

Achieving Sustainable Networks - Operator's Perspective

Orange group

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Orange Group

over 224 million customers worldwide...



in 2011

> our total ITN energy consumption : 4 TWh

> our CO₂ emissions : ~ 300,000 round trips Paris – New York by plane

Corporate Social Responsibility :

The way a company contributes to sustainable development while seeking a fair balance between competition, social progress, and protecting the environment



- Orange group have the ambition to reduce GHG emissions and Energy consumption by 20% in 2020 and +renewable energy +20% (EU commitment)
- CSR is being more and more considered by international rating organisms
- Make green as a service (green computing, cloud, M2M)
- Innovation as a differentiation enabler
- New regulation and taxes are expected before 2020

Our ambition : green by design infrastructure

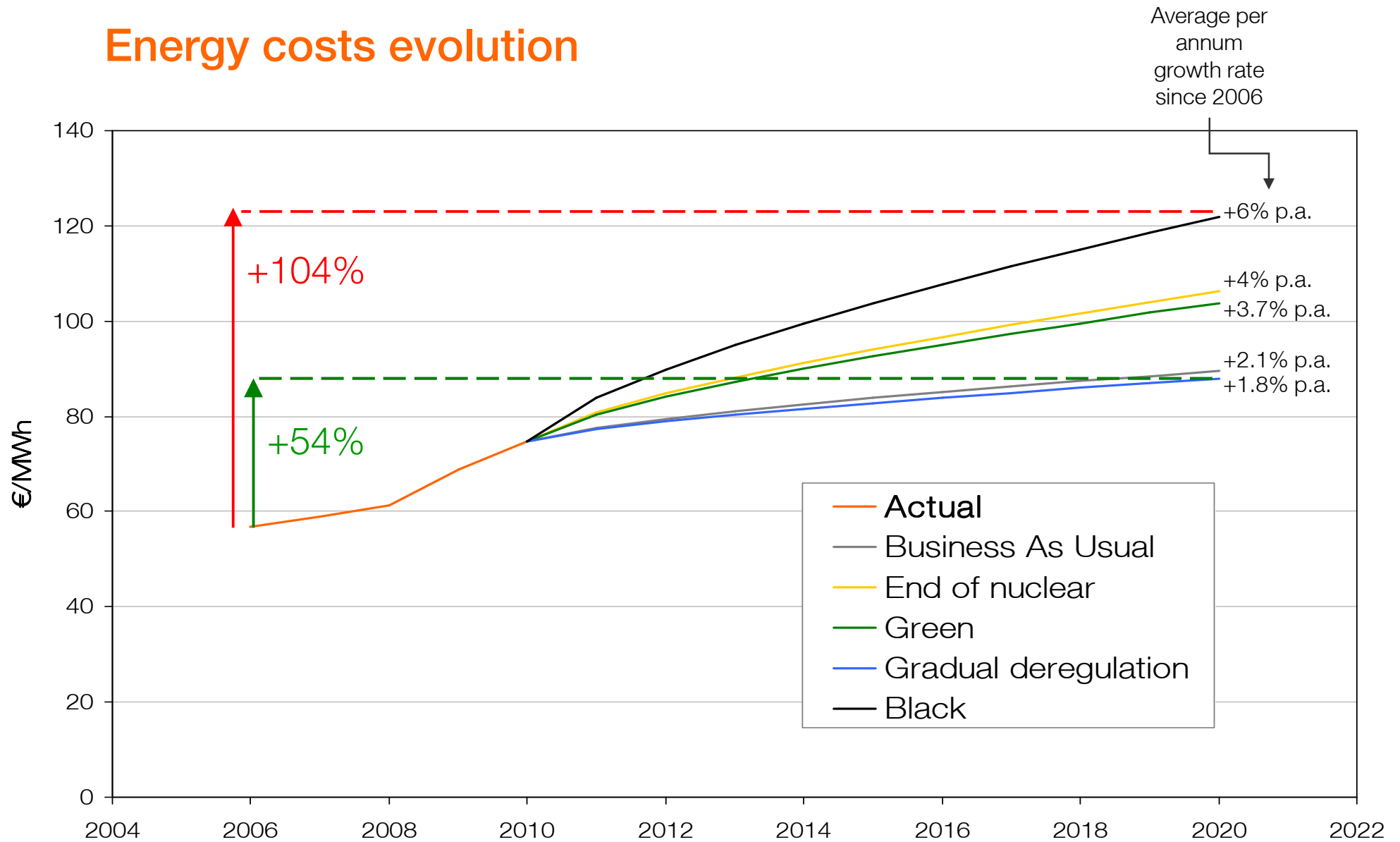
objectives: Put green in our DNA

- Prepare the **green transformation** of our networks
