



GreenTouch™



Models for Energy Reduction

Open forum

Azeddine GATI
OrangeLabs

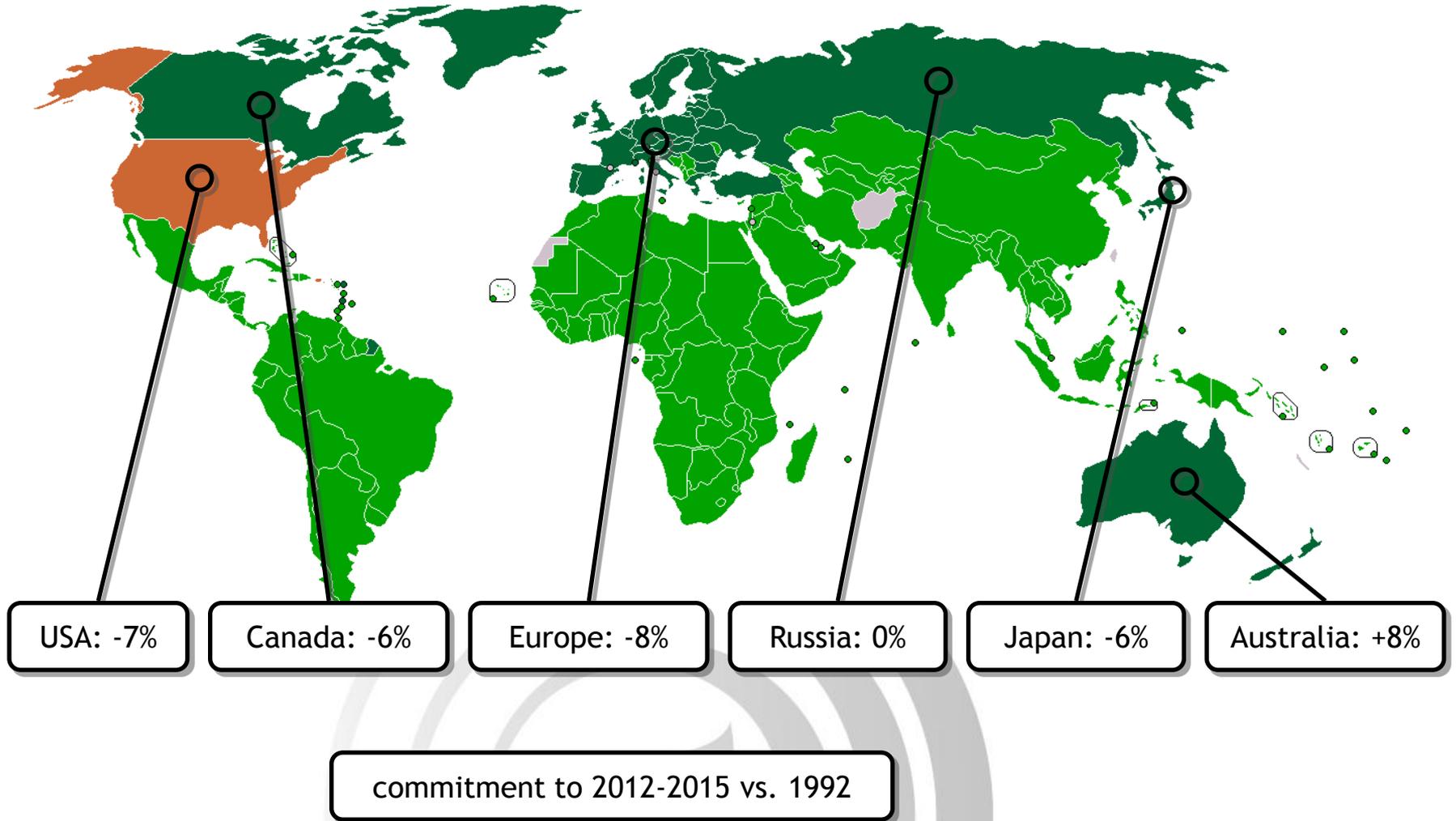
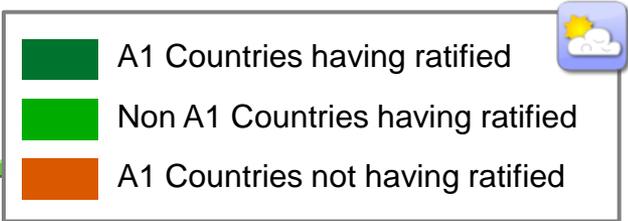
GreenTouch Meeting
Seattle
November 14-17, 2011



1997 - Kyoto Protocol

Adopted December 11th, 1997. Entered into force in 2005.

