

How to calculate cost efficiency of energy ?

Energy
Efficiency
... and cost

R.Ferret GN3+ CBP DC IaaS workshop, Helsinki 09/2014

Introduction

This talk is dedicated to energy; focusing of course on ICT use of electricity. But ... may i propose you a slightly different approach ?

- Electricity : 17% of world wide energy used,
- Energy is not the only problem for us in ICT, natural resources globally speaking are,
- Please stop the « bla bla » of green IT,
- Virtualisation, dematerialisation and other lies (oups),
- Numbers are « stubborn », i love them,
- What can we do ? Best practices 😊

Energy, some words

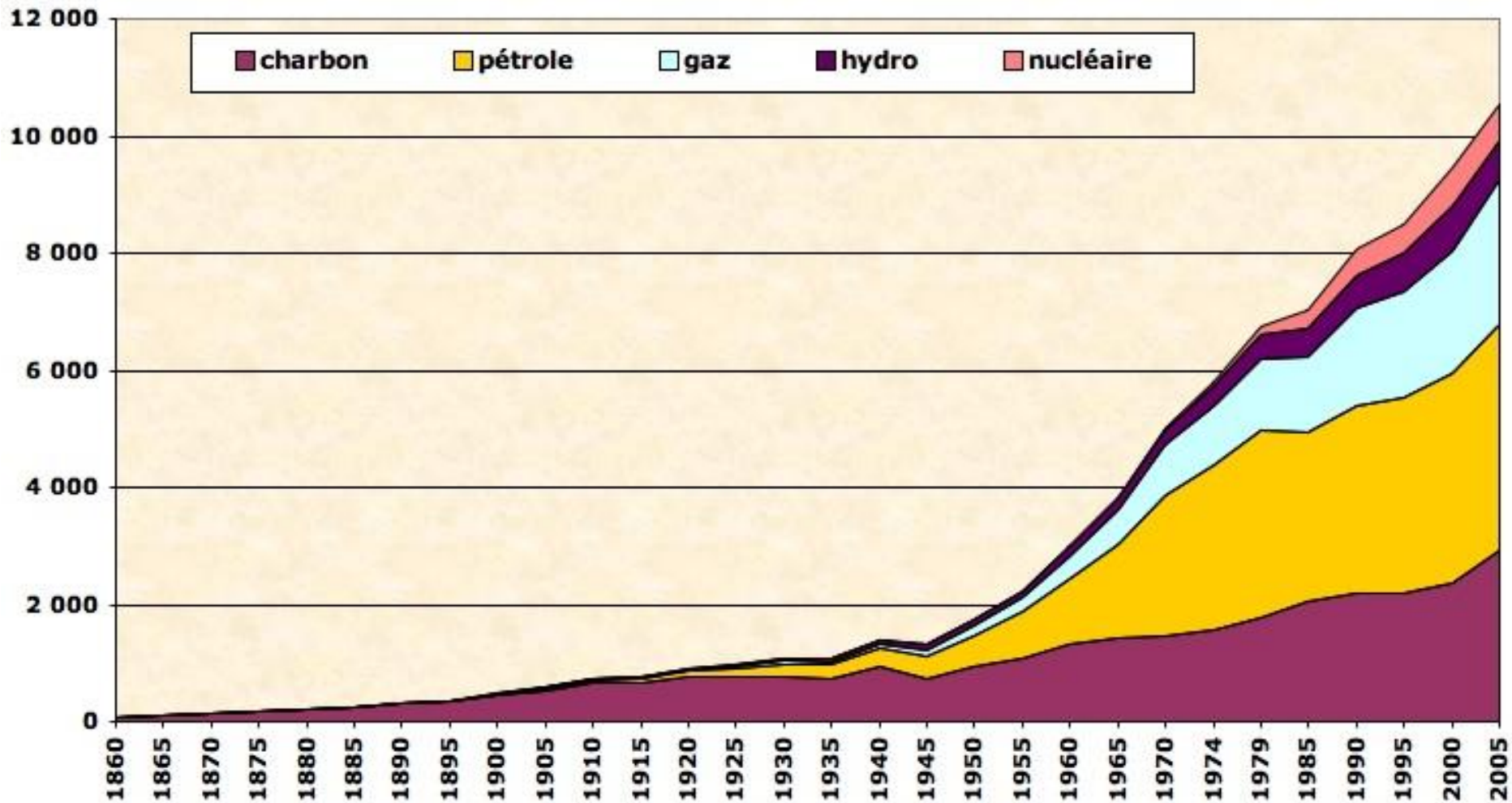
Depending of jobs or businesses, different units are used; but it's easy (☺) to translate. A short abstract :