- Make green as a service by developing **green-by-design** devices and services (M2M applications, cloud)
- **off-grid** countries
- **out-of-the box ideas** (architecture, hardware, ...)

Constraints & opportunities

- The traffic is expected to increase x100 in the next decade which induce more infrastructure
- broadband everywhere and seamless connectivity
- Energy price is expected to increase : +60% rise forecasted in Europe in 2018 (vs. 2011)
- Hardware consumes energy even with zero traffic

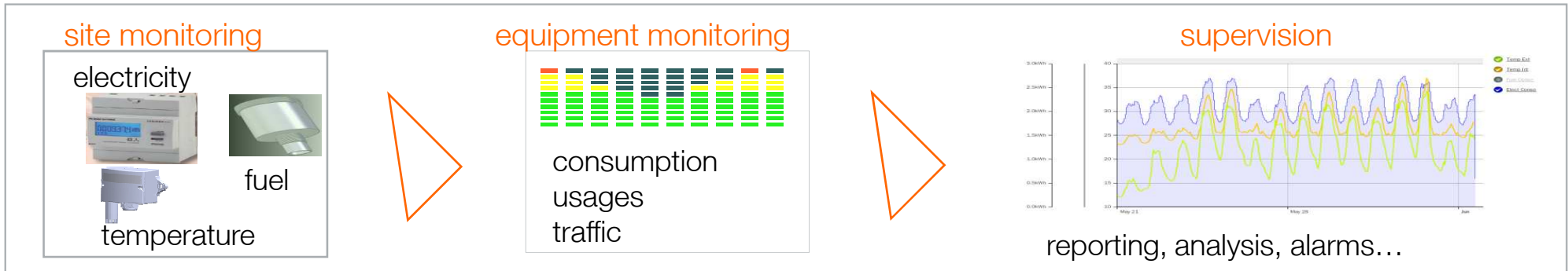
Energy costs evolution



Carbone 4 projections: electricity unitary cost for Orange– example of France

what else ...

- need for global and unified solution for monitoring networks consumption



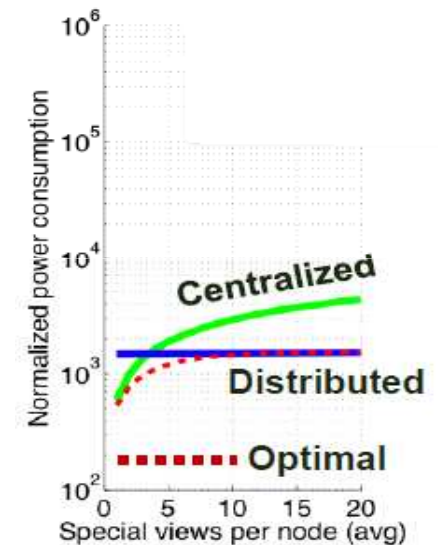
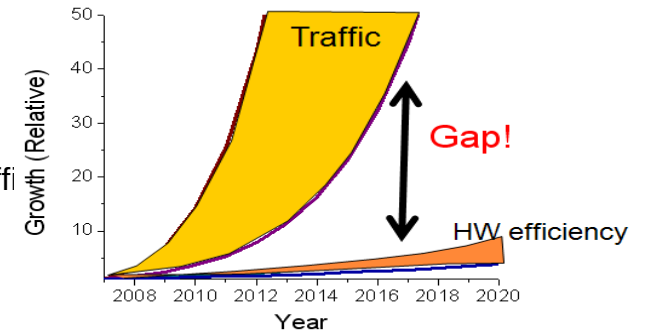
- need for scalable and dynamic hardware : zero consumption at zero traffic
 - fast sleep modes, dormant mode
- move from technology centric networks to software defined networks
 - reconfigurable hardware
- move from always on to always available
- collaborative and open innovation : disruptive solutions (GreenTouch)

