Roles of Telecoms and IT Service Providers in Tackling Climate Change

ICT & Climate Change Training Program

Session 4

ITU and climate change

ITU ACADEMY

Session Objectives

This module provides a detailed understanding of the role of telecommunications and IT service providers in tackling climate change, including their impact on energy efficiency and mitigation. It includes the regulatory issues around infrastructure sharing and provision of renewable energy and the infrastructure for smart cities.

STUDENTS

Session Topics

- How do TSPs report on GHG emissions?
- Ways to reduce energy consumption.
- Leverage of TSPs on equipment vendors.
- Infrastructure sharing – fixed and mobile.
- Use of renewable energy.
- What are barriers for TSP to introduction of green technologies?
  - how could regulators help overcome these?
- Infrastructure for Smart Sustainable Cities.
- Enabling Standards.

Recap on roles of service providers in tackling climate change

- Improving the energy efficiency of the ICTs themselves.
- Applying ICTs to reducing emissions in other sectors (mitigation), e.g. in the transport sector.
- Applying ICTs to improving adaptation to climate change.

ICT Service Providers can have a major role in all 3 areas …but they might need some encouragement from regulation.

How do TSPs assess their carbon footprint and set targets for reduction?

- BT Group Better Future Report - www.btplc.com/Betterfuture/
- Orange CSR Report - www.orange.com/en/responsibility
- Telecom Italia Sustainability Report – www.telecomitalia.com/tit/en/sustainability/sustainability-report.html
- Verizon Sustainability Policy - www.verizon.com/about/responsibility/sustainability
- Vodafone India Sustainability Report - www.vodafone.com/content/dam/sustainability/2014/pdf/annual_sustainabilityreport_2013.pdf

Examples of targets for GHG emission reductions

- AT&T: to reduce carbon emissions by 60 by 2020 (against a 2008 baseline).
- BT: to reduce carbon emissions intensity by 80% by 2020 (against a 1997 baseline).
- DT: to reduce carbon emissions by 20% by 2020.
- Orange: to reduce carbon emissions by 20% by 2020.
- Verizon: to reduce carbon emissions by 50% by 2020 (against a 2009 baseline).

BT's worldwide energy use and GHG emissions - Year ended 31 March 2015

www.btplc.com/Sharesandperformance/Annualreportandreview/index.cfm

Reporting Emissions

- What is the difference between direct and indirect emissions?
  - Direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity.
  - Indirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity
- The GHG Protocol further categorizes these direct and indirect emissions into three broad scopes:
  - Scope 1: All direct GHG emissions.
  - Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam.
  - Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.
- These definitions avoid problems of double accounting
  - E.g. electricity emissions are reported by power generator companies, not by the user of the electricity

How are the figures collected?

- From energy bills.
- By making inventories of all the buildings (and their equipment) and vehicles.
  - This can be examined for possible savings through economy measures (e.g. forced air cooling) or lower power replacement equipment (when at end of life or obsolete).
  - Year on year reduction targets can then be met.
  - People need to be allocated to this task.

Example from BT

BT Delivering Our Purpose Report - Carbon emissions from our worldwide operations For the year ended 31 March 2015 Emissions source (CO_2e kilotonnes)	1997 (Base)	2011	2012	2013	2014	2015
Scope 1 - Direct GHG emissions						
Oil Combustion - Electricity Generation	12	8	7	3	4	2
Gas Combustion	108	61	50	58	49	37
Oil Combustion - Heating	67	4	5	5	5	3
Refrigeration Gases (HFCs and SF6 only)	1	5	4	4	6	6
Commercial Fleet Diesel	167	103	104	102	100	114
Commercial Fleet Petrol	18	0.01	0.02	0.02	0.02	0.02
Company Car Diesel	24	17	19	20	17	15
Company Car Petrol/Other Fuels	16	2	2	2	1	1
Total scope 1 emissions	**414**	**198**	**191**	**194**	**182**	**178**
Scope 2 - Indirect GHG emissions from consumption of purchased electricity						
Gross @ grid average intensity (excludes 3rd party consumption)	1,097	1,186	1,180	1,099	1,058	1,127
Less purchases of;						
Renewable supply	n/a	484	476	867	996	1,062
CHP low carbon supply	n/a	189	188	43	0	0
Scope 2 emissions (net)	**1,097**	**513**	**516**	**190**	**62**	**65**
Combined Scope 1 & 2 emissions (net) - excludes 3rd party consumption	**1,511**	**711**	**707**	**383**	**244**	**243**
Scope 3 - Other indirect GHG emissions						
Homeworker Emissions (estimated)	n/a	4	3	3	2	2
Electricity Transmission & Distribution Losses	45	85	92	92	88	97
Refrigeration Gases (CFCs and HCFCs only)	13	4	2	2	3	3
Private Vehicles on BT Business (All Fuels)	6	8	8	8	7	6
Rail travel (Using UK Factors)	11	5	6	5	5	4
Hire Cars	11	5	6	6	8	5
Taxi	n/a	0.16	0.15	0.12	0.12	0.10
Air Travel (Domestic)	n/a	13	12	12	11	9
Air Travel (short haul)	15	5	5	4	4	3
Air Travel (long haul)	15	24	23	20	19	14
Total Scope 3 emissions	**117**	**154**	**157**	**151**	**147**	**142**

https://www.btplc.com/.../BTEnvironmentalDataandEmissions2015.xlsx

BT Green Strategy

- BT consumes 0.7% of UK total electricity demand.
- BT have reduced UK carbon intensity by over 70% since 1996.
- BT aims to reduce carbon emissions:
  - UK: 80% reduction by 2016.
  - Globally: 80% reduction by 2020.
- Purchasing Renewable Energy.
- Creating energy efficiencies in the network and data centres.
- Investing in BT Infinity SuperFast Broadband.
- Increasing number of teleworkers/home workers:
  - Reduces Scope 3 emissions through travel to work.
  - Use of hot desking reduces Scope 2 electricity and building costs.

How ‘Green’ are your Suppliers? Some criteria from the UK

- Do they have a verifiable track record in the green area?
  - E.g. listing on Carbon Trust website
  - www.carbontrust.co.uk
- Do they meet the requirements for the European Codes of Conduct
  - http://re.jrc.ec.europa.eu/energyefficiency/
- Do they meet any of EPEAT’s Gold, Silver or Bronze criteria?
  - EPEAT evaluates electronic products in relation to 51 total environmental criteria, identified in the Criteria Table below and contained in IEEE 1680
  - Are their products listed on the EPEAT registry?
  - http://www.epeat.net/Criteria.aspx

Can your suppliers tell you if they design for End of Life?