- The reference : energy in SI = Joules (J)
- In ICT, we use kWh, MWh, GWh, TWh ...
- In industries or economy, we speak of « Tonnes Oil Equivalent » , TOE
- In cooling or heating industries : calorie and Btu

1 TOE = 7,3 barils (159 l) = 1160 liters = 42 US gallons =

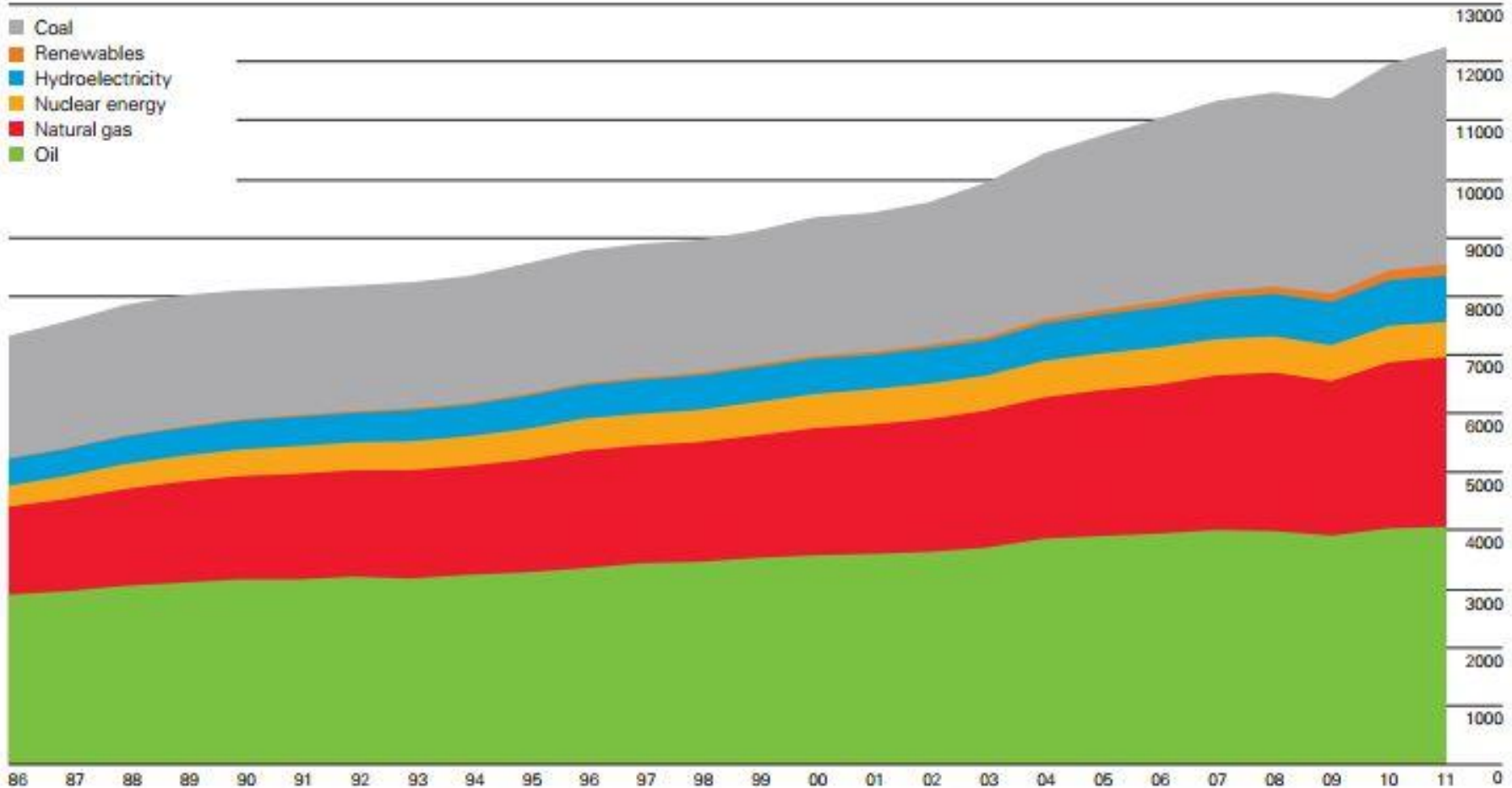
- 41,86 GJ = 10 Gcal ;
 - 39,68 Mbtu ;
 - 11 630 kWh ;
- 1 cal = 4,18 J ; 1 J = 1 W.s
1 Btu = 1060 J = 252 cal
1 l of oil = 10kWh

World Wide Energy



World Wide Energy (2)