Many projects on greener ICT equipment, network or architecture → need of unified assessment method

- **Greentouch**: new network architectures for high Energy Efficiency in W/bit/s
- **Trend**: dynamic management of transport network equipment to avoid explosion of consumption due to explosion of traffic
- **Econet**: Green Abstraction Layer (GAL): reduction by choosing optimal network paths through a minimum number of activated nodes
- **Opera-Net2**: high efficient radio emitter, standby mode management, less cooling and heating, hybrid solar energy
- **Odyssea**: peer to peer storage versus giga-datastorage ?
- COMBO : future converging networks and NGPoP

Fundamental questions

- reduce the consumption of IT is facing fundamental questions:
 - hardware energy efficiency (10% p.y) improvement does not compensate the rise of traffic (+60% p.y) and software → need new architecture, new development methods
- change the paradigm : move from “always-on” to “always available”
 - e.g. switch off non-used resources
 - use smart devices
- what type of networks : concentrated vs. distributed
 - Small and big data centers (CDN, ICN, caching, NGPoP...)
 - cloud / green computing
- how to manage the peak consumption
 - social acceptability to reduce the QoS
 - think telecom and energy
- optimize coexistence of multiple access technologies (2G, 3G, H+, LTE, Wifi, fixed)
 - need for seamless and multi-Radio-access optimization to avoid redundancy
 - SON, optical burst, MIMO, ...),



The green triumvirate

C. Shannon

$$C \leq W * \log(1 + P/N)$$



G. Moore

- the number of transistors on integrated circuits doubles approximately 18 months