Source: UNFCCC/Kyoto_protocol





Energy & Climate change policies

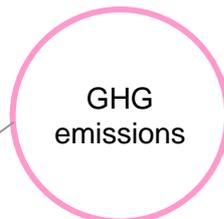
EU climate & energy package (2009)



> GHG emissions



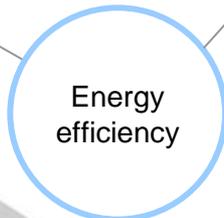
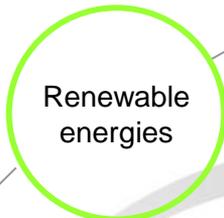
- **-20% in 2020** (v. 1990)
 - -30% in case of international agreement
- Longer term: - **80 % to 95% in 2050** (v. 1990)
(Roadmap 2050, see figure on next slide)



> Energy efficiency



- 2020: **-20% primary energy consumption**, as compared to a baseline "business as usual" scenario



"20-20-20"



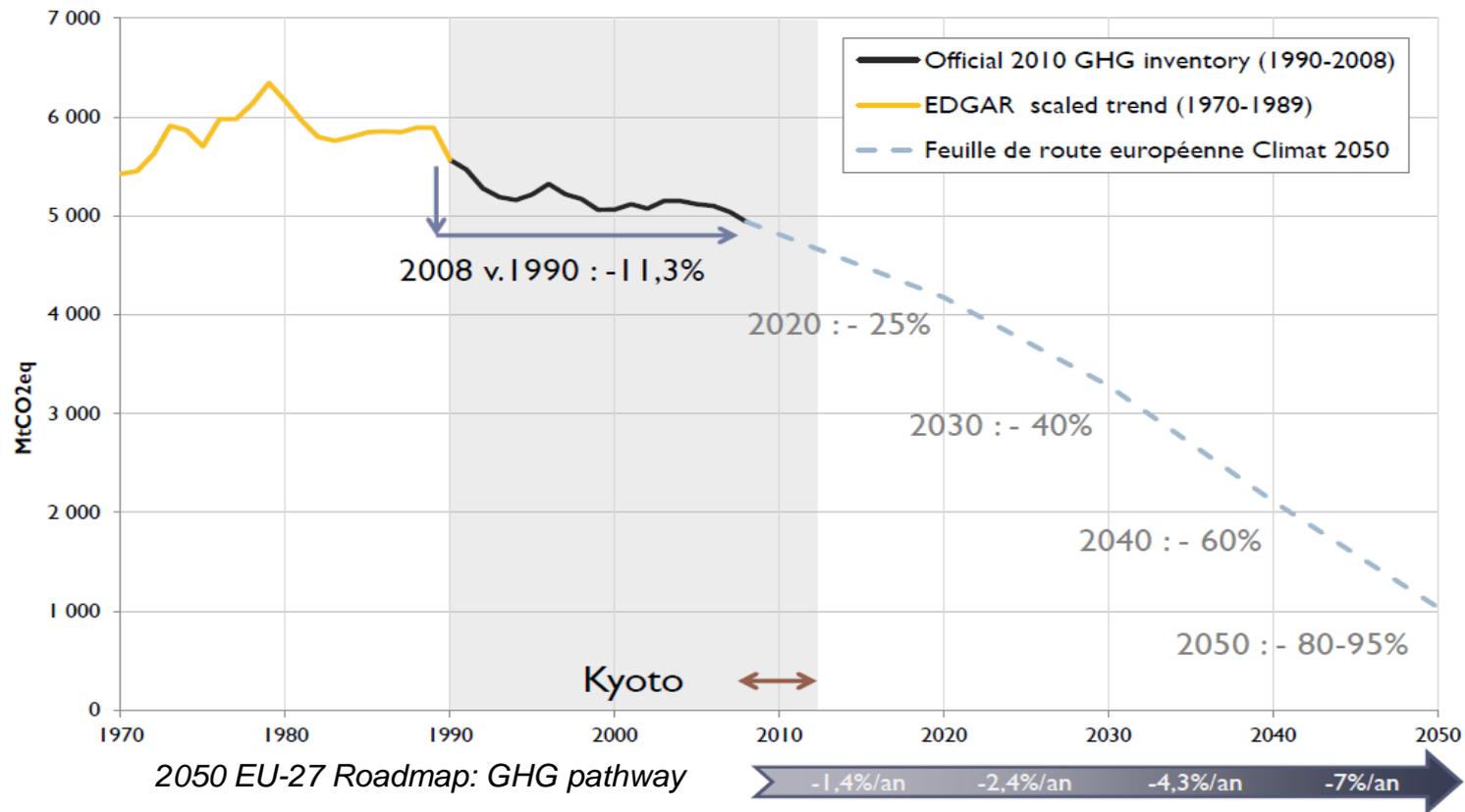
Renewable energies

- **20%** of the EU final energy consumption **from renewable sources** in 2020 (v. 9.2% in 2006)
- binding, differentiated national targets (France: 23%)

Source : European Union [1] and [2]

Energy & Climate change policies

EU Roadmap 2050 (not law so far, 2011)



- Based on:

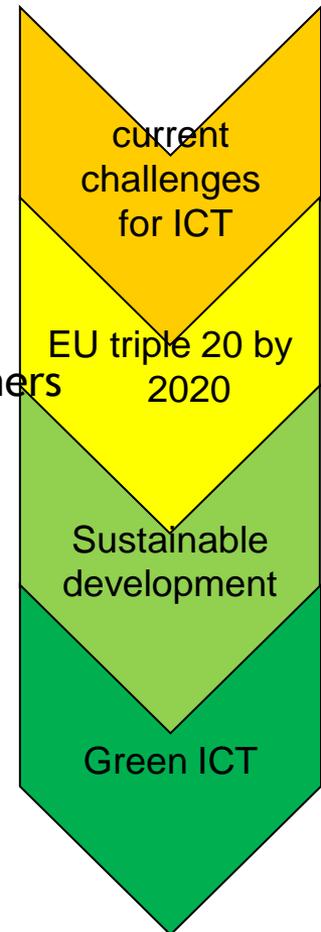