- Identify all materials with special handling needs?
- Eliminate paints and coatings that are incompatible with recycling or reuse?
- Design the external case to be easily disassembled?
- Identify all plastic components for recycling?
- Make it easy to identify and remove components with hazardous materials?
- Optional areas to explore with your supply chain:
  - Reduce number of plastic types used
  - Eliminate moulded/glued metal
  - Ensure at least 65% of product is recyclable or reusable
  - Ensure at least 90% of product is recyclable or reusable
  - Design products to make it easy to separate plastic types

Ways to reduce energy consumption of ICT equipment

- Set mandatory limits on energy consumption, preferably in conjunction with other countries in region (e.g. EC CoCs or US EnergyStar).
- Use eco-design (global) standards in procurement.
- Use energy efficient network architectures – e.g. mobile network site sharing.
- Encourage best practices in ICT design – e.g. use of low power states for equipment.
- Use local renewable power supplies – e.g. wind and solar on mobile base stations.

All of these can be helped by regulation and the setting of targets.

Setting Mandatory Limits on Energy Consumption

Example of EU Codes of Conduct:

- CoC for Data Centres.
- CoC for Digital TV Services.
- CoC on Energy Consumption of Broadband Communication Equipment.
- CoC on Efficiency of External Power Supplies.
- CoC on AC Uninterruptible Power Systems (UPS).

(Voluntary) regulation has helped to bring about a reduction in energy consumption.

Source: EU Codes of Conduct available from http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative.htm

Setting Mandatory Limits on Energy Consumption

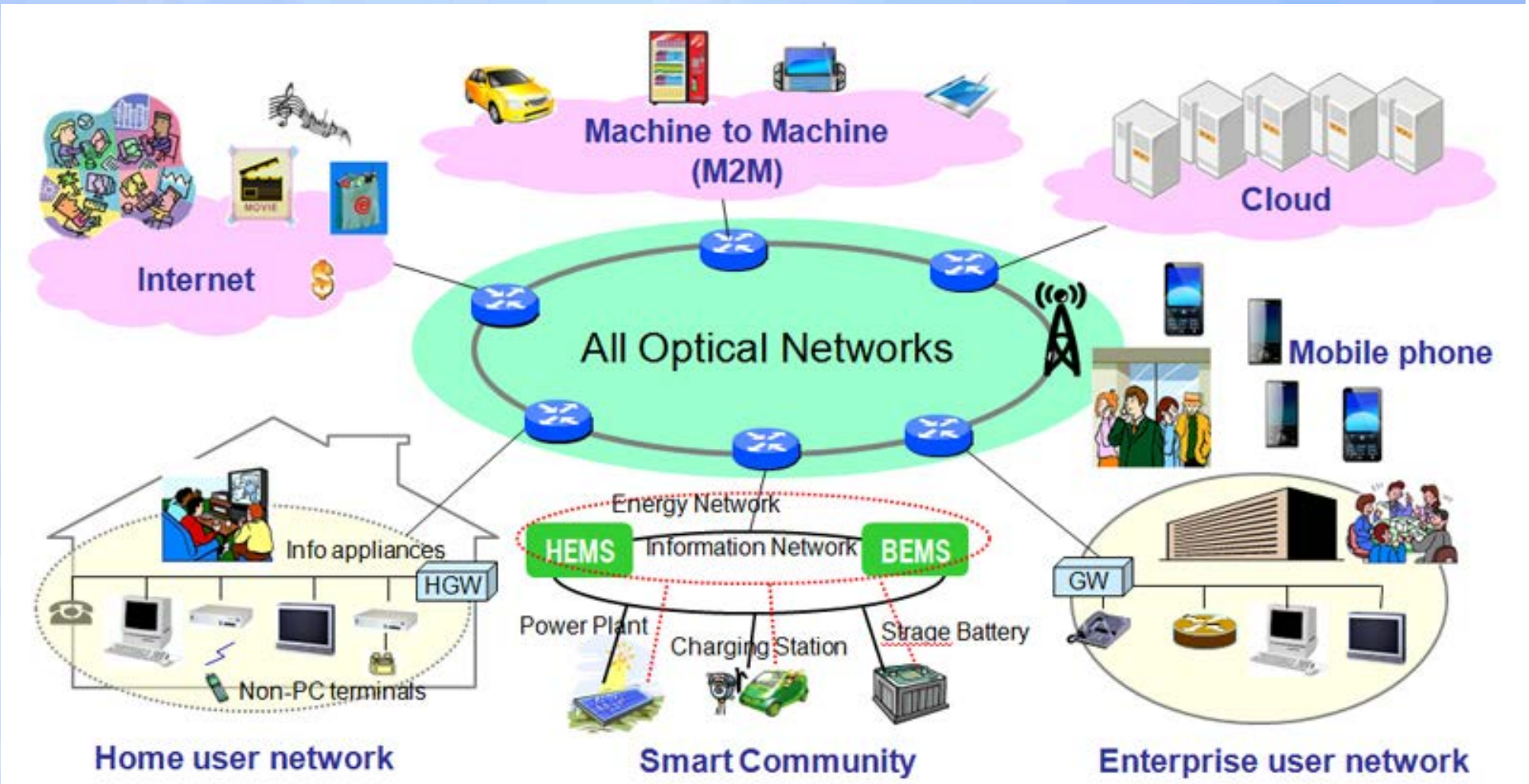
Example of Energy efficiency Standards & Labelling Programme (BRESL) in Pakistan:

The following devices are covered:

