

Wireline Networks

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Vision Statement

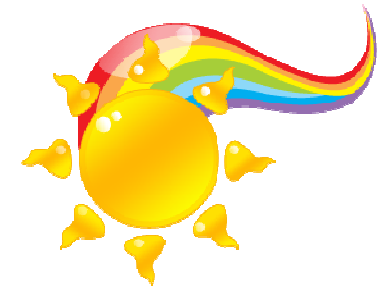


- Wireline Networks must provide connectivity needed for work and play without a negative environmental impact for the next generation to clean up



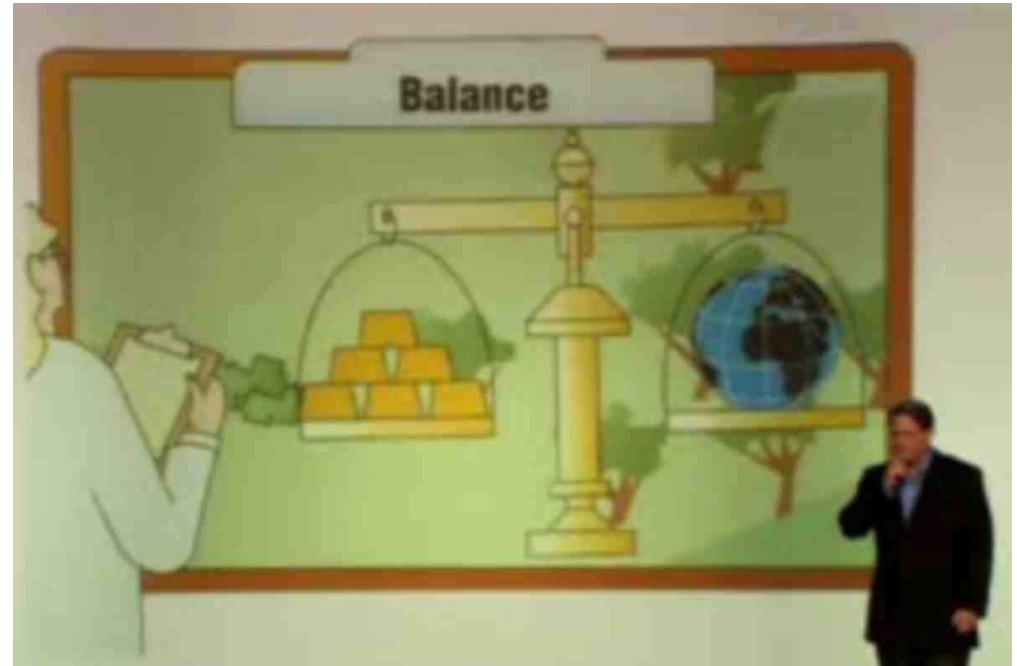
Goals

- Minimum energy requirement which scales with traffic
 - Minimum photons/bit or Joules/bit
 - (5 photons per bit is best minimum reported performance for optical transmission)
- A zero carbon strategy
 - Energy sourced from non-fossil fuels
 - Solar, tidal, wind etc.
- ‘Cradle to cradle’ approach for manufacturing and recycling [1]
 - New products made from old
 - Minerals stay in circulation
 - No need to mine scarce minerals



The problem with ICTs (and wireline)

- Moore's Law
 - Chip capacity doubles every 2 years
 - Communication systems (i.e. wireline) need corresponding speed increases (read-out, read-in)
 - Exponential growth means that even at 5 photons per bit we will have an energy problem
- Market Growth
 - Limited by world population
 - But new 'must haves' come along every year
- "Are we getting the balance of resources right?"