- > 93 to 99% de-carbonation of the power sector
- > Energy efficiency: at least -30% primary energy consumption (v. 2005)

Source : [European Union](#)

Why green networks



- New networks are being deployed and legacy are being renewed
- Corporate social responsibility
 - Understand the main social indicators that make our networks and systems acceptable and sustainable : bring well-being to our customers
 - EU recommendations (triple 20 by 2020)
- Promeut Green as a service (ICT for green)
 - allow our customers to reduce theirr own footprint
 - green services (green computing, smart metering and M2M applications)
- Green drive innovation (revisiting Shannon, cellular deployment, smart networks)

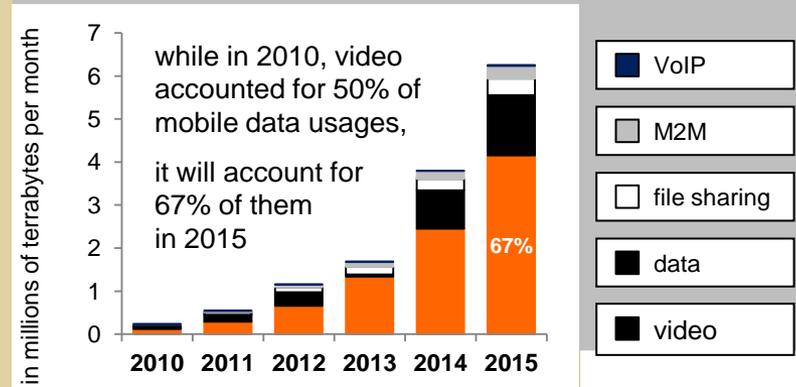


challenges with green

- Seamless wireless access
- broadband everywhere
- off-loading
- Emerging countries
 - off-grid
 - Opex optimization
- Networks as a service : cloud computing

