Turbines have a higher failure rate
in the early years

Lost days per year over the years by component group



It is not well known why but the highest number of problems is encountered shortly after commissioning, causing the highest number of days lost per year. Then lost days per year decline sharply by the second year of operation. From then it peaks at year 8 before decreasing, overall, for the lifetime of the turbine.

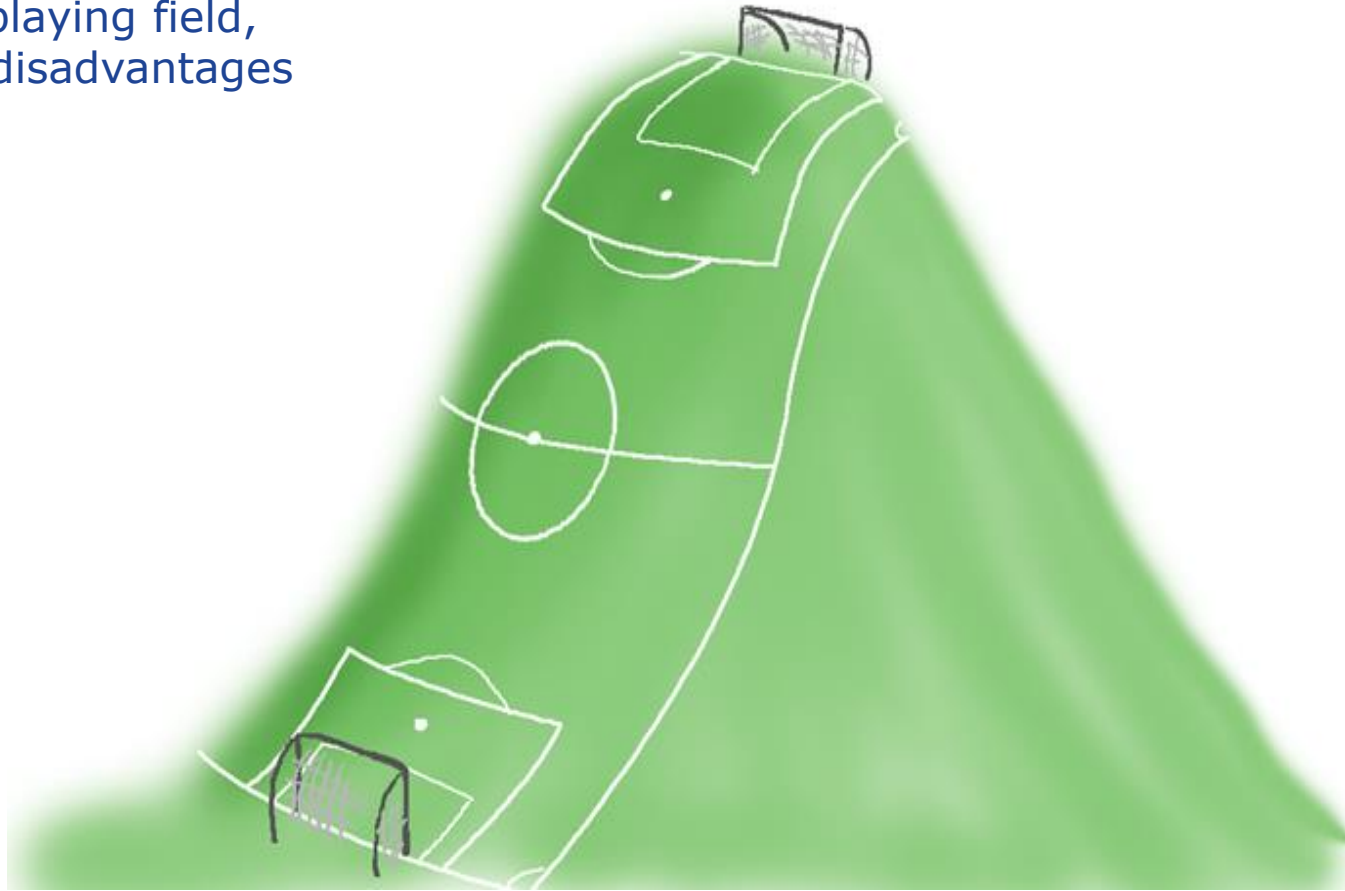
These facts were all extracted from the Wind O&M Report 2016
[DOWNLOAD THE FULL REPORT BROCHURE HERE](#)





Fundamental Building Blocks

- Creating a level playing field, advantages and disadvantages



Is it this Simple?....

.....we need to understand what citizens
/stakeholders think



The Institute
for Energy
and Transport
Energy Beyond Tomorrow

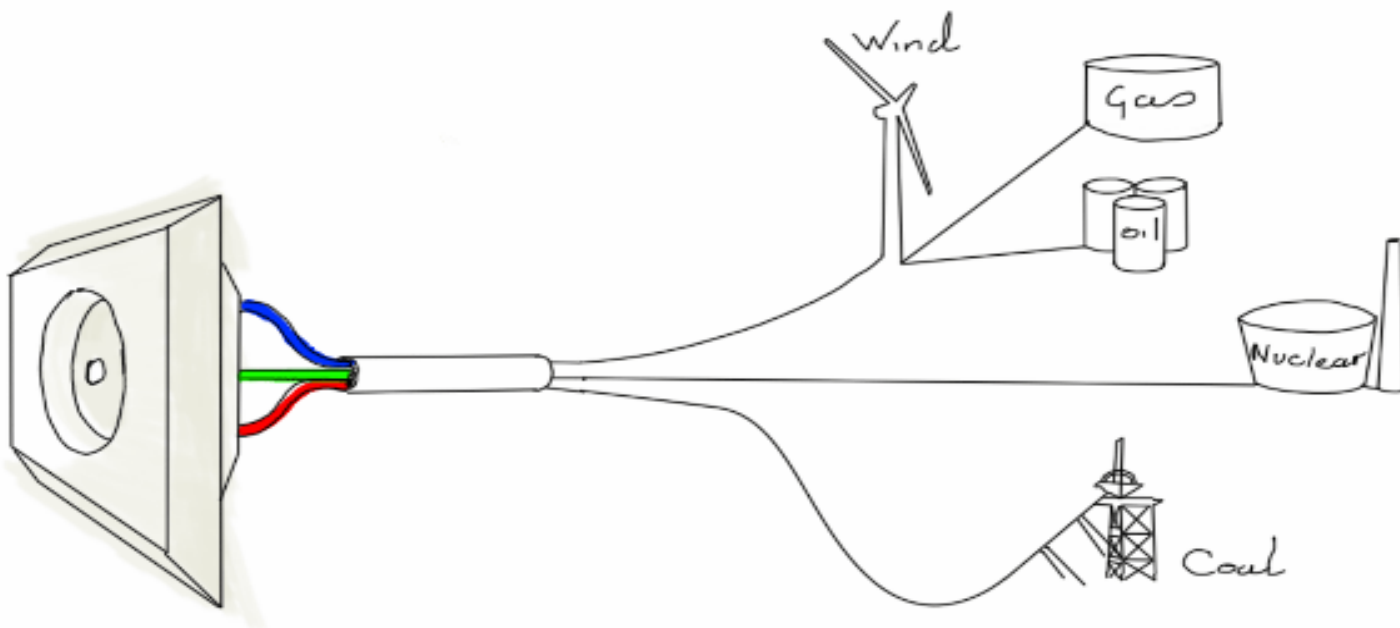
The JRC

Scientific & technical support
for policy makers






Be Visual.....
Does the story end here.....