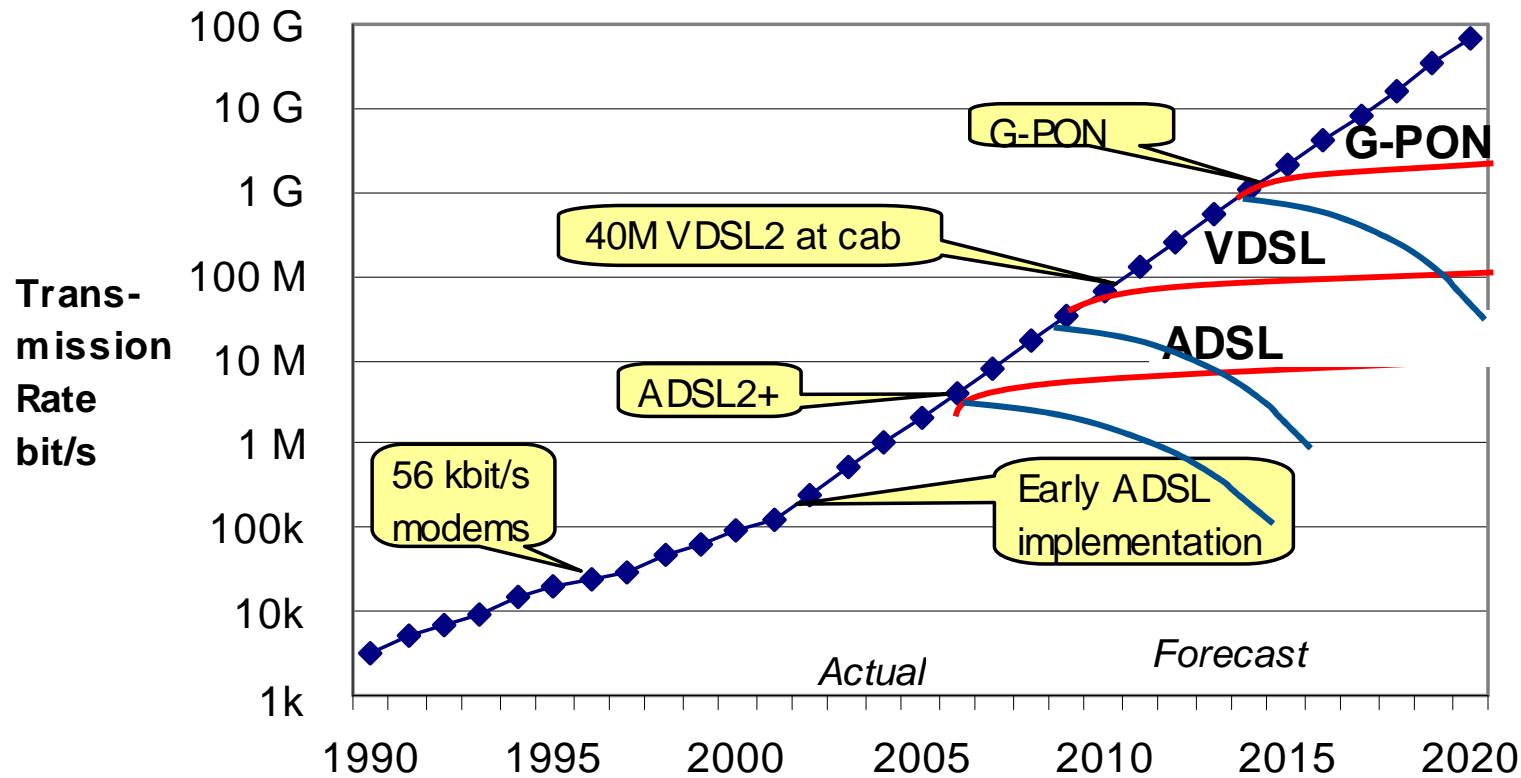


From the film 'An Inconvenient Truth', Al Gore
<http://www.youtube.com/watch?v=Do2AHLxul2Y>

Device Example- Broadband Modems

Bit-rate and power consumption versus time

Can we increase speed while saving power?