video is driving both data and Wi-Fi usages

global mobile data traffic per service



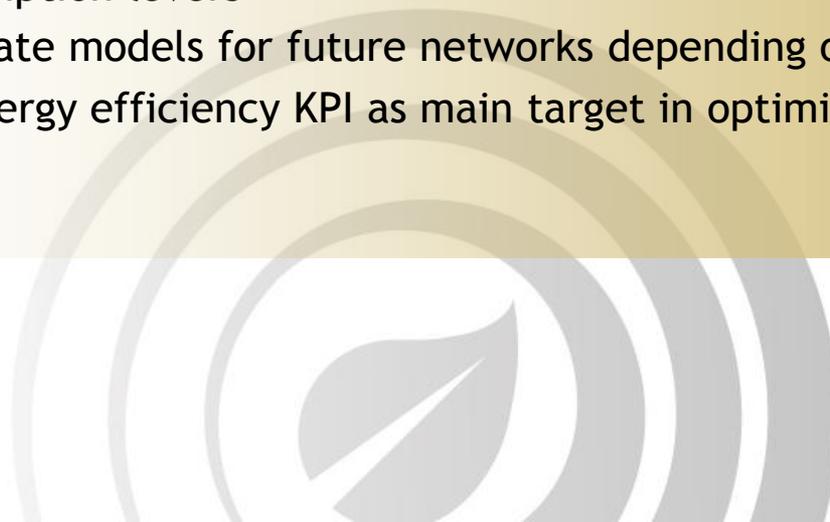
Source: Cisco VNI Mobile 2011

- **global approach**

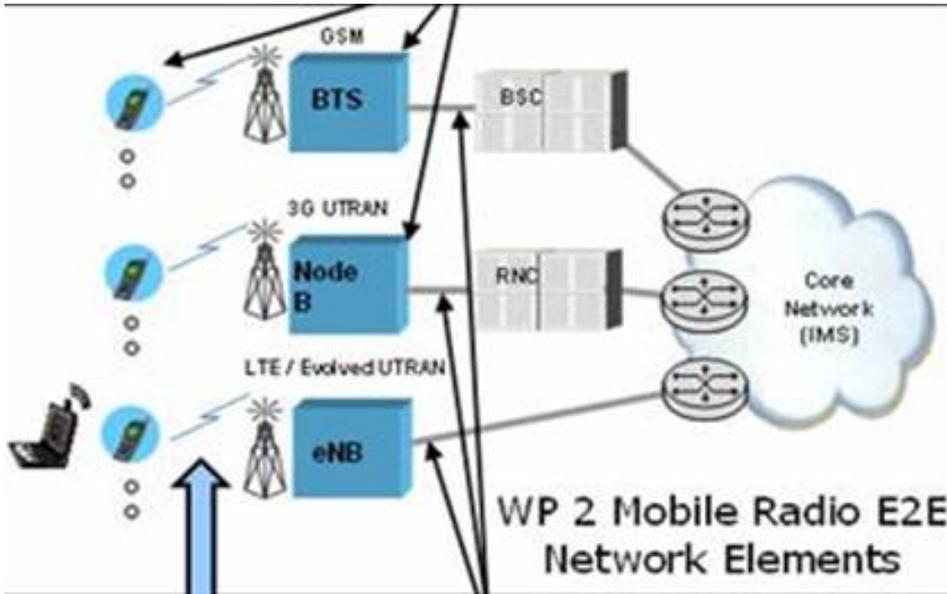
- core , access and services : avoid rebound effect
- legacy and future networks
- bottom-up and top-down
- tech-eco studies for supporting actions