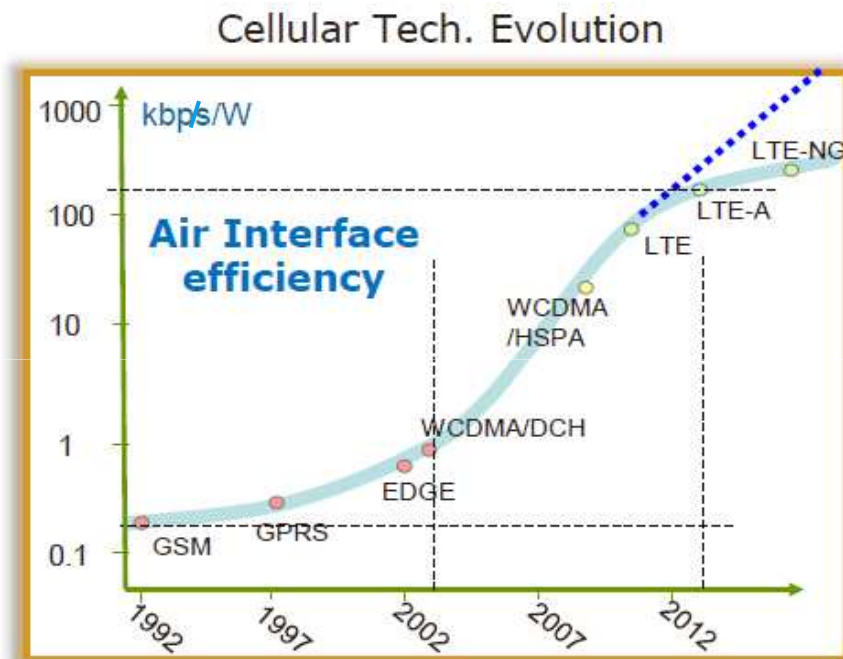


Jonathan Koomey

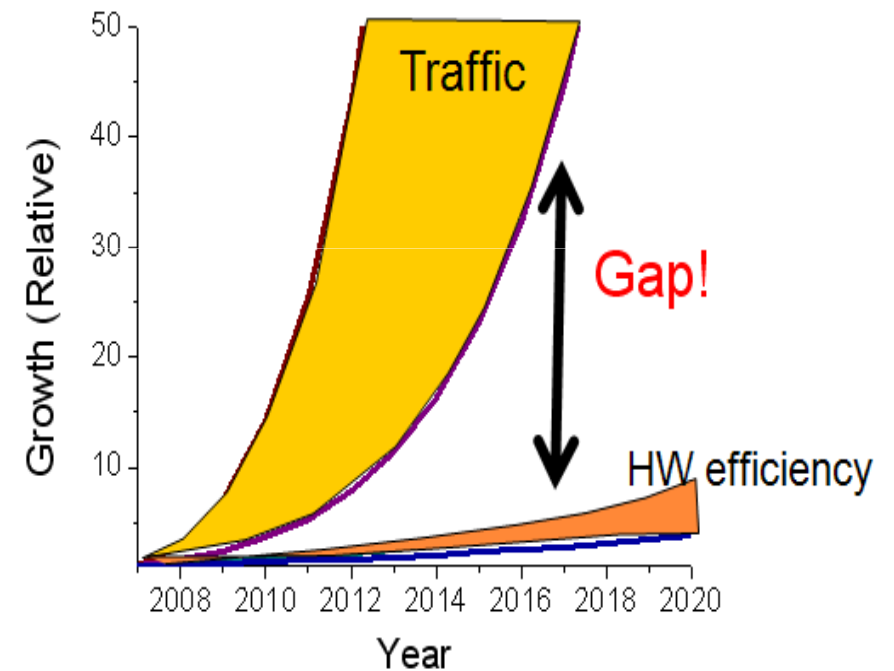
- the energy efficiency of computers doubles roughly every 18 months