LT and NT Power consumption trend

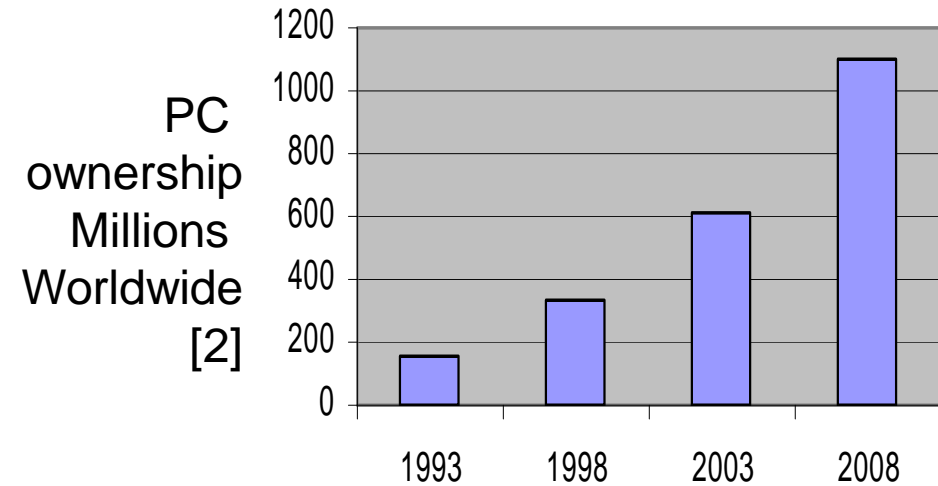
Trend line based upon "Next Generation Broadband in Europe: The Need for Speed", Heavy Reading Report, Vol. 3, No. 5, March 2005.



Today's Global Market

*This month (Nov 2009)
broadband wireless link
connection numbers are set to
exceed wireline*

*PC ownership is a driver for
wireline or wireless connectivity*



- Wireline

- DSL 300M [1,5]
- Cable 95M [1] } 448M
- Fibre 53M [1]
- Ethernet 600M [2]
- Fixed line telephony 1270M [4]

- Wireless

- Cellular broadband 432M [3]
- Wifi 700M [2]
- Cellular voice 4090M [3]

Wireline supports backhaul bandwidth growth.....

[1] www.Ovum.com

[2] projection from

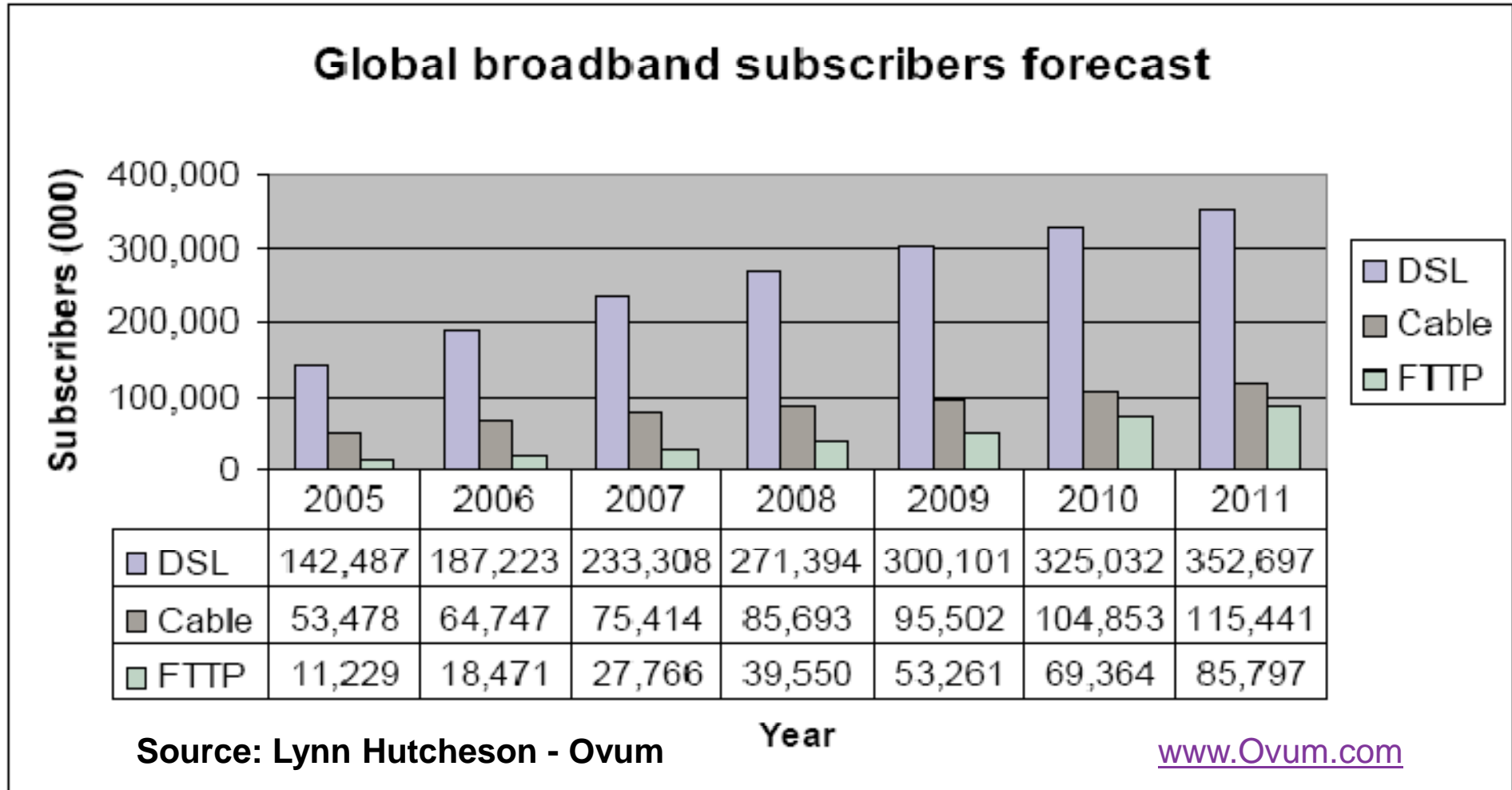
http://upload.wikimedia.org/wikipedia/commons/5/53/Personal_computers_%28million%29_ITU.png