- **actions**

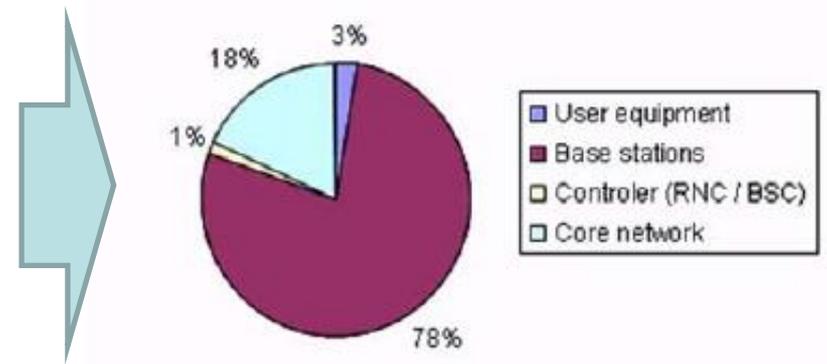
- evaluate past and current consumption (metering) : identify main consumption levers
- elaborate models for future networks depending on applications
- put energy efficiency KPI as main target in optimization



Energy consumption of mobile networks' components



Power consumption distribution in cellular networks

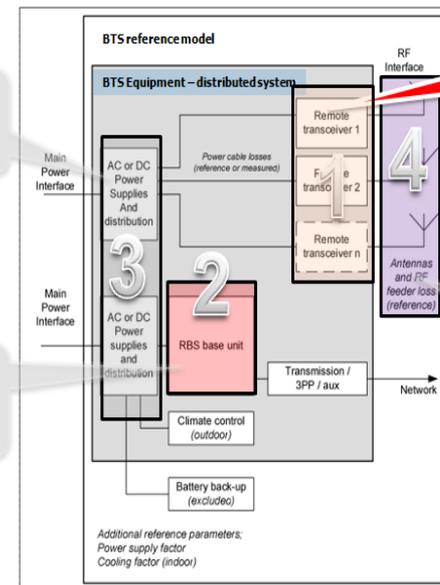


Power Consumption Analysis of ETSI Models

- Macro BTS is 80% of mobile consumption
- PA is 70% of Macro-BTS consumption

About 5% BTS power consumption

About 15% BTS power consumption



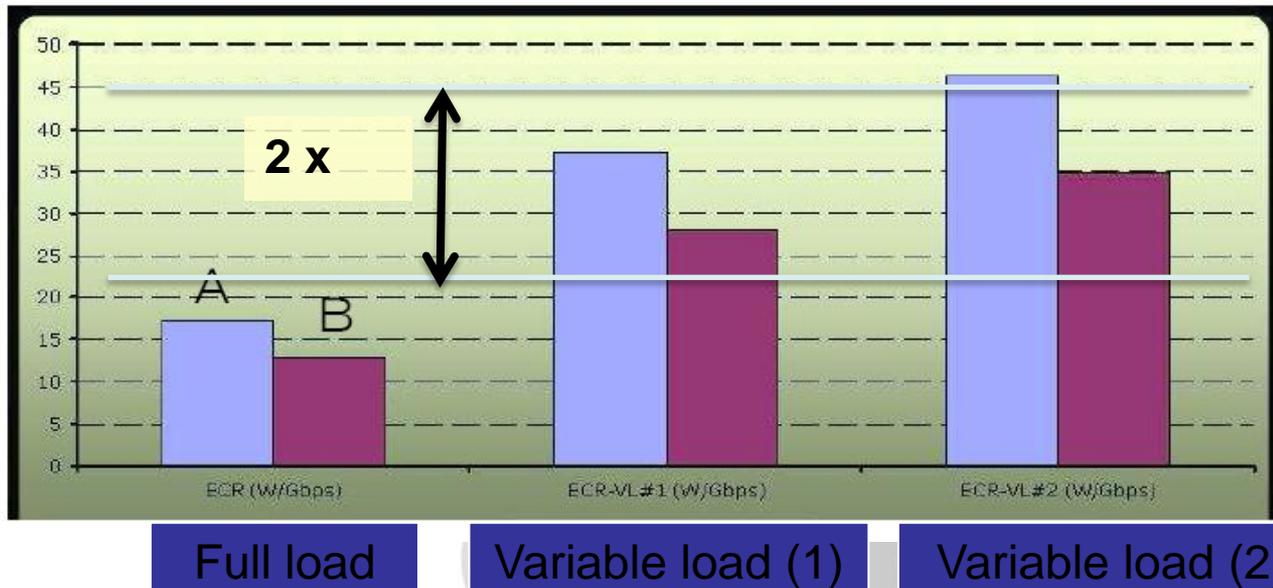
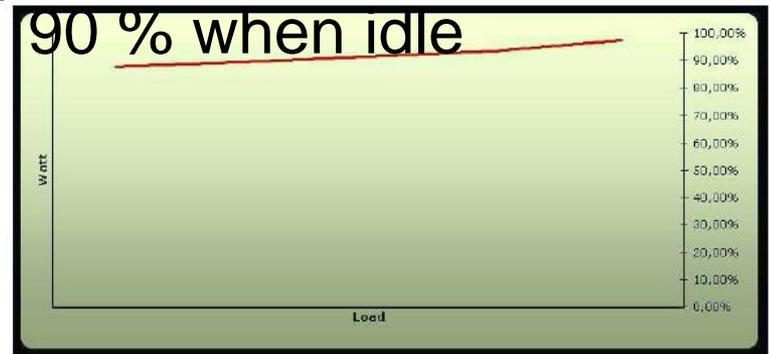
About 70% BTS power consumption