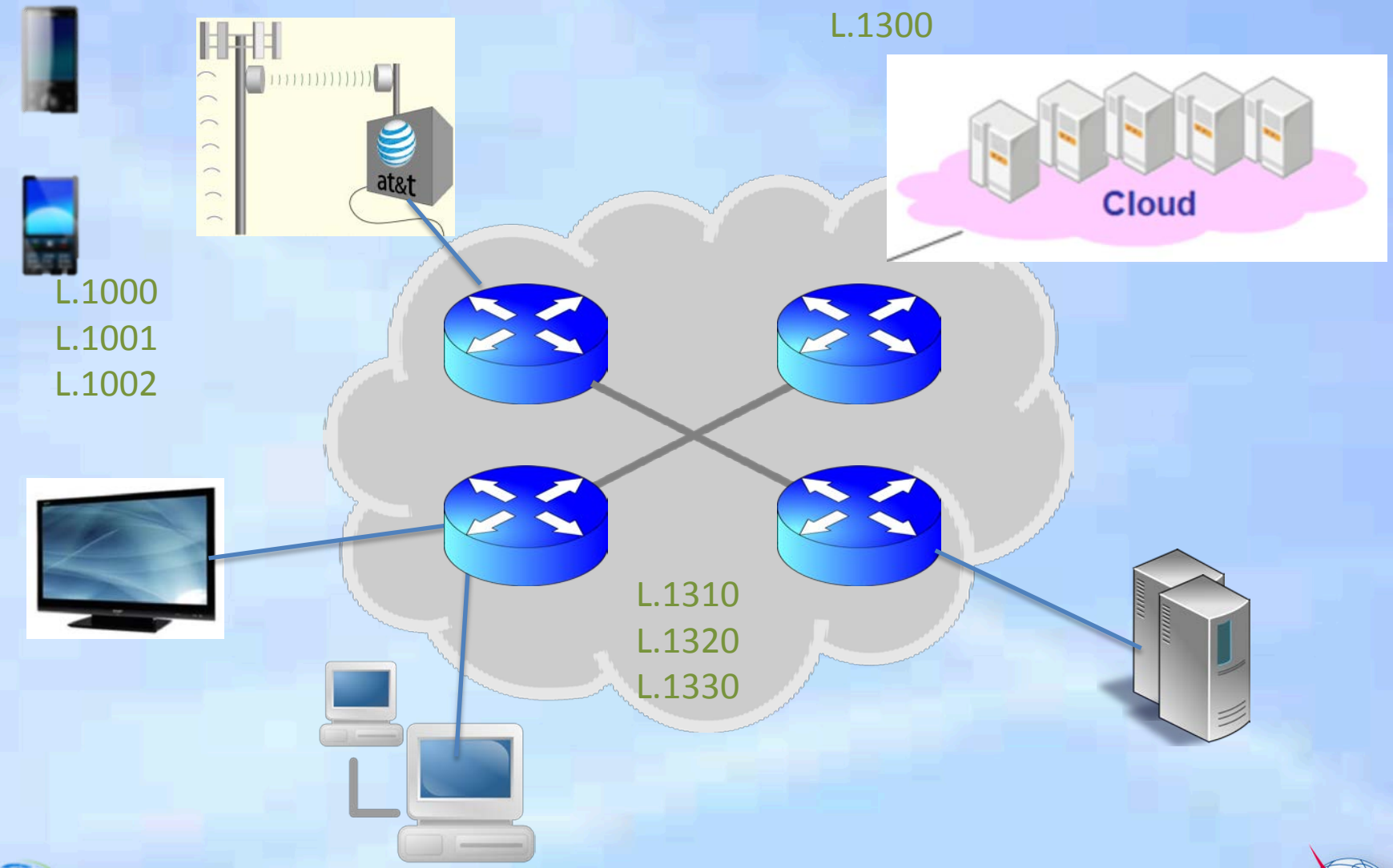
- Fans
- Motors
- CFLs
- Ballasts
- Air Conditioners
- Refrigerators.

This is a good start but not enough devices are currently covered.

Telecoms/ICT Infrastructure



Simplified diagram…



Resource sharing

- Network infrastructure can be shared between TSPs who cooperate with a common infrastructure provider:
  - Mast and electricity supply.
  - Technologies, e.g. LTE, UMTS and GSM.
  - Antenna system.
- Same principles can be applied to fibre optic cable:
  - Cable route sharing.
  - Fibre sharing.
  - Equipment sharing.

Infrastructure Sharing

- Should a TSP be offering active or passive sharing for BTS sites?

(Passive) Mast Sharing and (Active) Mast and Antenna Sharing

Passive and Active Sharing

- Passive sharing involves infrastructure such as the land, physical site or rooftop, tower mast or pylons, cables, shelter cabinets, power supply, battery, air conditioning and alarm systems.
- In addition to the above, active sharing includes the antennas, antenna systems, backhaul transmission systems and Base Transceiver Station (BTS) equipment. It can also include spectrum.
- Passive sharing at BTS sites can save 30% of power consumption as well as significantly reducing the CAPEX required by TSPs to roll out a new network.