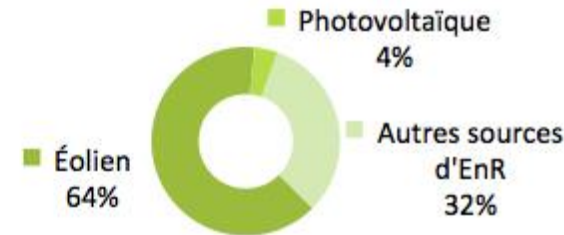
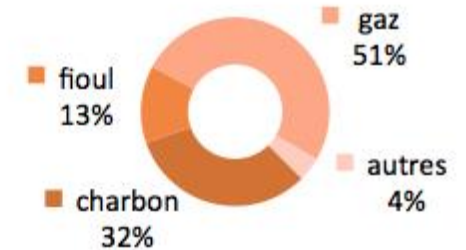
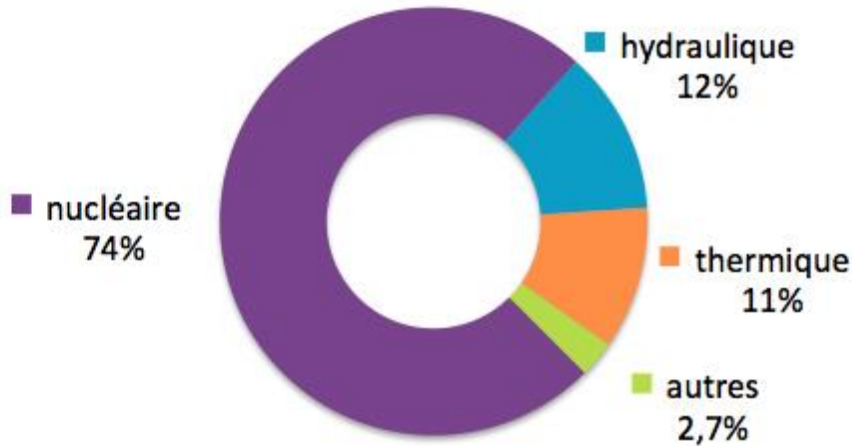
World consumption Million tonnes oil equivalent



World primary energy consumption grew by 2.5% in 2011, less than half the growth rate experienced in 2010 but close to the historical average. Growth decelerated for all regions and for all fuels. Oil remains the world's leading fuel, accounting for 33.1% of global energy consumption, but this figure is the lowest share on record. Coal's market share of 30.3% was the highest since 1969.

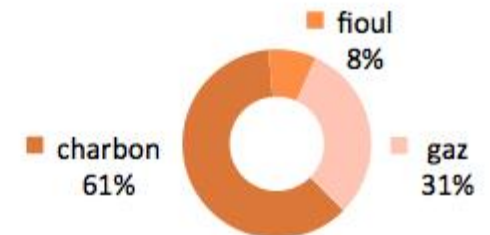
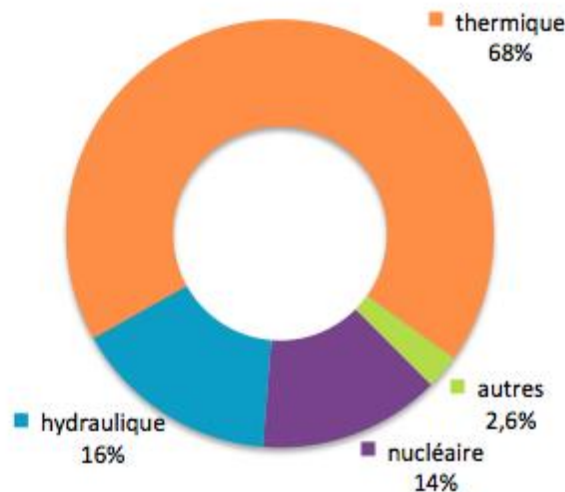
World Wide Electricity

550 TWh
France⁽¹⁾



Atlante & Cie
atlante.fr

19800 TWh
Monde⁽²⁾



World Wide resources

Treath resources due to human usage

Ref : <http://www.consoglobe.com>

- Today : Water and sand begin to be problems
- 2021 – end of silver
- 2025 – end of gold
- 2030 – end of lead
- 2039 –_end of cupper
- 2040 –_end of uranium
- 2050 – end of oil
- 2072 – end of gas and iron
- 2139 – end of aluminium
- 2170 – end of coal

World Wide resources and so what ?

**Energy and natural resources are clearly THE subject,
THE question, THE challenge of our (21th) century**

**2-3 centuries of so called « industrial revolution » from
approximately 1850 to 2150 use (will use) 100 000 000
years of fossile resources production (carbon, gas, oil)**

We have no choice : we must find renewable energies

Sun; Wind; Sea tide; sea currents; dams; geothermal

Why not Fission !!!!!!!!!!!!! Oups ITER in France

And by the way, why not, « not consume » ?

I mean energy saving !!!