Base load, Energy security



The world of tomorrow
needs answers that last.

That's why we're building them today, with customers all over the world.

Be Visual

YouTube passed FaceBook as largest social media site

- 20% of citizens are influenced by what they read
- 83% by what they see

WE DISCOVER
THE VARIETY
OF ENERGY



COAL
POWER



1 batch

of cupcakes made by only 1 kWh of energy

JRC – JOINT RESEARCH CENTRE

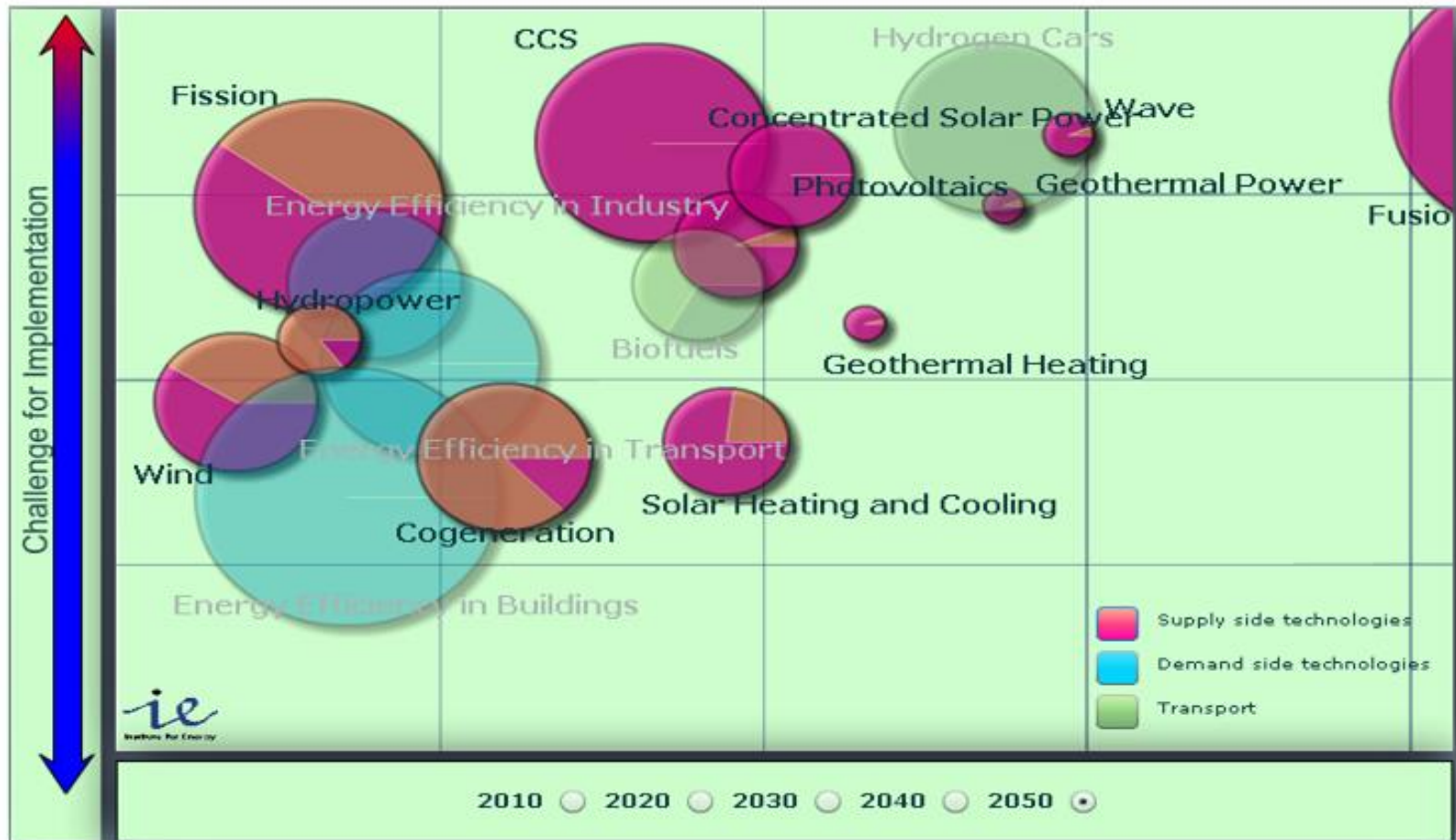
To ensure that you still can enjoy your electric devices, our **Institute for Energy and Transport** is responsible for the research to provide enough energy for your future.