how to deal with traffic increase

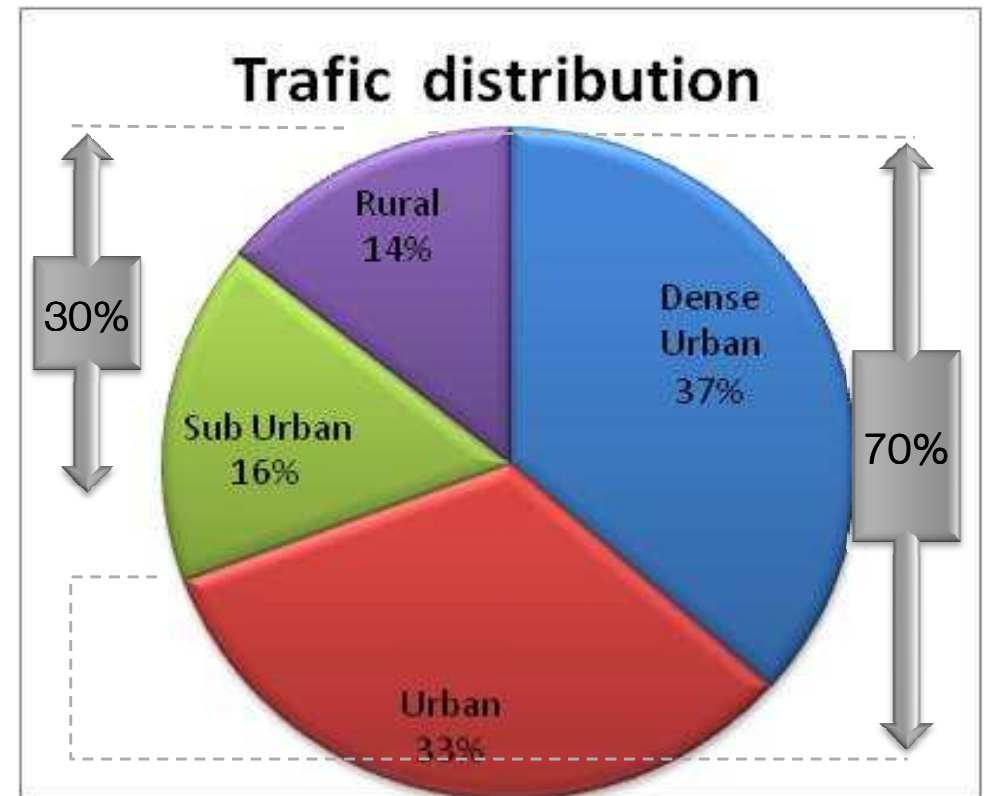
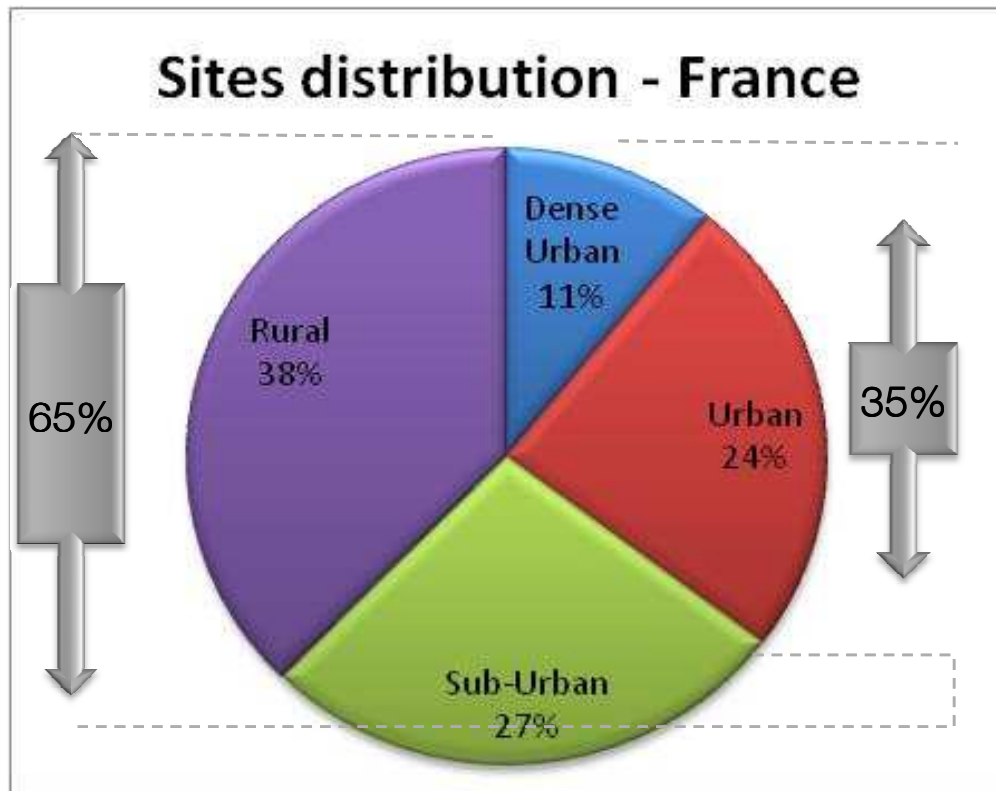
- a factor of x1000 (kbps/w) has already been achieved : GSM-> LTE but in 20 years essentially driven by spectral efficiency



- ◆ GSM → LTE-A, 1000x, 20 years
- ◆ WCDMA → LTE-A, 100x, 10 years
- ◆ LTE-A → LTE-NG, ~3x??, <5 years??
- ◆ Peak Efficiency is no longer enough to deal with the exponential traffic growth