[3] <http://www.gsacom.com/index.php4>

[4] <http://en.wikipedia.org/wiki/Telephone>

[5] <http://www.dslprime.com/dslprime/42-d/1329-dsl-prime-issue>

Broadband Subscriber Forecast



ICT trends and energy consumption

- Market doubles every 5 years [1]
 - E.g. Broadband expanding to more users
 - Until market saturates
- Moore's Law triggers increased bit rate and functionality
 - Annual growth rate of internet traffic is 85% [2]
 - upgrades replace 'obsolete' devices
- Plethora of devices become a 'must have'
 - 100 processors in average home
 - E.g. e-book reader [3] and HDTV

All trends exponentially increase demand for energy

- the GeSI Smart 2020 report [4] predicts growth in ICTs power requirement of 70% over the period 2007-2020

We need to understand our industry's apparently insatiable demand for energy and resources

[1] Source Lynn Hutcheson Ovum. www.ovum.com

[2] cfp.mit.edu/events/jan08/presentations/ODLYZKO-traffic-growth.ppt

[3] http://en.wikipedia.org/wiki/File:Sony_PRS-700.jpg

[4] <http://www.smart2020.org/>

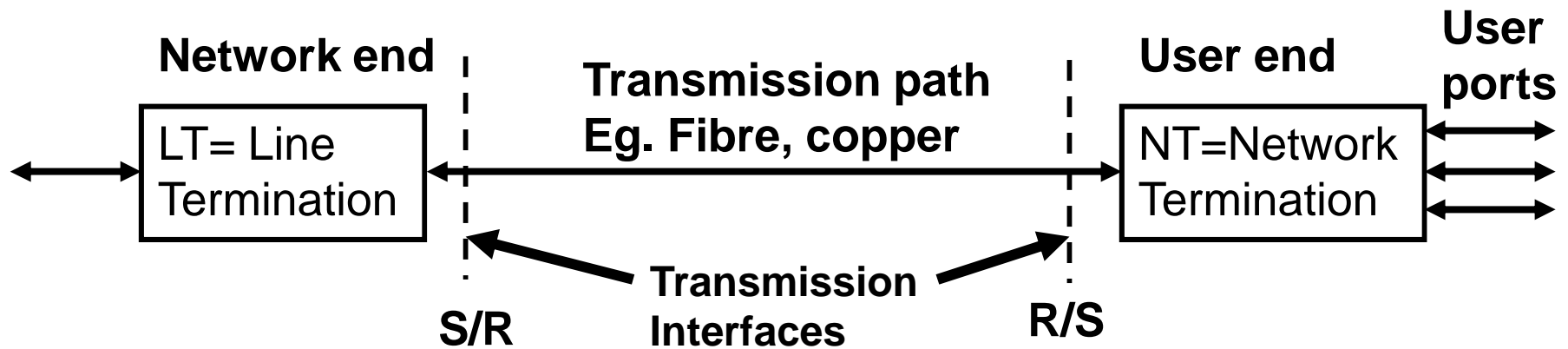