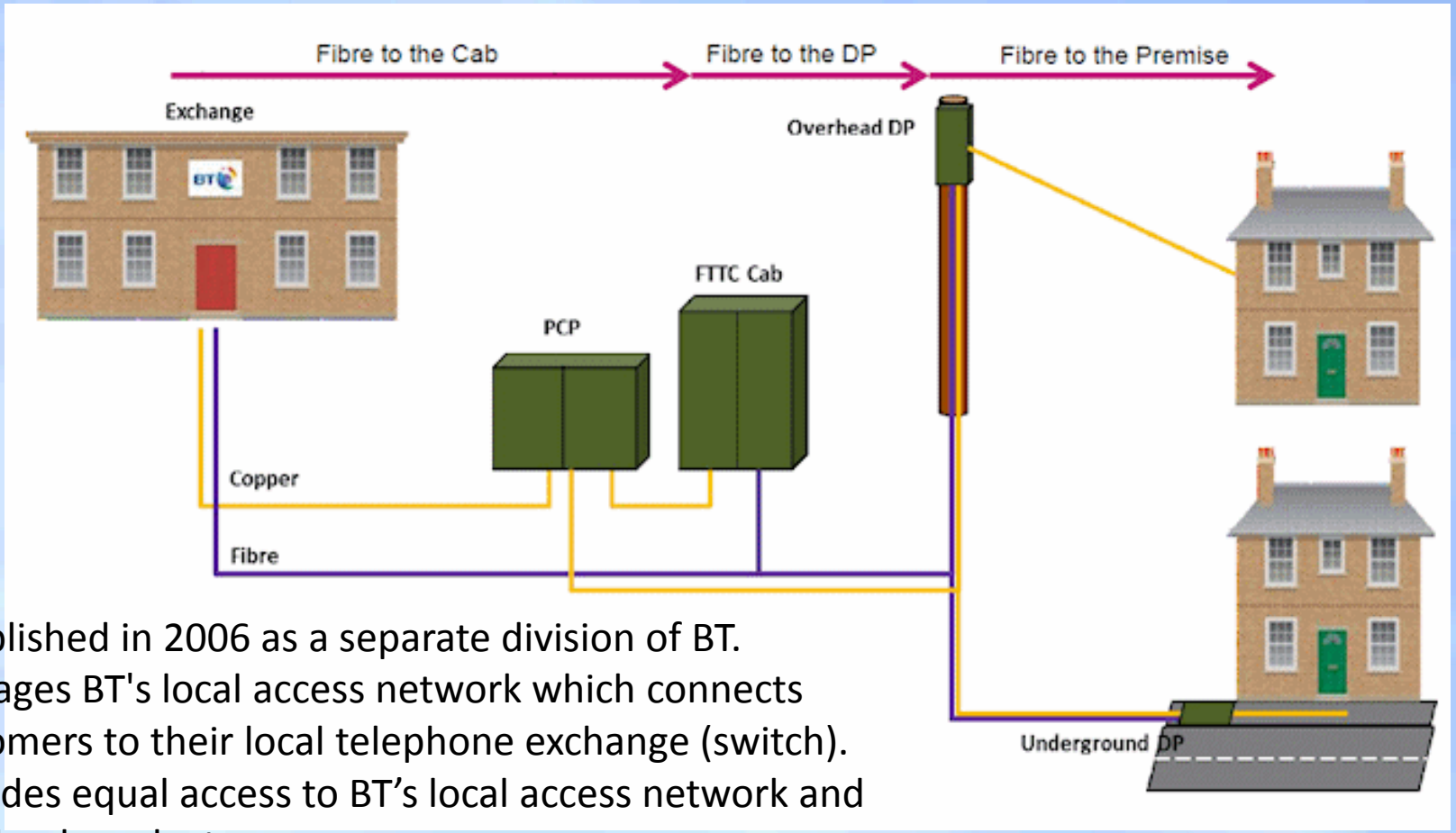
Barriers to infrastructure sharing

- How much would it cost upfront to put facilities for infrastructure sharing in place?
- How much revenue could be expected over what period?
- How do I know that the tariff is in line with costs?
- Might give ‘unfair’ advantage to competitors.
- How can a regulator address these concerns?

Regulatory Approaches to Infrastructure Sharing

- Put in place a policy encouraging infrastructure sharing in both fixed and mobile networks.
- Examine Openreach (UK) model for benefits and disadvantages.
- Set a target of an average of at least 2.0 operators to share each BTS site by 2020.
- Move from a passive to an active BTS site sharing policy.
- Charges for facilities levied to other operators by the owner of a BTS site should be set nationally and reviewed each year to ensure they are in line with changes in costs.
- Look at how the move to a 5G mobile network architecture would impact on the provision of renewable energy to BTS sites.

BT Openreach Model of LLU in UK



- Established in 2006 as a separate division of BT.
- Manages BT's local access network which connects customers to their local telephone exchange (switch).
- Provides equal access to BT’s local access network and backhaul products.
- Addresses issue of Significant Market Power (SMP) where competitive network provision would not be economic.

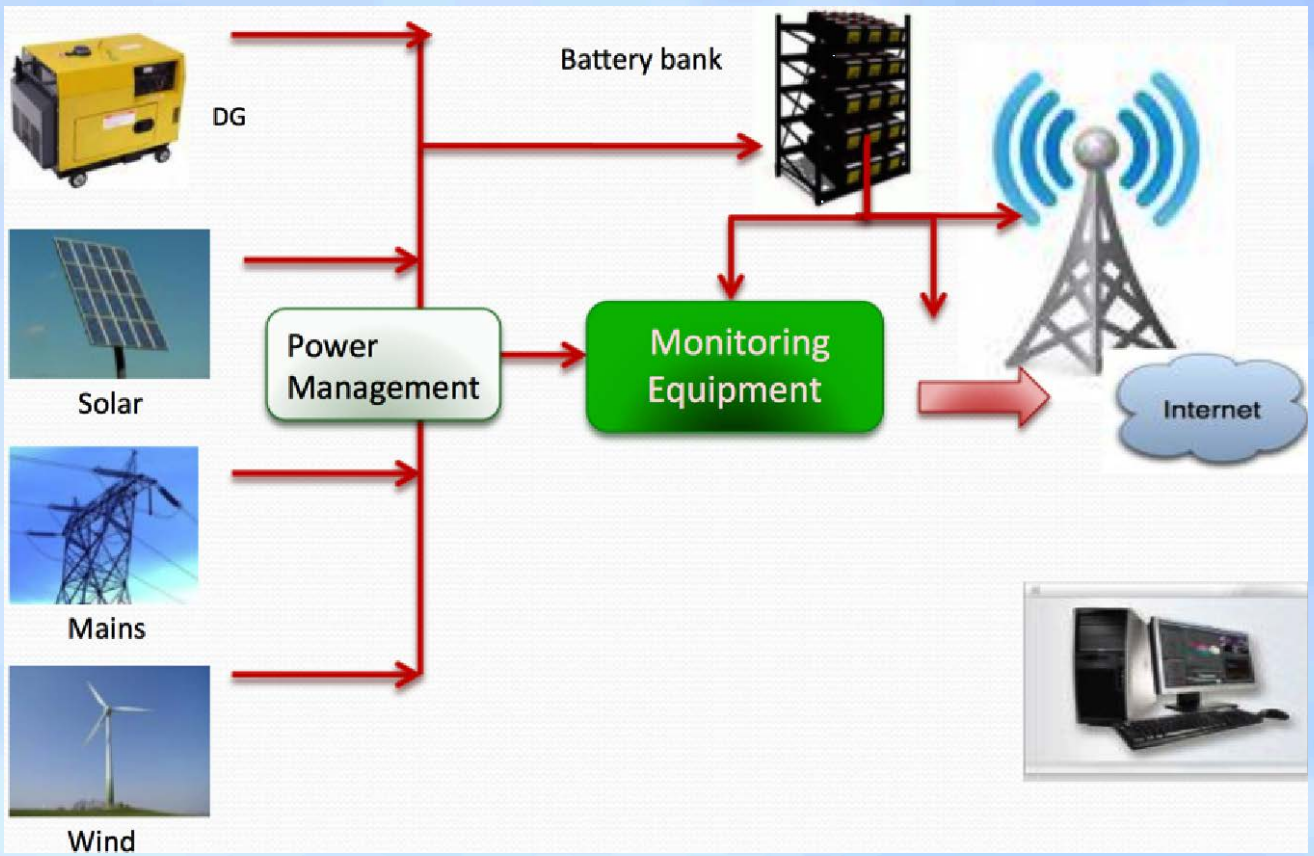
www.openreach.co.uk

Using renewable energy sources

- In developing countries, around 30% [1] of emissions from a mobile TSP's carbon footprint comes from use of diesel (or other fossil fuel powered) generators where there is no connection to the electricity grid or where it is unreliable and may supply electricity for only 8 hours per day.
- To overcome this, Renewable Energy Technology (RET) can be used to power mobile BTS at local level. Options include:
  - Solar PV
  - Wind
  - Biomass
  - Fuel Cell & Hybrid combinations
- Estimated that more than 84,000 RET platforms will be in use by 2020.
- Typical power consumption ranges from 1-3kW depending on whether air conditioning is required but 50% of this power can be saved by switching off base station functions depending on traffic conditions, for example at night time and weekends when traffic loads are lower.