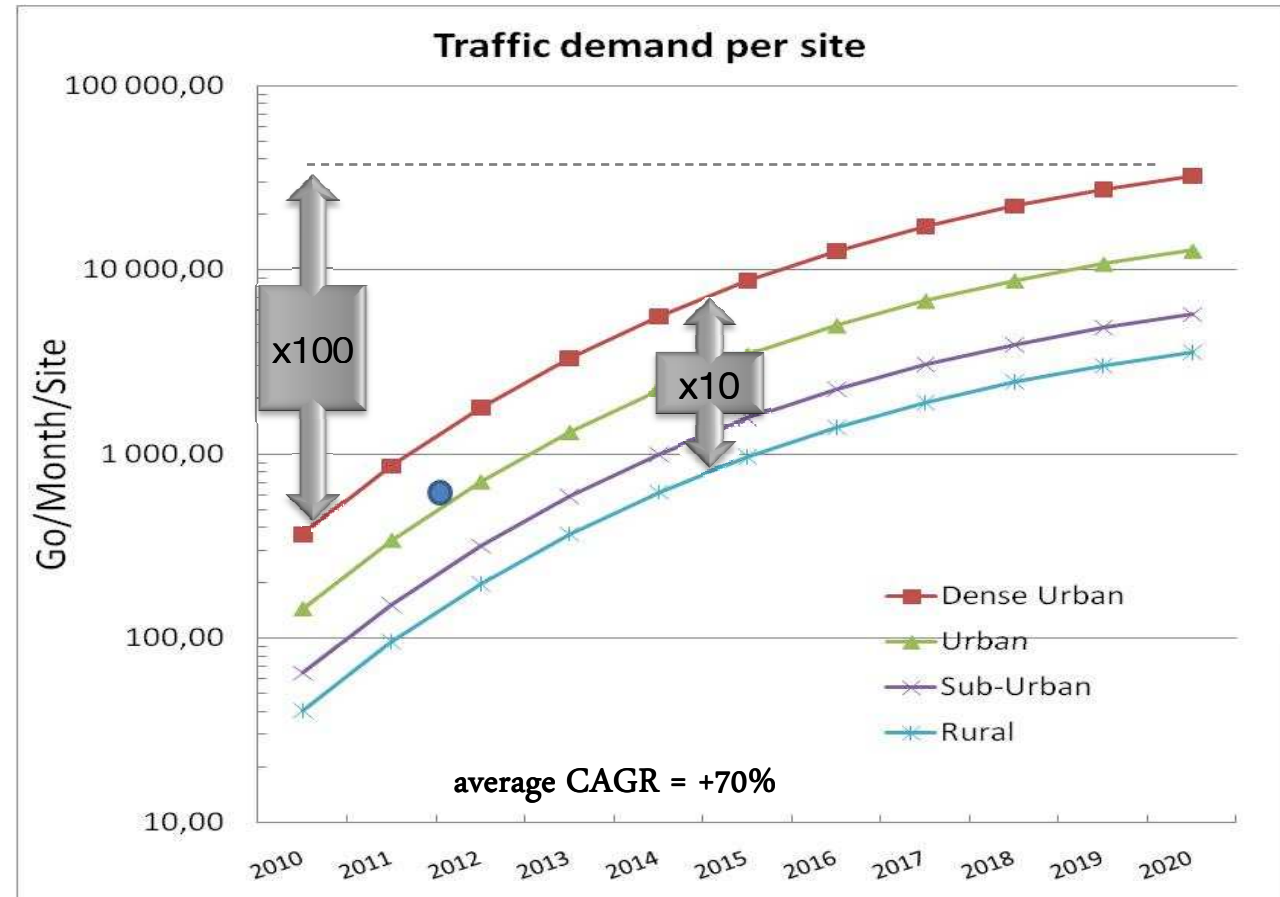


Traffic and network repartition : 70% of traffic is transported by 35% of the sites



- Consumption (watt) is driven by Rural and sub-urban Areas
- Energy efficiency (bit/s/watt) is driven by Dense-urban and urban areas