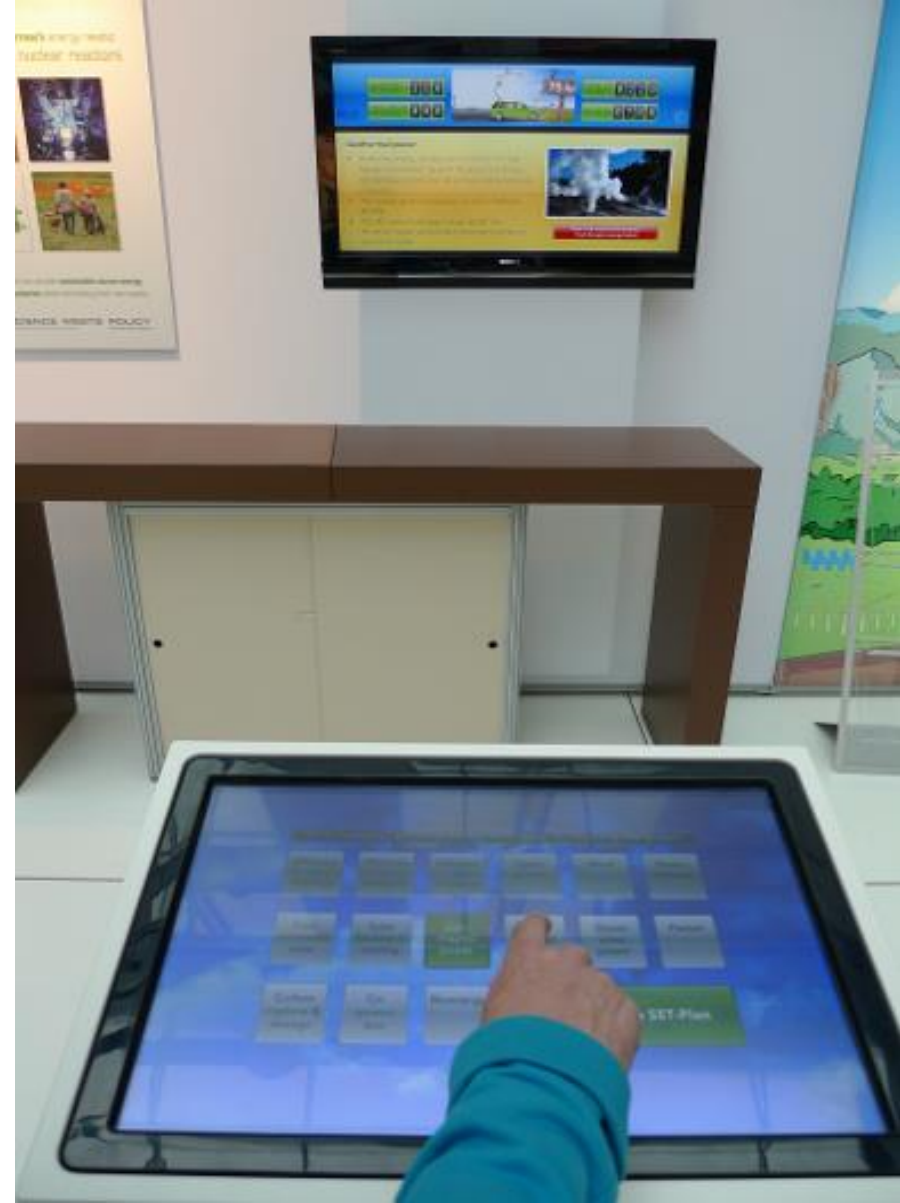


<http://snehls.de/visdat/gruppe4/>



Communication Innovation





Communication Innovation

What happens? Select an energy technology by touching the screen

Efficiency
in
Buildings

Efficiency
in
Transport

Efficiency
in
Industry

Hydropower

Wind

Photo-
voltaics

Concentrated
Solar
Power

Solar
heating
and Cooling

Geothermal
Power

Geothermal
Heating

Ocean Wave
Power

Fission

CO₂ Capture
and
Storage

Cogeneration

Bioenergy

Hydrogen

All combined

NO ACTION
 KM DRIVEN

2	2	0
---	---	---

THIS CHOICE
 KM DRIVEN

1	6	1
---	---	---



TOTAL
 KM DRIVEN

0	3	8	1
---	---	---	---

KM TO GO

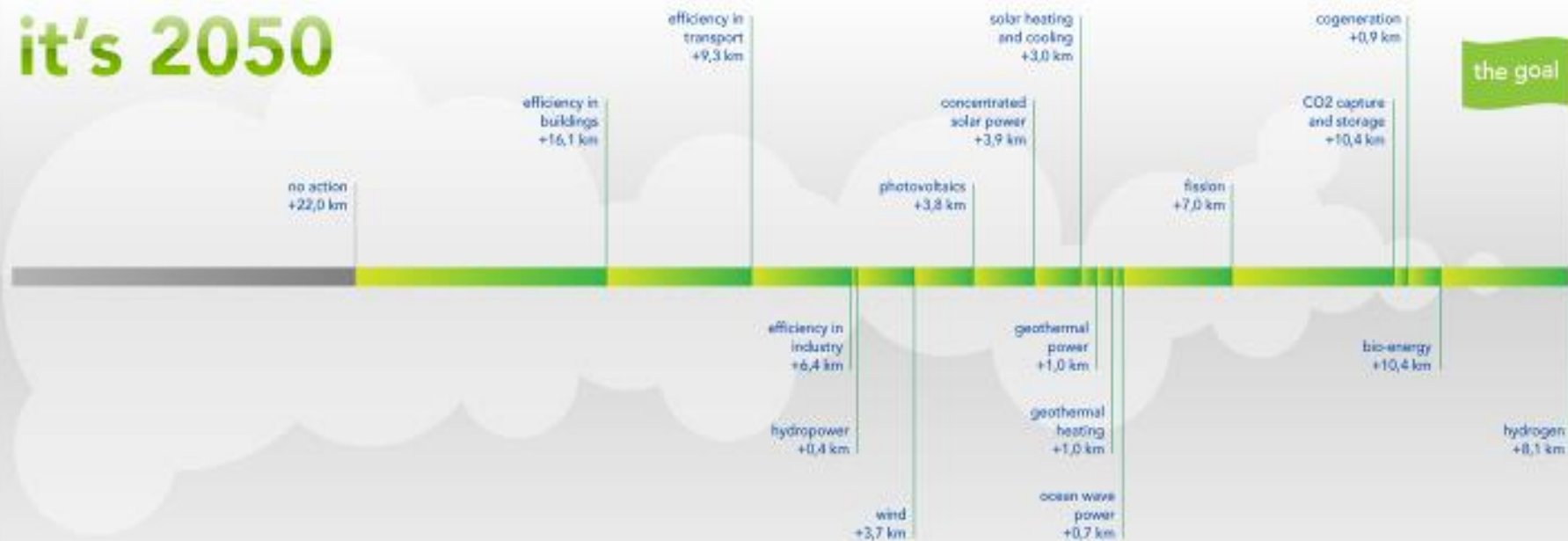
0	6	1	9
---	---	---	---

it's 2050





it's 2050



We've reached the goal! The relative potential of all the energy technologies is shown in a clear everyday language