Energy in ICT, emerge and immerse

Everybody have a smartphone and a box ? 😊

A smart phone battery cell : $3,6V * 1 Ah = 30 kWh / year = 4€$

A box : $16 \text{ to } 20W = 143 \text{ to } 173 kWh / year = 25€$

But !

23 M boxes in France = 4 TWh / year

Equal to 0,8 % of global electricity usage ... mainly for waiting !

Who use « cloud services » ?

ICT world use 1500 TWh of electricity (IEA 2013) : 7 % of total
3 times the consumption of France, equal consumption of Japan and
Germany

total production of 150 nuclear units

What are the good news ?

- We : users, manufacturers, all stakeholders, can do something !
- ICT can help other 93% of electricity and 99% of energy users to decrease their consumption, ex: VC
- ICT consumption can be decreased, and our costs reduced 😊
- And, best of all : **YOU** can (simply) help

What are the good news (2) ?

At Home

Smartphone, PC, tablet, TV, box, recorders, DVD players, NAS ...

Just switch them off with a physical switch, do not leave them only in « wait mode » when they are not in use. Just switching off your box = easily 33% savings in energy (11 pm to 7 am)

If you buy a new one : have a look to « wait mode » consumption, remember that wait mode is longer than used mode ... and don't buy a new one just because there is a new one. Do you need it, or do you want it ?

If you can : measure your home electricity consumption when « nothing is on » ... and step by step look for « where are used watts » ?

What are the good news (3) ?

At a lab or office level,

Also good news, IEA studies show that PUE (Power Usage Effectiveness) of mean datacenters is ... poor.

$PUE = \text{energy used in datacenter} / \text{energy used for IT}$

Mean result : more than 2, meaning than 1kW for IT = more than 2kW used.

Why : « facilities », mainly air conditioning and UPS efficiency

But ... of course if IT power decrease, with the same PUE, energy requirements decrease ... FUN !

So :

- Decrease power requirements of IT with more efficient solutions
- Reduce PUE with more efficient « facilities »

As an IT responsible, what can i do ?

Power supplies of computers

Power supplies « 80 PLUS » at 50% of full power :

- Standard : 80%
- Gold : 92%
- Titanium : 96%

Required Efficiency depending on % of Rated Load

80 PLUS Certification	115V Internal Non-Redundant			230V Internal Redundant				
	% of Rated Load	20%	50%	100%	10%	20%	50%	100%
80 PLUS		80%	80%	80%	N/A			
80 PLUS Bronze		82%	85%	82%	—	81%	85%	81%
80 PLUS Silver		85%	88%	85%	—	85%	88%	85%
80 PLUS Gold		87%	90%	87%	—	88%	92%	88%
80 PLUS Platinum		90%	92%	89%	—	90%	94%	91%
80 PLUS Titanium		—	—	—	90%	94%	96%	91%



Mean that :

Between standard and Titanium, you can save 16 % of energy :

$$1 \text{ kW} * 8760\text{h} * 0,07 \text{ €} = 613 \text{ €} * 0,16 = 98 \text{ €} / \text{year}$$

Your « little » DC of 100 kW IT « Standard » => 876 MWh = 61,3 k€ / year

The same DC of 84 kW IT, « Titanium » => 736 MWh = 51,5 k€/an

PUE = 2 => 200 kW => 122,6 k€ / year; save 32 kWh = 19,6 k€ / year

As a DC designer, what can i do?

Some very basic (simple if you want) but **very** important questions :

First of all : if you want to understand something : make measurements !!!
Don't be blind.

A major choice : modularity because efficiency of clim or UPS is better close to the nominal power

UPS: do all services need UPS ? Remember that UPS = need of GE

Cooling, the key choices ?

- T°, don't cool « old fashion » at 20°C, see Ashrae 2008 : 18 - 27°C, servers today accept 10 - 35°C ; see data sheets ... and run a little bit warmer
- Flow control : use at least cold and hot corridors for better efficiency
- Free cooling can be used in most of cases, remember 35°C !

As a DC designer, what can i do?

Other interesting questions :

Who knows CoC ?

Code Of Conduct ?

CoC is an UE initiative, based on voluntary ... today

You can be :

- Participants, you manage a DC
- Endorsers : you are a DC « builder »

Measure and audit

Action plan

Implement of action plan

Some references

- <http://www.eia.gov/totalenergy/data/annual/#summary>
- http://www.tech-pundit.com/wp-content/uploads/2013/07/Cloud_Begins_With_Coal.pdf?c761ac
- <http://www.consoglobe.com/epuisement-des-ressources-naturelles-et-demographie-cg>
- <http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/data-centres-energy-efficiency>
- http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/data_centre_coc_folder.pdf
- <http://iet.jrc.ec.europa.eu/energyefficiency/universit%C3%A9-joseph-fourier-1-data-center>