About 10% BTS power consumption

Data sheet versus measurements IP/MPLS layer



- Measurement conclusions:
 - Consumption depends strongly on hardware used (type & nb of ports)
 - Not a lot on the load per port
 - Real-life traffic power consumption **double** of feasible (=full load) power consumption



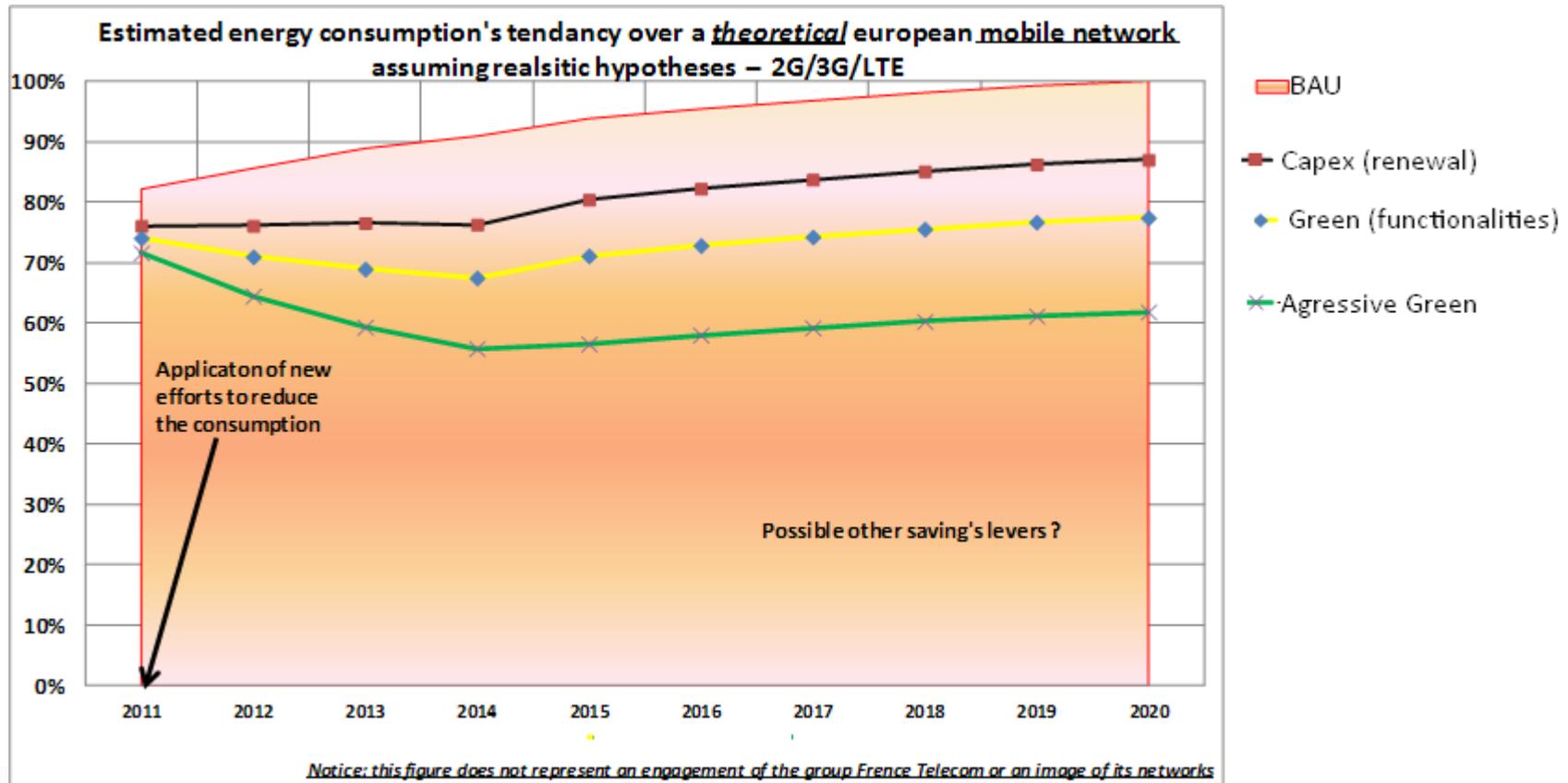
Evolution of the consumption a mobile network