ICT propositions to reduce emissions

- ICTs' 'own' emissions
 - Lower embodied
 - Lower in-use energy
 - More recycling
- Efficiency gains in other sectors
 - E.g. satellite guidance of vehicles
- Travel substitution services
 - telecommuting
 - E-learning
- Energy generating systems
 - PV Solar panels

What can ETSI do?

- Support and promote smooth relationship with EU Stand-by Initiative
 - Turn CoCs into ETSI standards
 - Plugfests to enforce and support CoCs
 - Seek ITU-T endorsement to make them international
- Support and promote mitigation technologies
 - E.g. standardise services which offer travel substitution
 - Teleworking, teleconferences, virtual holidays!
- Consider including solar power into the devices or related power supply
 - Standardise solar power units for ICTs

Broadband Access Standards



- Focus is on transmission interfaces
 - Describing “the signals passing through”
 - But the “black boxes” at the ends consume most of the energy

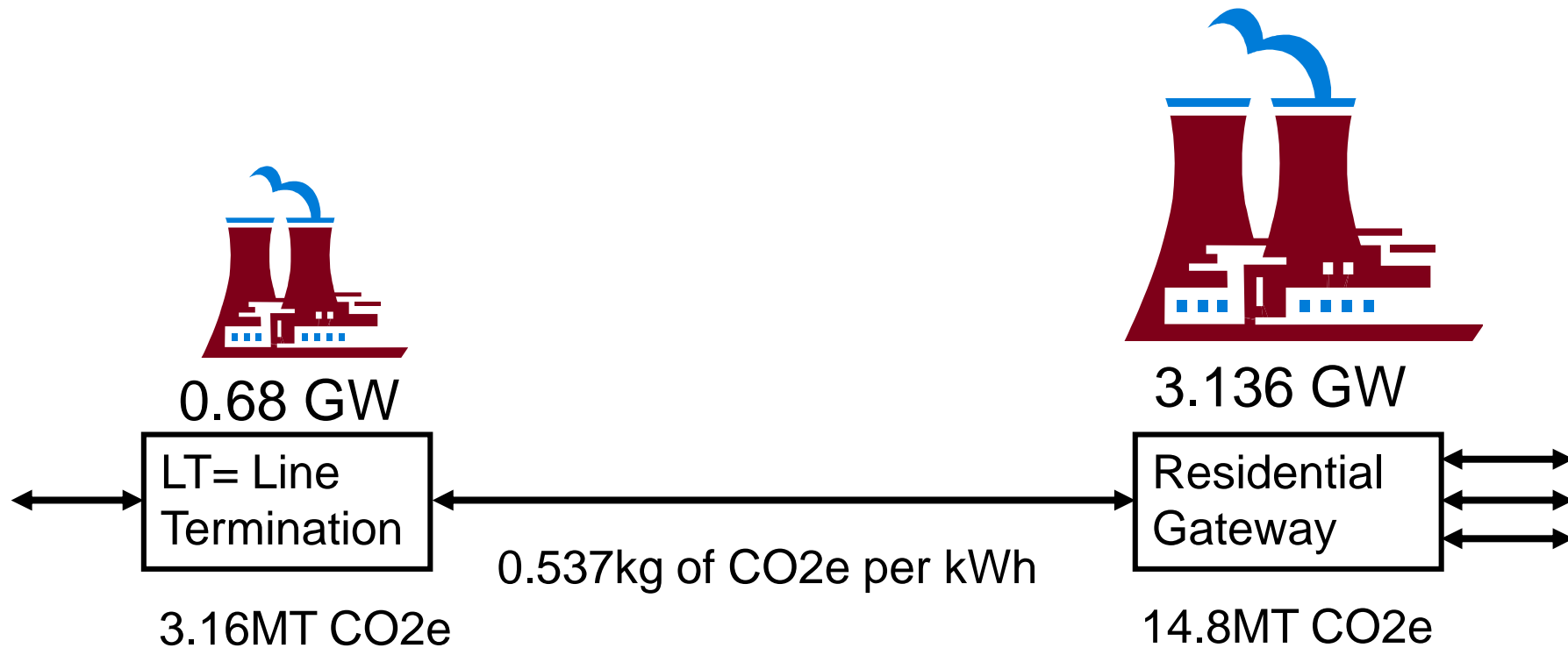
What is the power consumption of Wireline Access Technologies?