[1] www.gsma.com

Hybrid Power Site Architecture



Solar PV and wind turbine powering mobile BTS in Qatar

Use of solar PV and wind power for BTS in West Bengal

Barriers to Renewable Energy Technologies (RET)

- Mainly cost (example India):
  - Grid electricity is Rs 6-8 a unit (when it is available).
  - Diesel is Rs 15 a unit.
  - Solar PV is Rs 28-32 a unit.
  - CAPEX cost is Rs 11-15 lakh per site.
  - Indian Telecom industry has Rs 2,50,000 crore of debt.
- But also:
  - Security of installation.
  - Complexity of technology.
- How can a regulator address these concerns?

http://timesofindia.indiatimes.com/tech/tech-news/Telcos-reluctant-to-go-green/articleshow/23209781.cms

Benefits of a RESCO

- Setting up a RESCO (Renewable Energy Service Company) useful in India to ensure deployment of RET on a wide scale.
- All investment carried out by RESCO in return for payments by mobile TSPs to use infrastructure.
- RESCOs have introduced the concept of micro finance to tackle the problem of investment.
- RESCOs require sufficient scale/volume in cluster with a long term contract to make their business model more viable.

Regulatory Approaches to RET

- Set a target for the % of BTS using renewable energy by 2020.
- Request figures from mobile TSPs providing "*average power originating from fossil fuels per customer connected*" to assess and compare progress on energy efficiency:
  - would encourage use of renewable energy sources,
  - would need to estimate % of fossil fuels in grid-supplied electricity if BTS takes power from grid for part of day,
  - would need to apportion power used by TSPs at shared sites.
- Permit different BTS site sharing tariffs to be levied when renewable or battery power is provided.

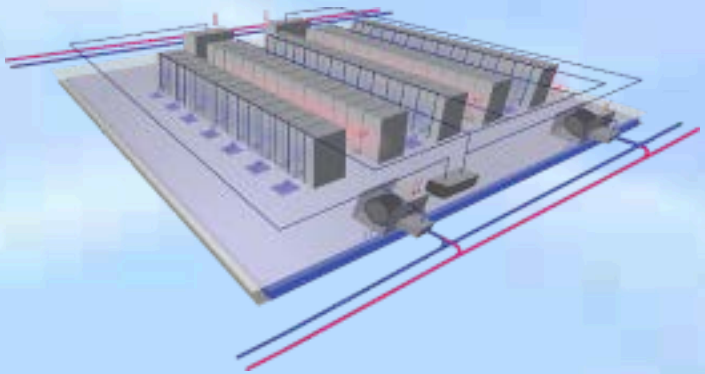
Recap on how ICT services can reduce GHG emissions

- Smart Metering and Smart Grids
- Sustainable Buildings
- Sustainable Transport, including real time navigation (RTN) and e-logistics
- E-commerce
- E-government, including e-civil service
- E-learning
- E-health care
- Digital content
- Home energy management systems
- Telepresence
- Remote (or smart) work

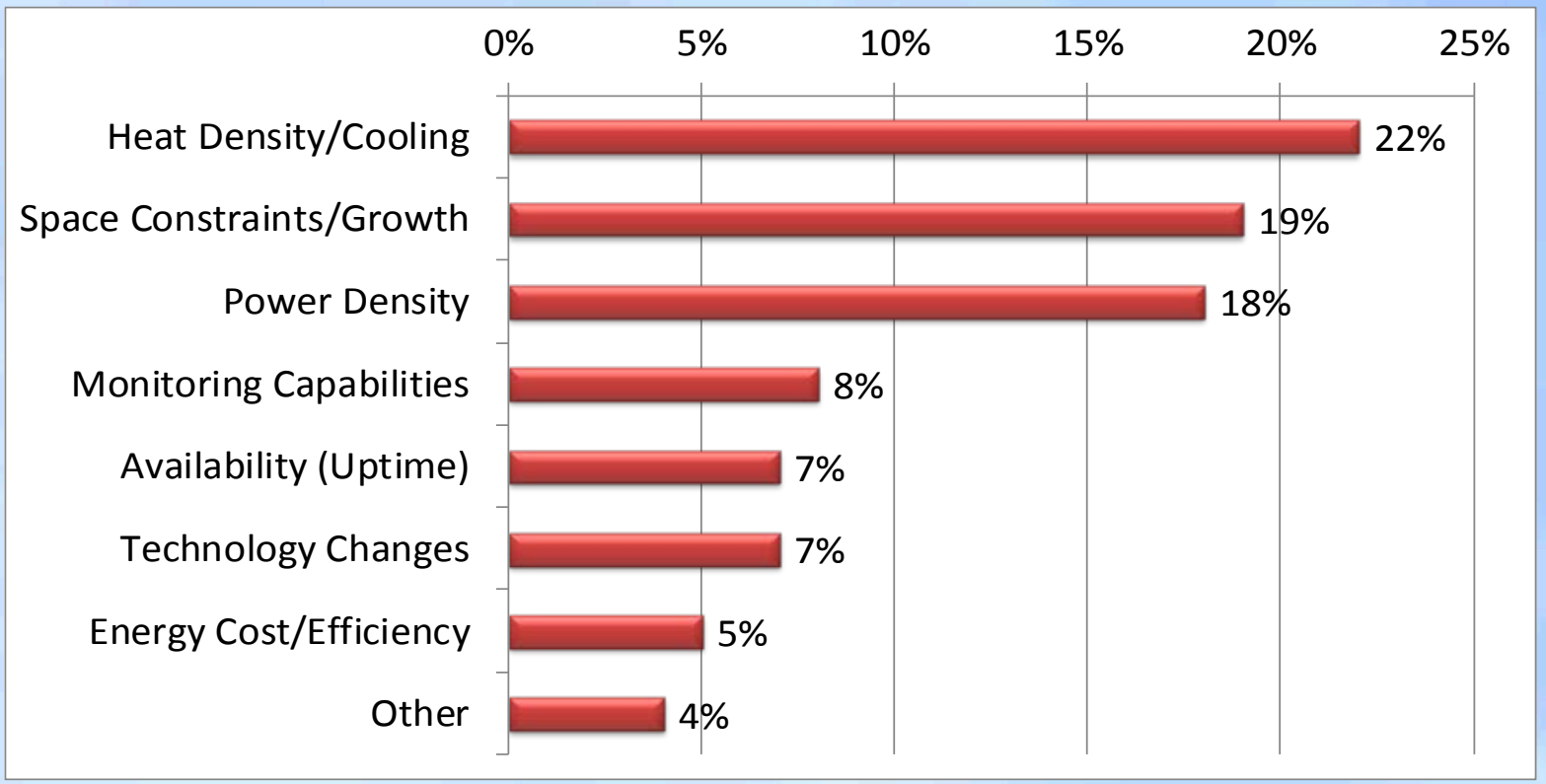
To deploy these green ICT services will require large data centres “in the cloud”.