- Let's take a theoretical example of a generic European network from 2011 and 2020
 - with the evolution of a heterogeneous network 2G/3G
 - LTE deployment (2012-2020)
 - Technical environment evolution
- Some evolution scenarios:
 - Basic scenario: starting point with the supposed current image of the network and new deployments
 - Progressive renewal scenario
 - Sleep mode scenario
 - RRH, and BS hostelling scenario

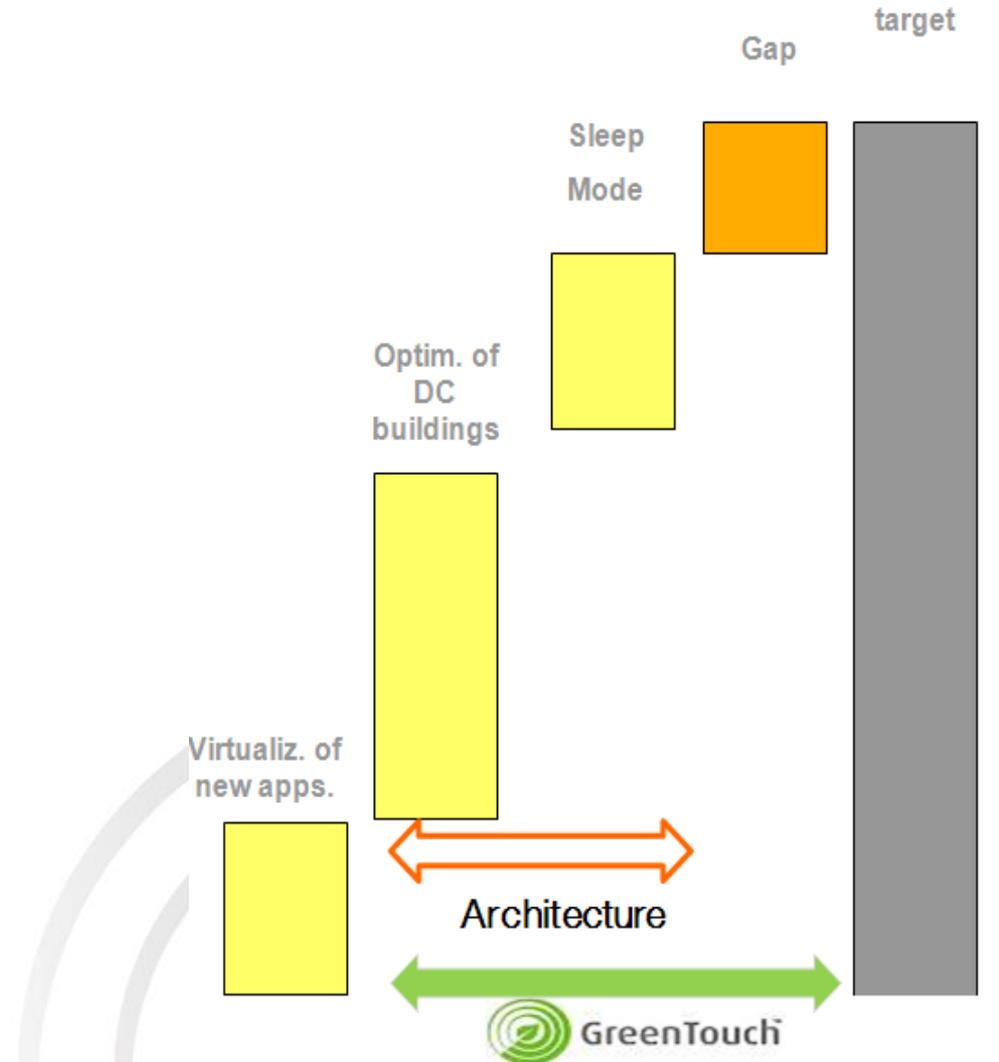


Energy forecast till 2020

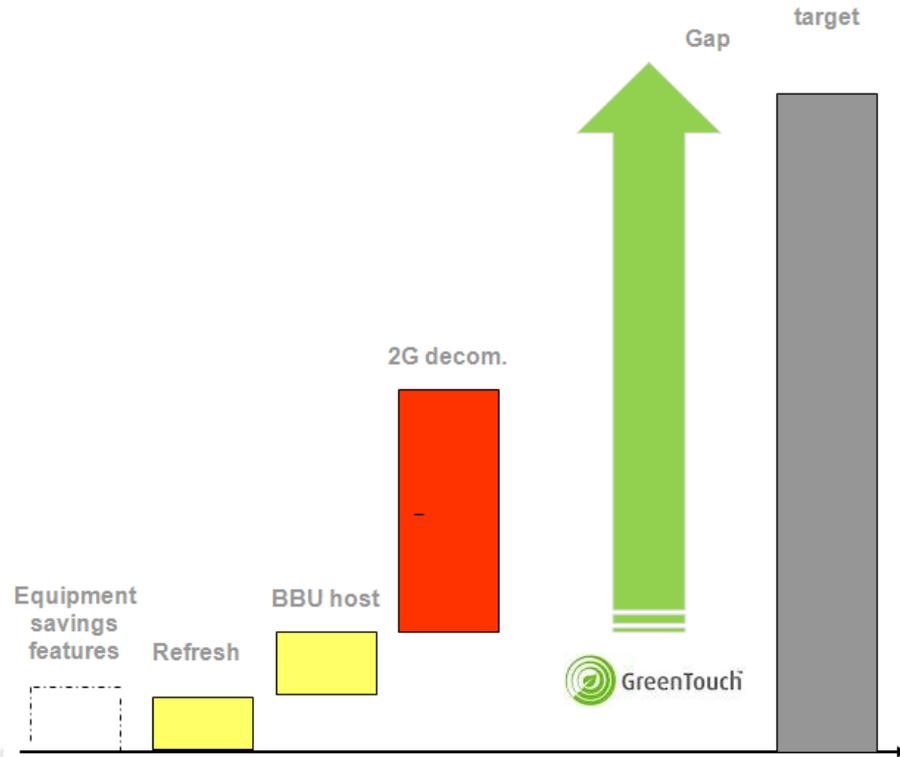


- real potential functionalities of energy saving although the network is increasing!
- Mobile is only a portion of the total energy consumption
- Aggressive green to stabilize the consumption by 2020 (how about EU recommendations : 2020)
- GreenTouch : stabilize consumption for BB anywhere

How to meet datacenter target



how to meet RAN target



need for new energy aware architecture for a sustainable deployment : tech-eco studies

GreenTouch goal



Improve by 1000-fold the network efficiency in 2020 (baseline, 2010)

Broadband for all and everywhere in 2020 at the same level of energy consumption of 2010

- top-down approach
 - QoS based
- bottom-up approach
 - consumption based

The diagram features a large, light blue curved arrow that starts from the top of the list and points towards the equation. A second, smaller light blue curved arrow starts from the bottom of the equation and points back towards the list, creating a circular flow. The equation itself is:
$$EE\ 2020 = \frac{\text{Traffic 2020}}{\text{Power 2020}}$$

Imagination is more important than knowledge.

Albert Einstein