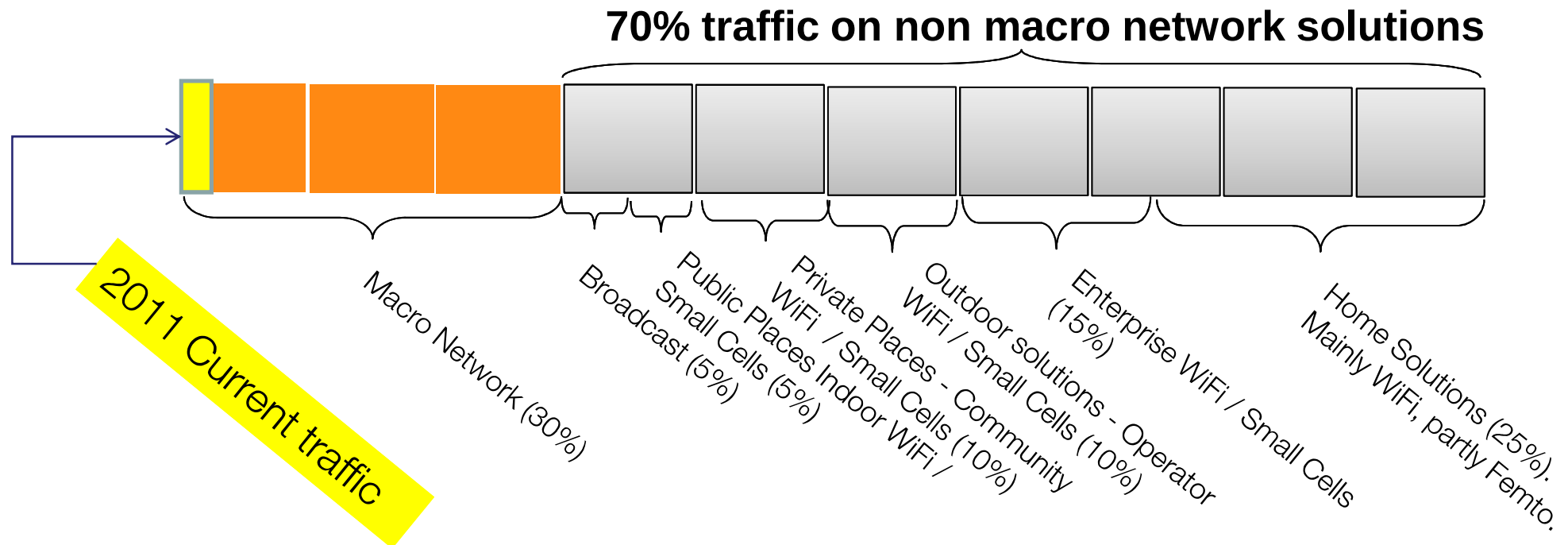
Annual traffic projection



- Each site is loaded according to the traffic demand given in this figure (GreenTouch traffic group)
- the projections gives :
 - x 100 traffic demand/sector between 2010 vs. 2020
 - x 10 for Dense Urban vs Rural