HOME

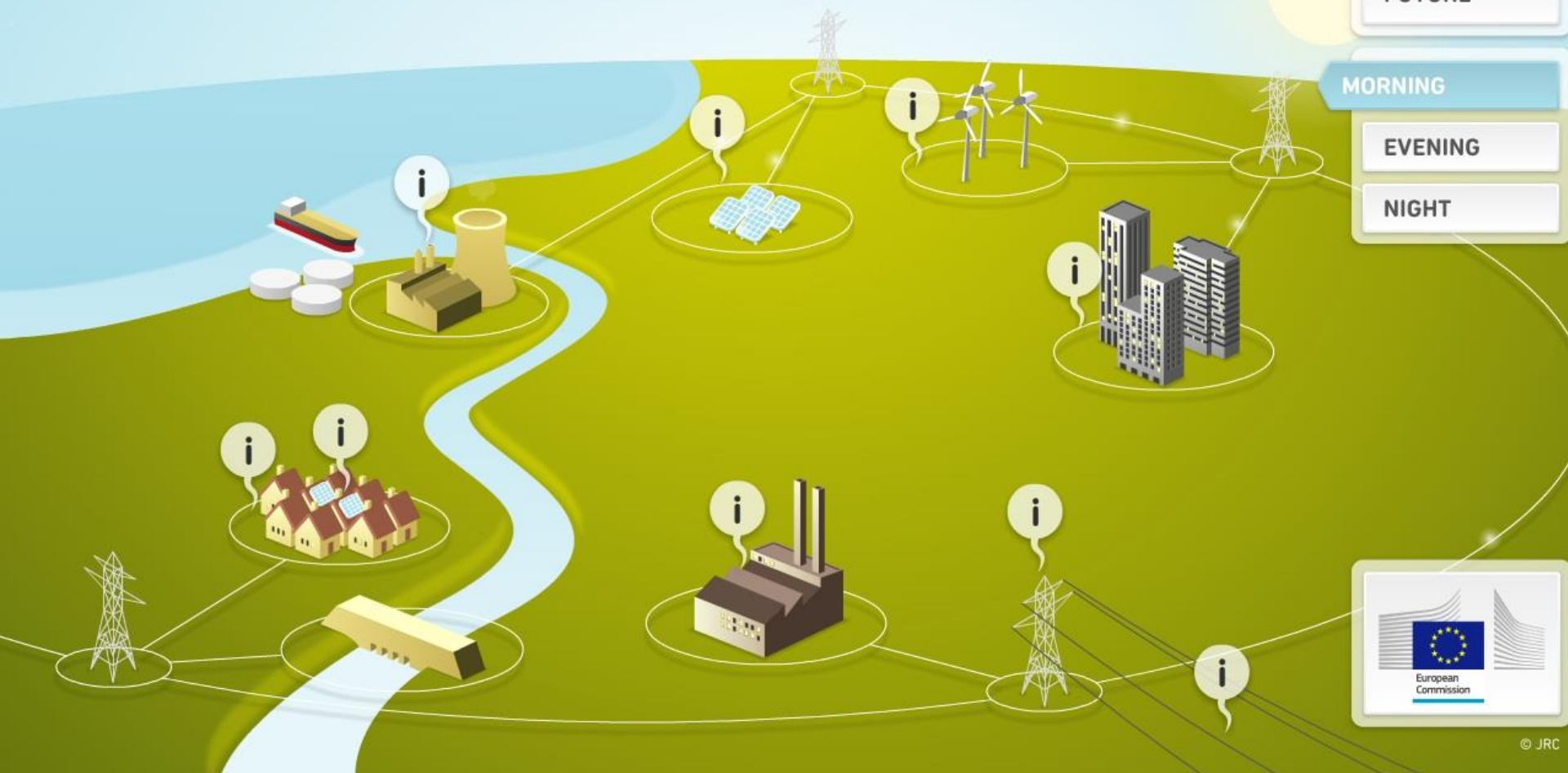
PRESENT

FUTURE

MORNING

EVENING

NIGHT



HOME

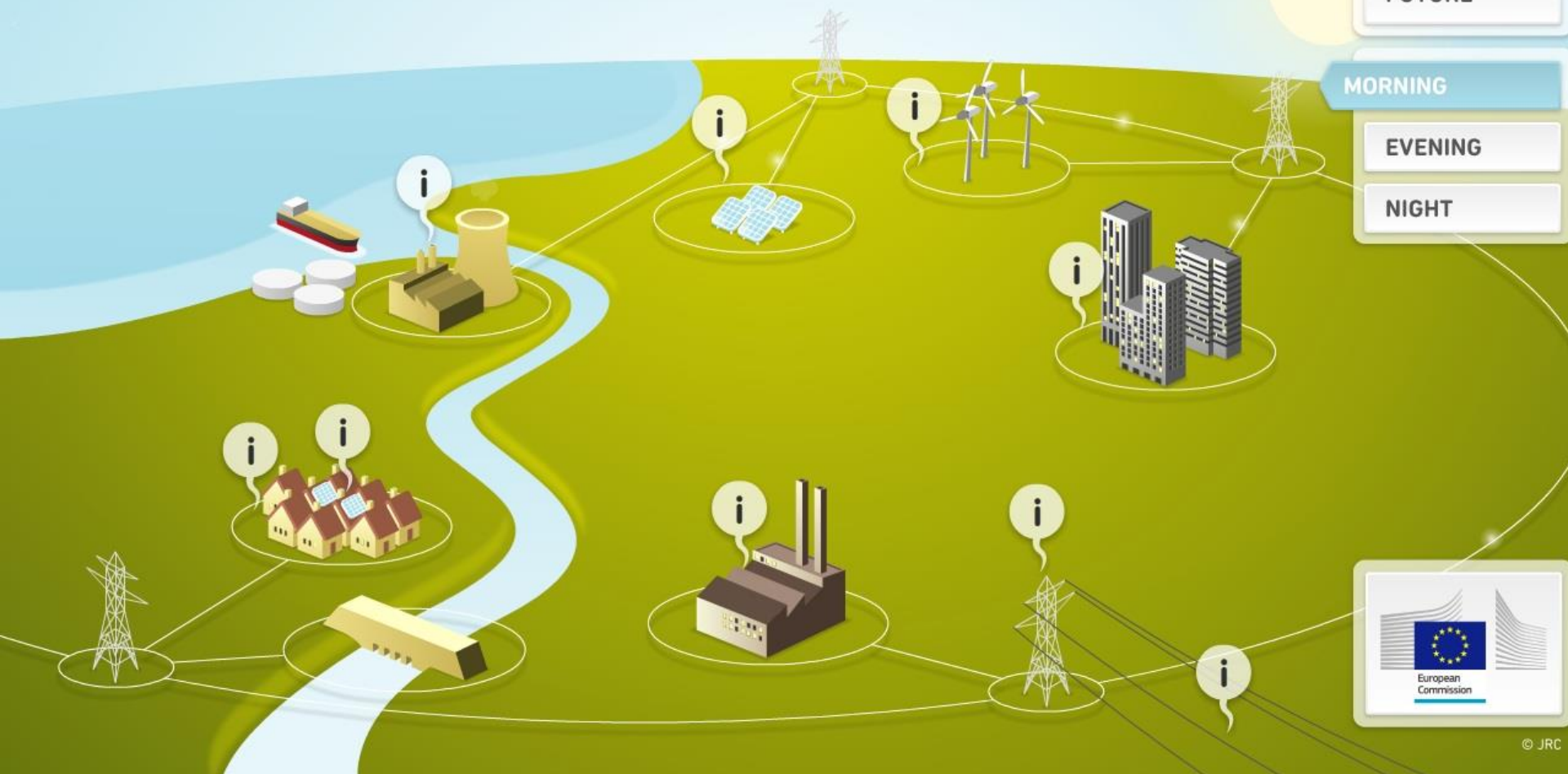
PRESENT

FUTURE

MORNING

EVENING

NIGHT



HOME

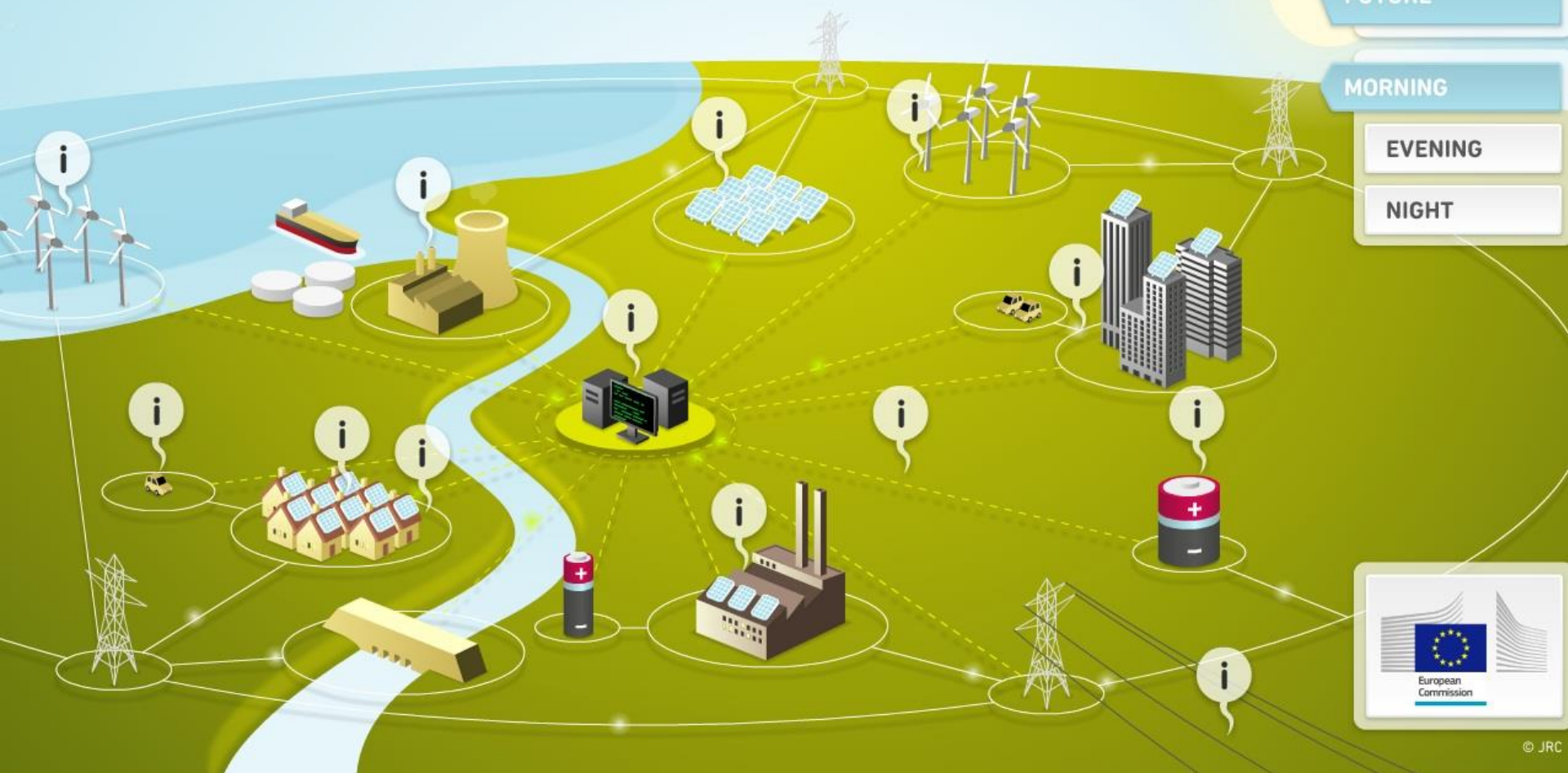
PRESENT

FUTURE

MORNING

EVENING

NIGHT



© JRC

HOME



IN 2020

DURING THE NIGHT

- » Most people are asleep while some factories work through the night.
- » Energy mainly comes from traditional power plants and renewable sources such as wind power.
- » Please check the energy meters below to find out what this means for production, consumption and CO₂-emissions.

CONSUMPTION GENERATION STORAGE CO₂ EMISSIONS



FUTURE
MORNING

PLAY
AGAIN

ENERGY BARS

- » Any surplus of energy is stored.
- » Information & Communication Technologies (ICT) are used to control and optimise production and consumption during the day, preparing the network to make the most of the low consumption night-time period.
- » Result: optimisation of the usage of available energy resources, reduction of carbon emissions and balance between generation and consumption.

PRESENT

FUTURE

MORNING

EVENING

NIGHT



© JRC

HOME

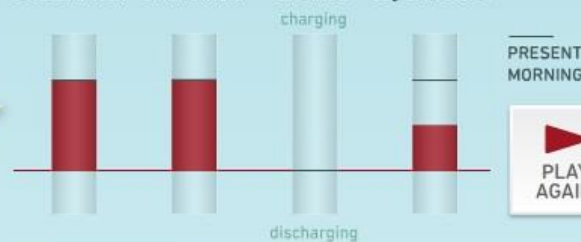


IN THE MORNING IN 2020



- » Everybody is at work.
- » Electricity comes from both traditional power plants and a significant number of renewable sources such as wind, hydro and solar.
- » The need for stored electricity is not high, but stored electricity can be used at any time to balance small variations in the network.

CONSUMPTION GENERATION STORAGE CO₂ EMISSIONS



ENERGY BARS

- » Balance between generation and consumption.
- » CO₂ emissions have been significantly reduced from 2011 levels and we are using traditional power plants together with renewables and storage when needed.
- » Information & Communication Technologies (ICT) are used to control and optimise production and consumption throughout the whole day, preparing the network to make the most of the morning medium consumption period.
- » Please check the energy meters to find out what this means for production, consumption and CO₂-emissions.

PRESENT

FUTURE

MORNING

EVENING

NIGHT



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European
Commission



European
Commission

Energy efficiency

Keeping Europe's lights on



Joint Research
Centre

56TWh, savings of approximately 50%, 28TWh



Data centres

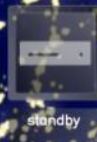
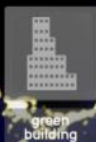
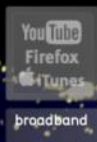
Europe's data centres consume 56 TWh of electricity per year. This is equivalent to the electricity consumption of the Czech Republic in 12 months!