The role of IT Service Providers

- A data center is a repository for the storage, management and dissemination of data.
- Data centers are the basis for the cloud services that allow green ICT services to be deployed.
- Green data centers are energy efficient and environmentally responsible with a holistic design of flexible management solutions for monitoring energy consumption.
- Looks for benefits in:
  - Reduction in power and cooling
  - Increase server/storage utilization
  - Reduction in data center space

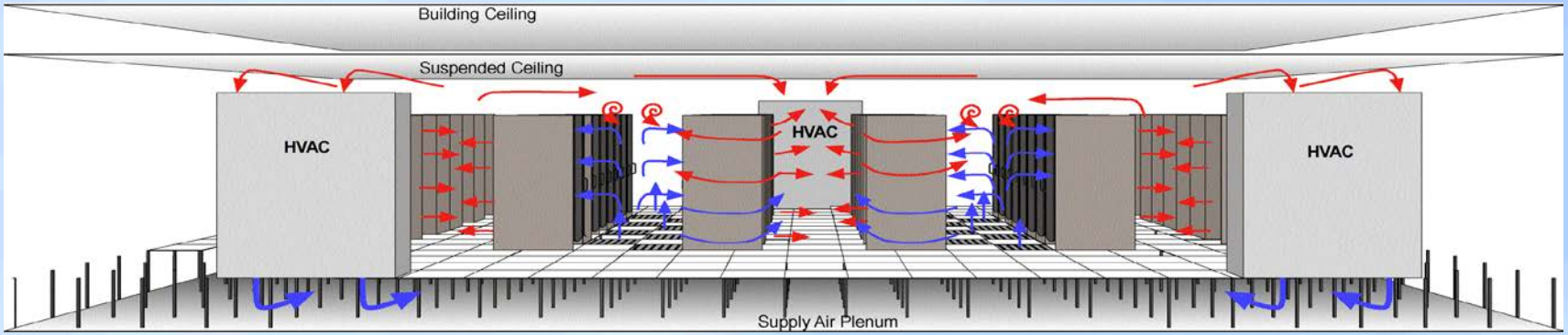


Key Issues Facing Data Center Managers



Green Data Centers

- A major issue for data centers is energy consumption as this is growing faster than any other type of ICT equipment.
- Minimising energy consumption requires efficient cooling involving airflow design and management:
  - *Design* –Contained hot or cold air: apply design concepts as Hot/cold aisle containment, contained rack supply/room return, room supply/contained rack return
  - *Design – hot* / cold aisle: ensure that the airflow shares an airflow direction
  - *Design* – Contained hot or cold air – retrofit to provide basic separation
  - *Rack airflow management* – blanking plates: to reduce cold air passing through gaps in the rack, reduce the air heated by one device being ingested by another device.
  - *Rack airflow management* – other openings: Installation of aperture brushes



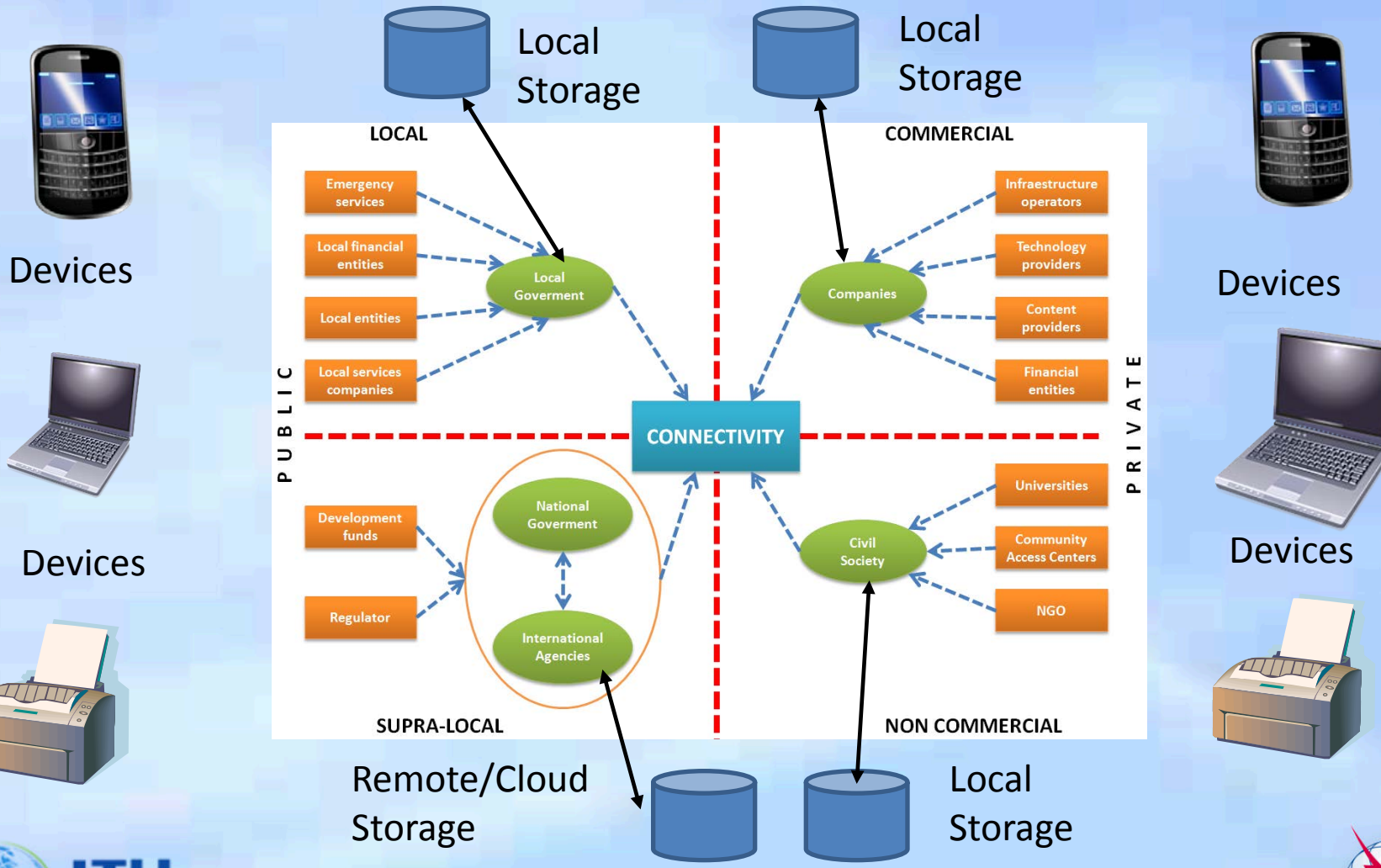
Source: ITU-T Recommendation L.1300 “Best practices for green data centres” Edition 2.