- Power consumption of a modem pair per line (approximate without user ports)
 - ADSL 3.0 W (1.5W NT plus 1.5W LT*)
 - VDSL 6.75 W (4W NT plus 2.75WLT*)
 - PON 2 W (1.5W ONT including a 1/32 share of OLT at 0.5W per line)
 - PSTN 1W (LT only)
- *At the customer end (NT) central functions and user ports can add up to a further 2.3-5 W and include*
 - *Router/Firewall, 4 Ethernet, Wifi, and VOIP ports*
 - *As integrated 'home gateways' this power is reducing*

Initiatives to reduce the energy requirements of Wireline Technologies

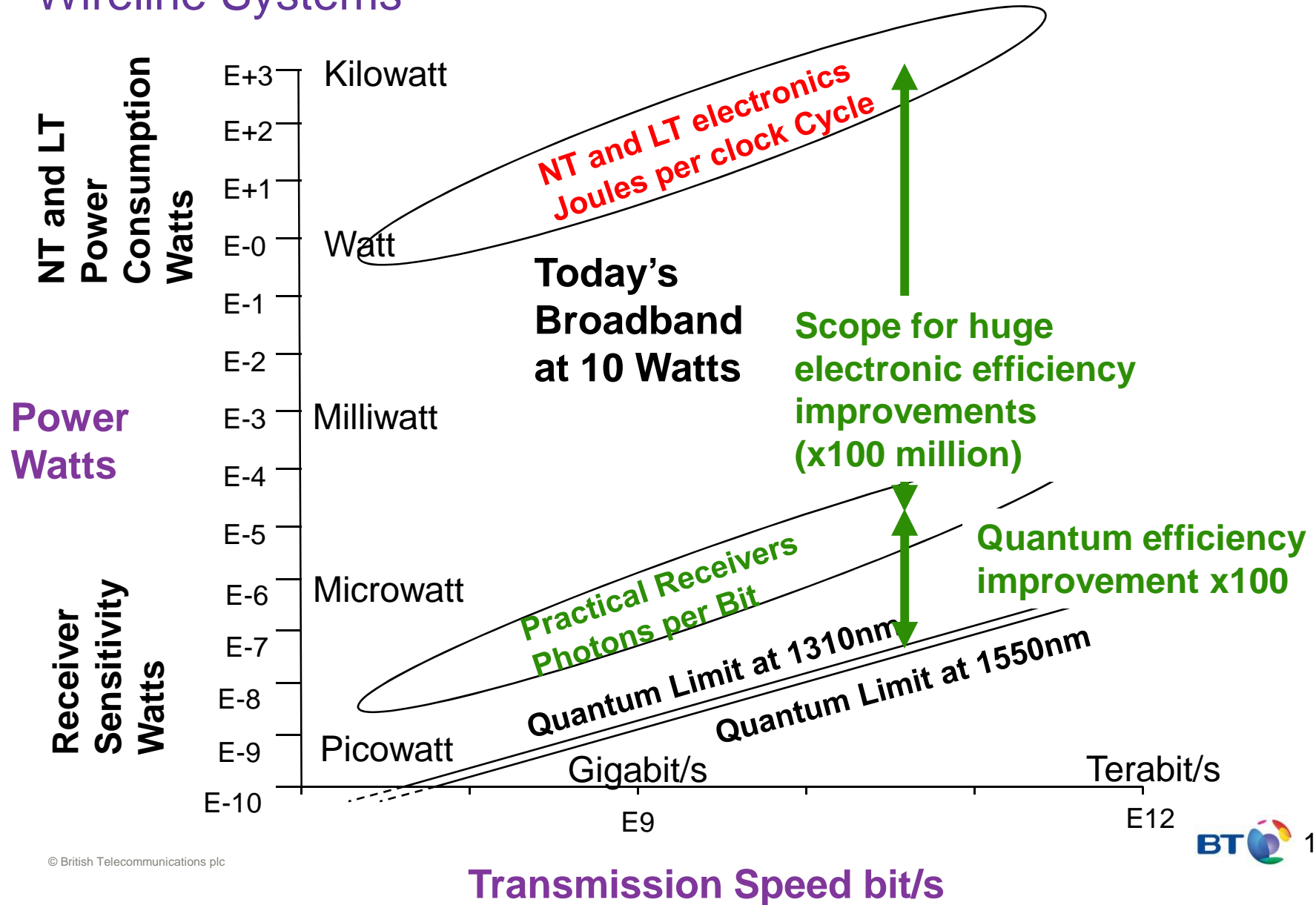
- With energy saving modes and increased integration, the energy per device is going in the right direction
 - ADSL2/2+ supports low power modes (L2)
 - A reduction of 50% on wireline (e.g. ADSL2/2+ 0.8W LT-only)
 - G-PON is introducing energy saving modes saving up to 50% at the ONU
 - Includes detection of mains failure, power shedding, 'dozing' and 'sleeping'
 - Awaiting publication of a G.984 supplement on this topic
 - However, for VDSL2 G.993.2 there is power reduction to reduce crosstalk
 - but no standby or energy saving modes are described
 - ETSI should bring forward standardisation to drive change in this area
- *Should ETSI be sponsoring a low energy 'plugfest' for wireline technologies with a cup/prize/recognition for the least energy per bit?....*

Worldwide Broadband Access Emissions



- Focus is on LT and home hub for wireline
 - Currently always on