How can we reduce this huge amount of energy consumption?

Click the button to find out.

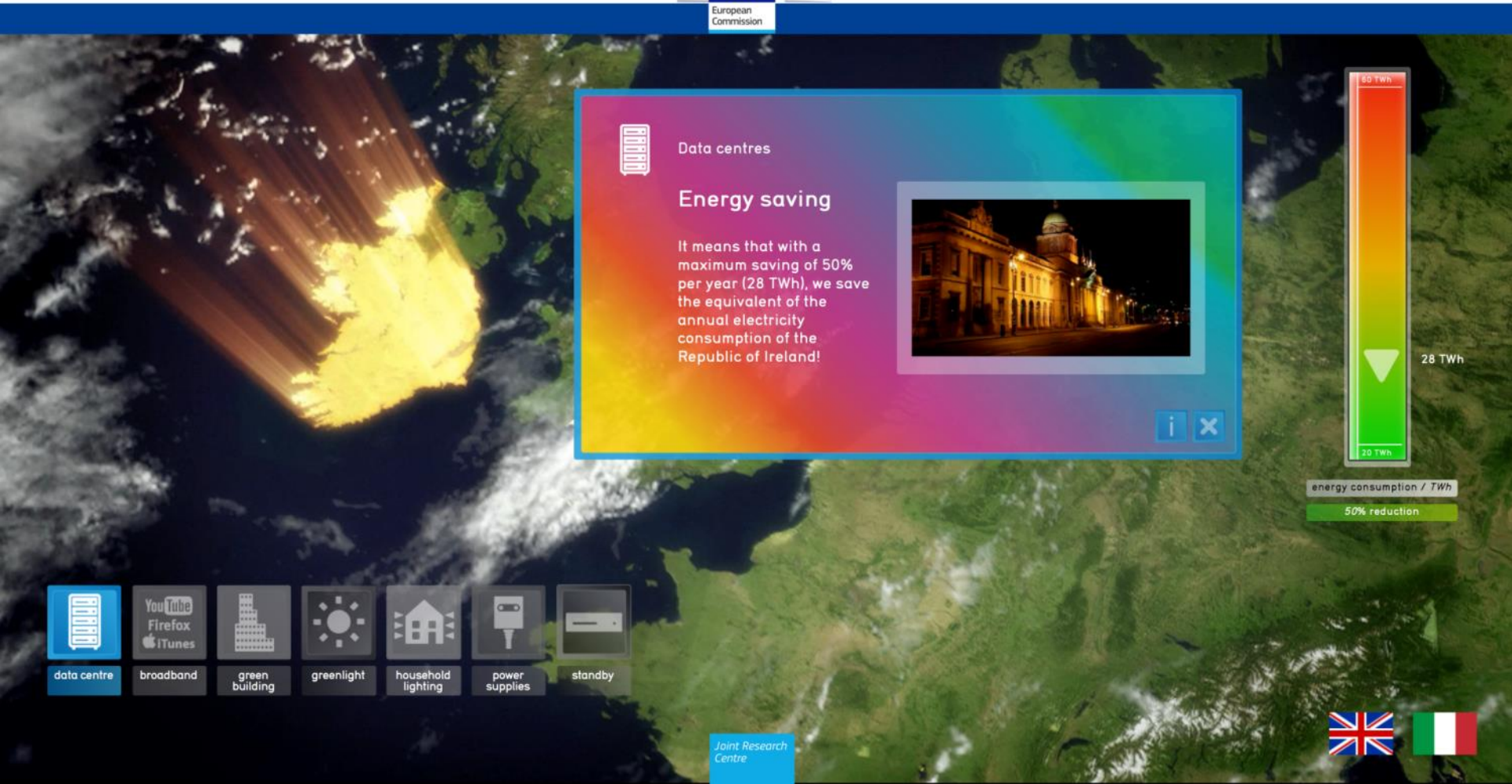


energy consumption / TWh



Joint Research
Centre





Approaches to data Visualisation

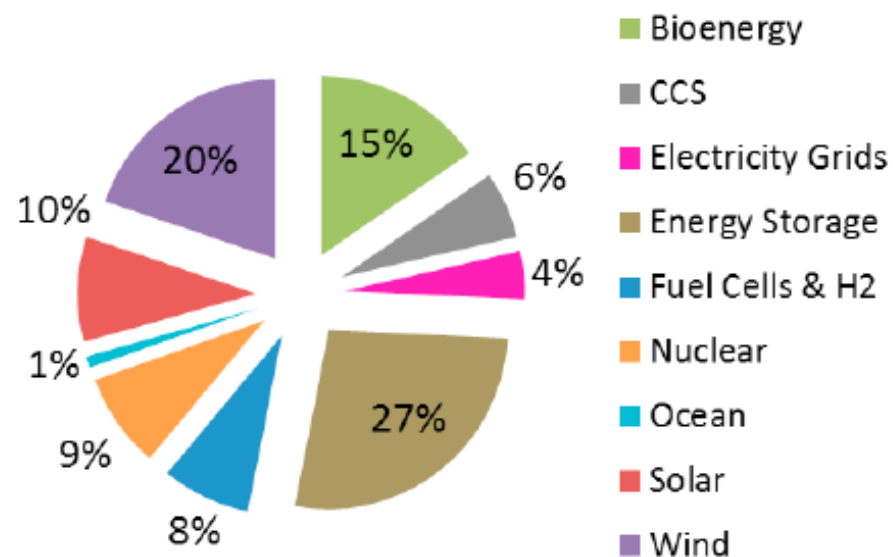
- ❖ Computer programmes
- ❖ Graphics / Design



GENERAL IDEAS

- › Simplification of the graphics
- › Reduction to one message
- › Only one graphic per page
- › Same style in every graphic
 - › Uniform headlines: Colour, Size, Font
 - › Uniform colours that suit the topic
- › Striking legends that are easy to recognize