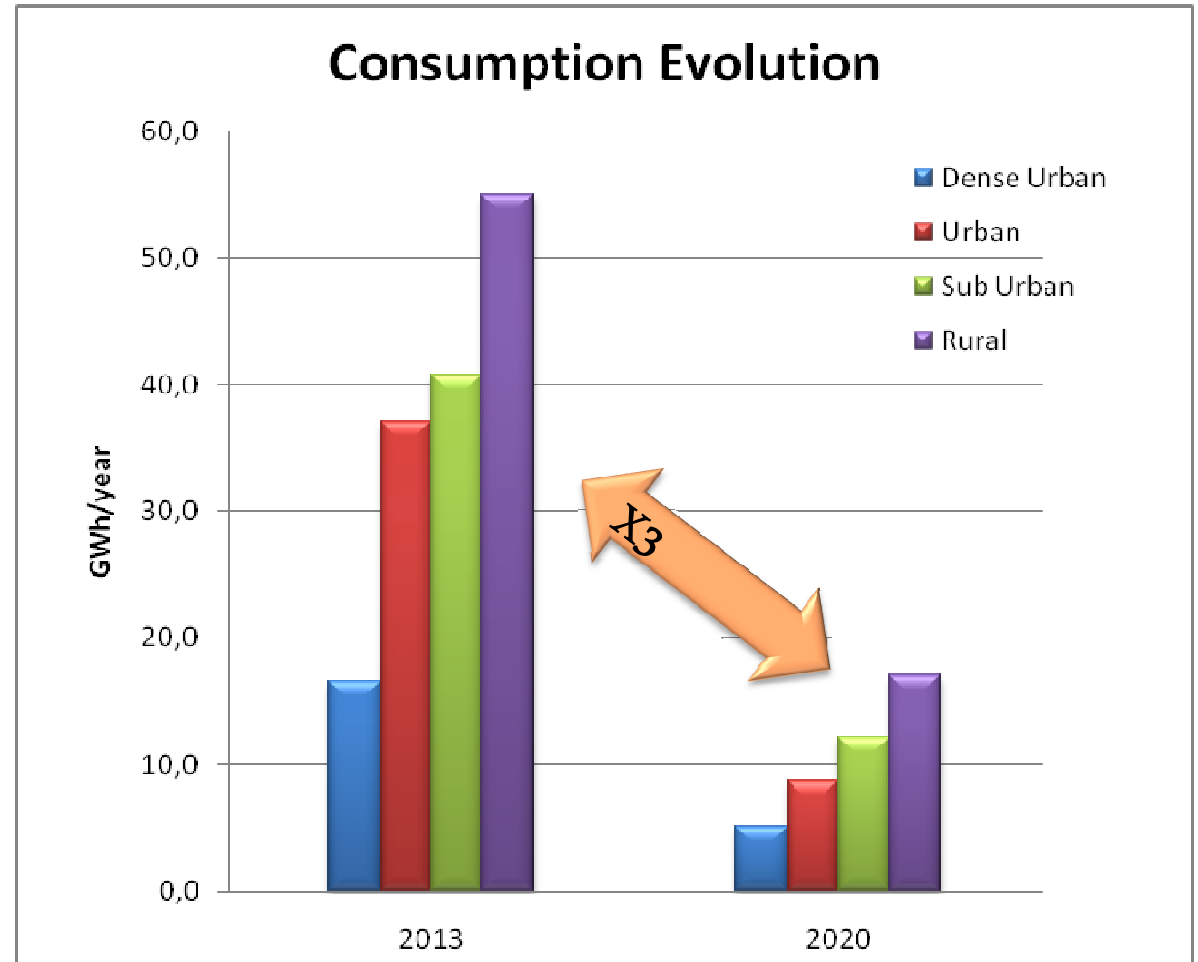
Potential Offload Scenario with traffic growth of x100 by 2020

- Case of Smartphone / Tablet driven market
- Based on usage location: 40% at home, 20% at work and 40% on the move



LTE study case – with GreenTouch

- Need densification
 - > in Dense from 2017 urban (2-4 picos/sector)
 - > in Urban from 2020 (1-2 picos/sector)
- energy opex saving estimation (LTE only)
 - > fast-sleep mode feature from 2013 : 10-15% reduction
 - > HW renewal in 2020 : x3 in EE
 - > off-loading is suitable for optimizing Fast-sleep-mode efficiency
- More saving if applied to 2G and 3G



conclusion

- Main advances will come from different levers:
 - > Electronics : move from CMOS 40nm to 20nm
 - > Power amplifiers: signal processing (how to reduce signal distortion) and new materials (GaN).
 - > Convergence: new point of presence that include fixe (MSAN) and mobile (nodes) in the same hardware and the same site
 - reconfigurable hardware
- push together for an aggressive improvement of energy efficiency and energy consumption of hardware
- need a paradigm shift in hardware (green by design) and software (management)
- standardization for accelerating time-to-market
- EU should take into-account ICT stakeholders that allow other sectors for reducing their environmental footprint

*we build too many roads and not enough
bridges*

I. Newton