Barriers to introduction of green technologies from a TSP perspective

- How much would it cost upfront to put these e-services in place?
  - how to pay for the large (and growing) data centres.
- How much revenue could be expected and over what period?
  - what would the RoI be?
- How to stimulate uptake to create critical mass of usage (network effect)?
- How can a regulator encourage deployment of green ICT services taking account of these issues?

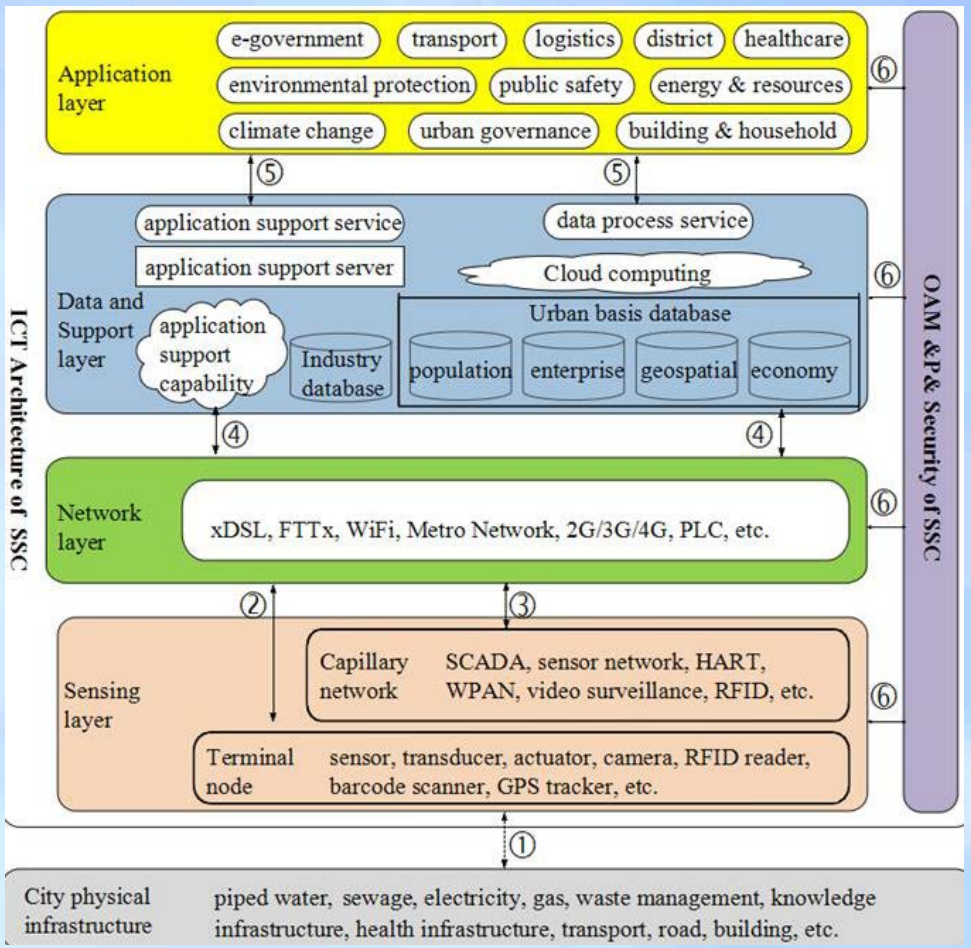
Infrastructure for Smart, Sustainable Cities

ICT Infrastructure Landscape for Smart Sustainable Cities



Sources: Adapted from ITU-T FG-SSC "Technical Report on Smart Sustainable Cities Infrastructure" Page 11 and Ministry of Transportation and Communications of Peru

A multi-tier SSC ICT architecture from the communications view (physical perspective)



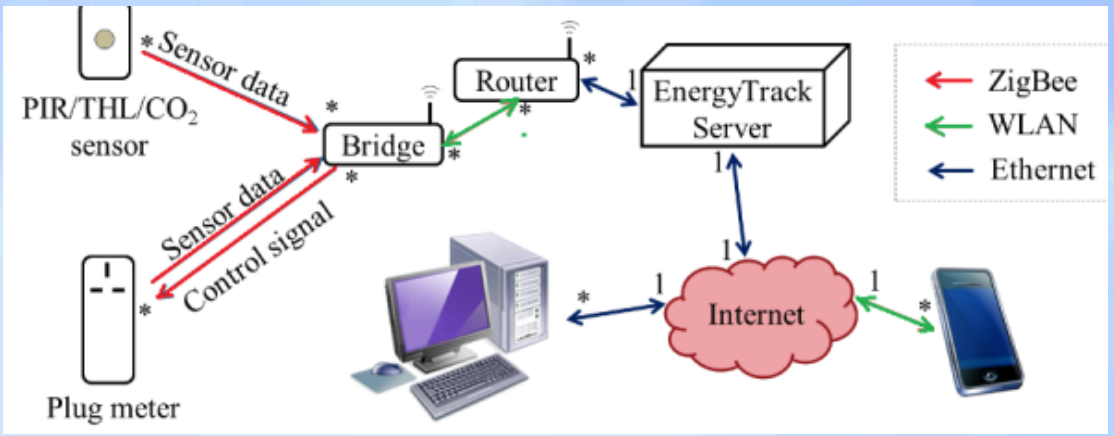
Sources: ITU-T FG-SSC "Technical Report on Smart Sustainable Cities Infrastructure"

Sensor Networks for Smart Sustainable Cities

- The sensing layer collects the data input from the system environment in order to capture and respond to various environment stimulations:
  - The data are collected by sensors such as thermometers, stress gauges, cameras, etc.
  - The data are transported via cables in conduits, manholes, common ducts, IT poles, etc.
  - This type of infrastructure is also used for services such as telecoms, cable TV and electricity supply.