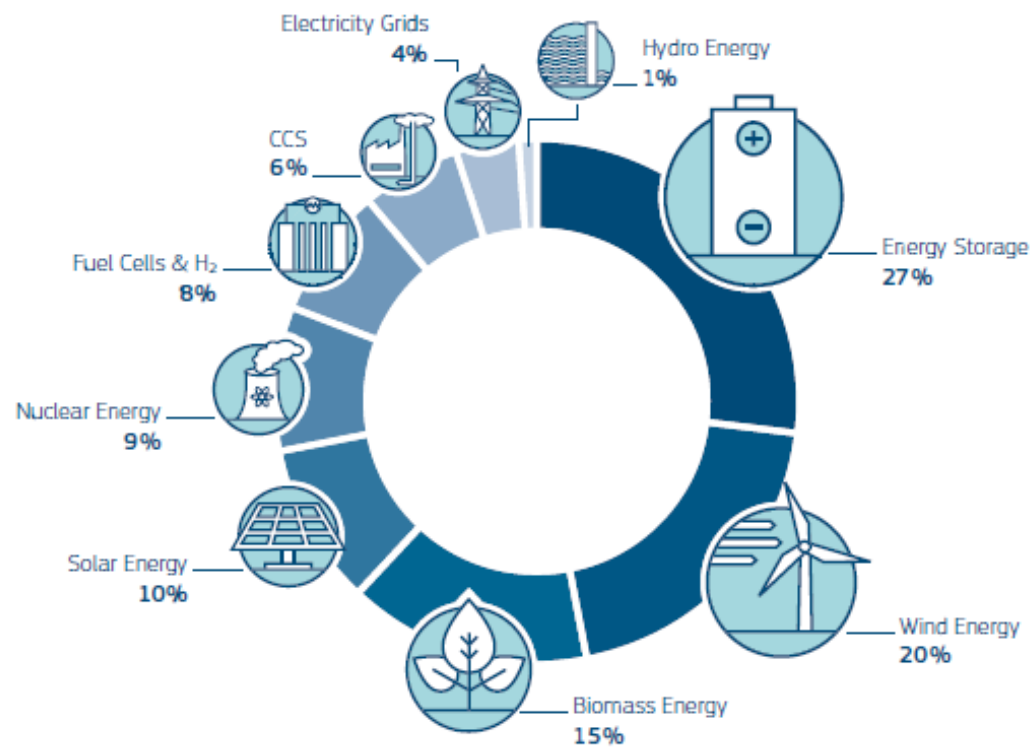
lockSTOFF



Focus on R&D investment per technology

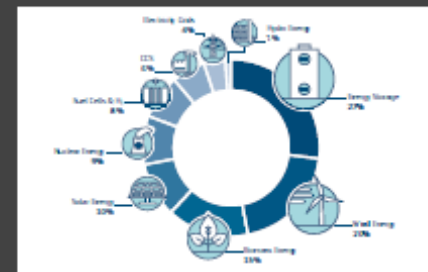
lockSTOFF

CORPORATE R&D INVESTMENT IN 2011 PER TECHNOLOGY



lockSTOFF

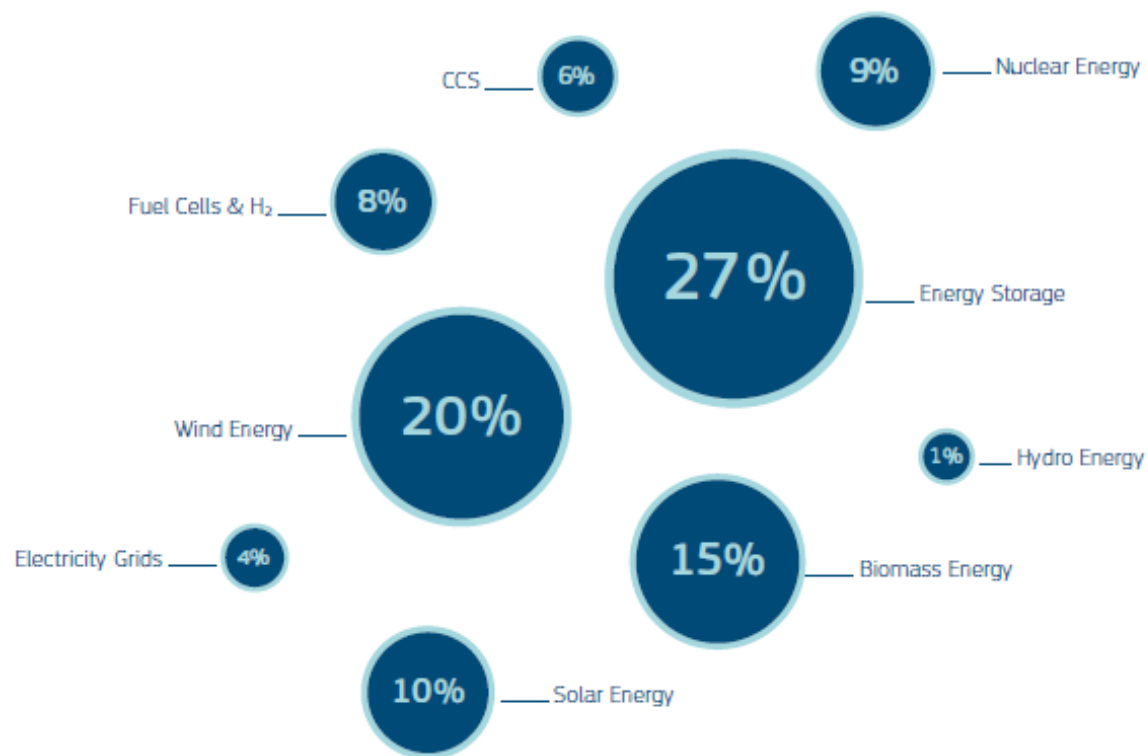
RING CHART WITH ICONS



- > Focus on energy technologies
- > Icons instead of coloured pieces
 - > No legend needed
 - > Icons are easy and fast to understand
- > Uniform lettering of the single pieces > clear to recognize
- > Hierarchy of percentages in both shading and size of single pieces and size of the icons

lockSTOFF

CORPORATE R&D INVESTMENT IN 2011 PER TECHNOLOGY



lockSTOFF

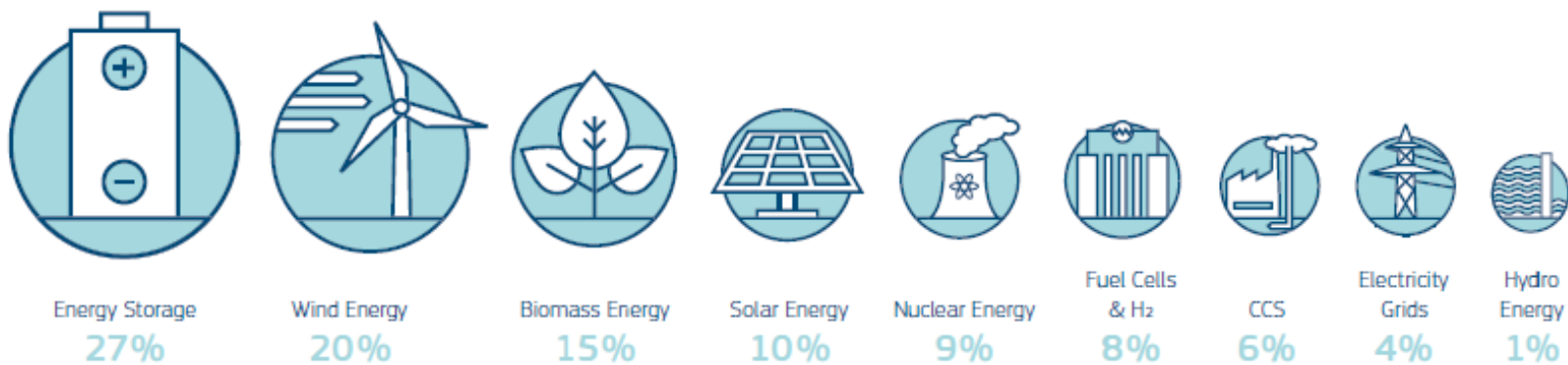
BUBBLE CHART



- > Focus on percentages
- > Reduced visualization with different bubble sizes
- > Uniform lettering of the single bubbles
- > No legend needed
- > Free composition