 - CPE is a large extra at customer end e.g. an old style PC at 100 Watts for the device plus 100Watts for the monitor
 - Multiplexer is an extra at exchange end

Relationship between Power and Speed of Wireline Systems



Issues to consider regarding wireline energy saving-What more can be done?

- Telephony services
 - How to integrate VoIP, avoiding overlays, but without exceeding the power of a direct exchange line?
 - USO?
 - Solution needed for all wireline types
- VDSL2
 - Energy saving modes. What can be done in this area?
 - Always available rather than always on (like L2)
 - **Green Plugfests** could stimulate interest in this area
- G-PON
 - OLT's. Can the split rate be increased to save per line energy?
 - ONT's. Reducing energy also reduces backup battery size for telephony service

The challenge for the future

- Exponential growth of internet traffic is unsustainable
 - At present rate of expansion of internet traffic (with server power doubling every 5 years) by year 2100 the entire earth's surface could be covered by pv panels and their rechargeable batteries
 - What other energy sources will we turn to?

Conclusion and Recommendations

- Plan for a zero carbon future
 - Every ICT product will have an associated non-fossil fuel energy source
- ETSI to support and promote smooth relationship with EU Stand-by Initiative
 - The emerging family of Codes of Conduct
 - And internationalise standards with ITU-T endorsement
- ETSI to consider a low energy plug-fest
 - A 'Grand Prix' with a **green prize/recognition** for the winner!