Source: FG-SSC "Technical Report on Smart Sustainable Cities Infrastructure" Page 12

Sensor Network



- Sensors and controls don't need high bandwidth but they do need low latency (delay) and very low energy consumption for long battery life:
  - Standards such as Bluetooth and WLAN are not suited for low power applications, because of high node costs as well as complex and power-hungry RF-ICs and protocols.
- ZigBee is new global standard for wireless connectivity, focusing on enabling interoperability of products
- ZigBee (IEEE 802.15.4) got its name from the way bees zig and zag while tracking between flowers and relaying information to other bees about where to find resources.

Source: ITU-T FG-SSC "Technical Report on Smart Sustainable Cities Infrastructure" Page 51

KPIs for Smart Sustainable Cities

- GHG Emissions per capita.
- GHG emissions per capita per sector including industrial (manufacturing, construction), commercial, household, transport, and waste disposal etc).
- Proportion of renewable energy consumed in the city (geothermal, solar thermal, solar voltaic, hydro, wind, and combustible renewable sources and waste).
- Electricity used for street lighting per capita.
- Proportion of waste recycled compared to total collected waste.
- Proportion of city inhabitants using online public services and facilities.
- Proportion of time during which electricity supply system works without outages.
- Freedom from traffic congestion exposure.

Elements of National Telecommunications Policy and Regulation

In order to reduce energy consumption and GHG emissions, National Telecoms Policy Makers / Regulators could consider:

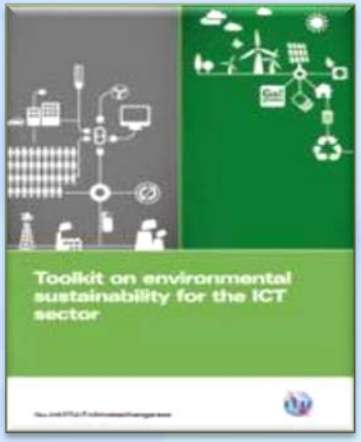
- accelerating the deployment of high speed broadband so that e-services can be rolled out effectively,
- setting targets for premises where fast broadband is available (not necessarily where it is adopted),
- requesting figures from mobile operators providing "*average power originating from fossil fuels per customer connected"* to assess and compare progress on energy efficiency,
- setting a target for the % of BTS using renewable energy by 2020,
- putting in place a policy encouraging infrastructure sharing in both fixed and mobile networks,
- charging for facilities levied to other operators by the owner of a BTS site should be set nationally and reviewed each year to ensure that they are in line with changes in costs,
- permitting different site sharing tariffs to be levied when renewable or battery power is provided,
- for BTS sites, an average of at least 2.0 operators should share each BTS site,
- moving from a passive to an active BTS site sharing policy,
- looking at how the move to a 5G mobile network architecture would impact on the provision of renewable energy to BTS sites,
- What new regulatory instruments would be required to pave the way for smart sustainable cities?

Ecosystem of standards bodies and technical standards

In general you have:

- Global SDOs (ITU-T, ISO and IEC).
- Regional SDOs (e.g. ETSI and ATIS).
- A large number of fora and consortia developing specifications (e.g. ZigBee, W3C).

But it's actually a lot more complicated than this, especially in cross sector collaboration including multiple sectors.



ITU-T Toolkit on Environmental Sustainability for the ICT Sector

www.itu.int/ITU-T/climatechange/ess/

Green ICT Standards (1)

L.1000 Universal power adapter and charger for mobile terminals and other hand-held ICT devices.

L.1001 External universal power adapter for stationery ICT devices.

L.1002 External universal power adapter for portable ICT devices.

L.1005 Test suites for assessment of the universal charger solution.

L.1010 Green battery solutions for mobile phones and other hand-held ICT devices.

Green ICT Standards (2)

L.1100 Procedure for recycling rare metals in ICT products.

L.1101 Measurement methods to characterize rare metals in ICT products.

L.1200 Direct current power feeding interface of up to 400V for ICT equipment.

L.1201 Architecture of power feeding systems of up to 400V DC.

Green ICT Standards (3)

L.1300 Best practices for green data centres.

L.1310 Energy efficiency metrics and measurement methods for telecommunications equipment.

L.1320 Energy efficiency metrics and measurement for power and cooling equipment for telecommunications and data centres.

L.1330 Energy efficiency measurement and metrics for telecommunication networks.

L.1340 Informative values on energy efficiency of telecommunications equipment.

Green ICT Standards (4)

L.1400 Overview and general principles of methodologies for assessing the environmental impact of ICTs.

L.1410 Methodology for assessing the environmental impact of ICT goods, networks and services.

L.1420 Methodology for assessing the energy consumption and GHG emissions impact of ICT technologies in organisations.

L.1430 Methodology for assessing the environmental impact of ICT GHG and energy projects.

L.1440 Methodology for environmental impact assessment of ICT at city level.

Summary

- TSPs report on their GHG emissions and try to reduce their energy consumption year-by-year.
- A number of ways have been described for TSPs to reduce energy consumption including following codes of conduct, sharing infrastructure and deploying renewable energy sources.
- IT service providers can employ the principles of green data centres to reduce energy consumption.
- Regulators can assist this process by setting targets for energy consumption.

References for further reading:

- BT Group plc. “Better Future Report”, London, UK.
- Verizon Sustainability Policy - www.verizon.com/about/responsibility/sustainability
- ITU-T Recommendation L.1300 “Best practices for green data centres” Edition 2.
- ITU-T Recommendation L.1310 “Energy efficiency metrics and measurement methods for telecommunications equipment”.
- ITU Report: “Enabling Energy Efficiency through ICTs: The case of Pakistan”.
- ITU-T FG SSC Deliverables:
  - Overview of Smart Sustainable Cities and the Role of ICTs.
  - Technical Report on Smart Sustainable Cities Infrastructure.
  - Overview of key performance indicators (KPIs) in smart sustainable cities
  - KPIs related to the sustainability impacts of ICTs in smart sustainable cities.
- ETSI TR 102 532 V1.1.1 (2009-06) “The use of alternative energy solutions in telecommunications installations”.

Background Slides

A more realistic picture of Standards

Green ICT Standards Ecosystem

Home/Building

Manufacturing/ Industry Automation

Vehicle/ Transportation

Healthcare

Energy

Cities

Wearables

Horizontal/Telecommunications