lockSTOFF

CORPORATE R&D INVESTMENT IN 2011 PER TECHNOLOGY



lockSTOFF

BUBBLE CHART WITH ICONS – ORDERED COMPOSITION



- Focus on hierarchy of energy technologies
- Ordered composition of different sized icons
 - Message clear at first sight
- Icons are easy and fast to understand
- Percentages in lettering are emphasized

lockSTOFF

TO SUM UP

- Simplification and reduction make graphics easier to understand
- Many ways to express the same data
- Different messages are told depending on the type of chart

lockSTOFF

Examples of software

- **D3 Software**

See examples, some knowledge of Java script / HTML can help
Templates available, open source

- **Pivot tables, or SQL / Matlab**

one of Excel's most powerful features. A pivot table allows you to extract the significance from a large, detailed data set.

- **Google fusion, data, maps & tables**

Share data on google drive, visualise, interactive maps

- **Color brewer**

Is the colour palette OK, colour blind, projector etc

Software & charting libraries

Interactive charts:

- datawrapper.de
- Google charts
- Maps: Google Fusion tables/CartoDB

Infographics:

- infogr.am
- piktochart.com

Charting tools:

- Raw: app.raw.densitydesign.org
- Datavisual: datavisu.al

Site:

- shorthand.com/social
- strikingly.com
- sway.com

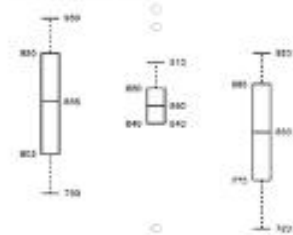
Dashboards:

- tableausoftware.com
- qlik.com
- powerbi.microsoft.com

Javascript Libraries:

- highcharts.com
- d3js.org

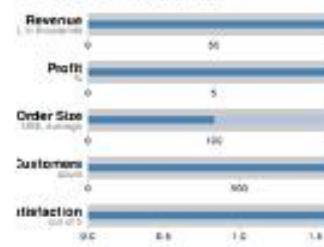
Box Plots



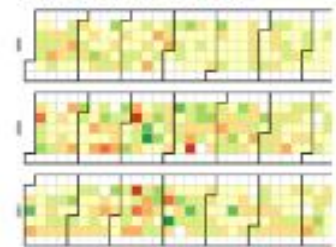
Bubble Chart



Bullet Charts



Calendar View



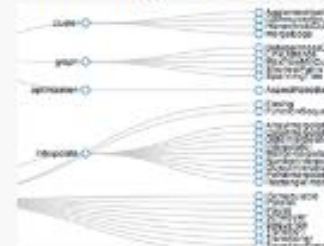
Non-contiguous Cartogram



Chord Diagram



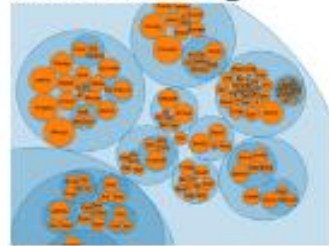
Dendrogram



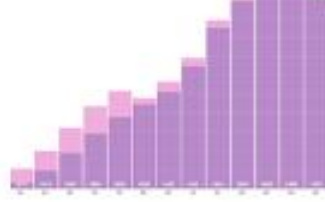
Force-Directed Graph



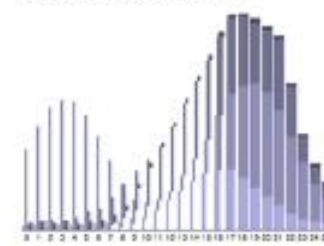
Circle Packing



Population Pyramid 2000



Stacked Bars



Streamgraph



Sunburst



Node-Link Tree



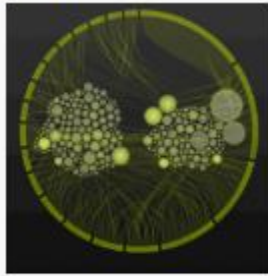
Treemap



Voronoi Diagram



Halo



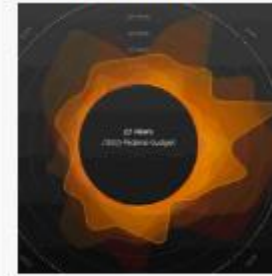
Radial Progress



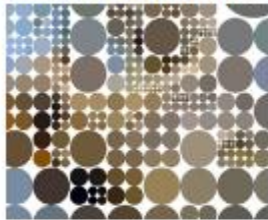
NFL Predictions



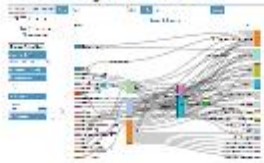
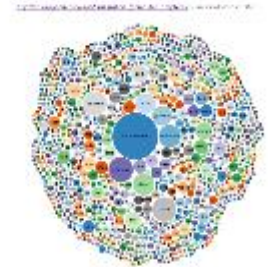
Corona Radar



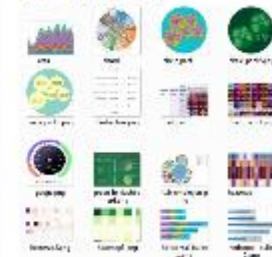
Koalas to the Max



Sankey Creator

Convert any page
into bubbles

D3 Builder



Particles



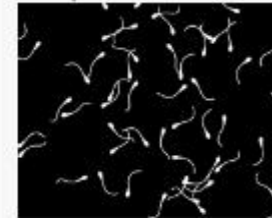
Indented Tree



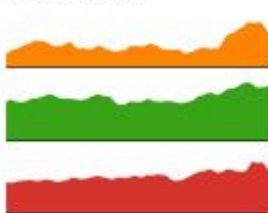
Rounded Rect



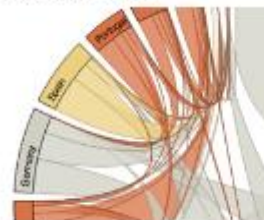
Tadpoles



Showreel



Euro Debt

Labeled Force
LayoutCircle-Square
Illusion