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Indo-European dialogue on
ICT standards & Emerging Technologies
(Growth, Profitability & Nation Building)
13-14th March 2014 • New Delhi, INDIA

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Project
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Energy Efficiency : Green Telecom

Flattening total energy while catering to 1000x more data

Amit Marwah, Head of Technology, NSN, India Region

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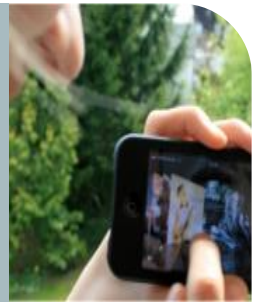
Our vision: Mobile networks are able to deliver one Gigabyte of personalized data per user per day profitably

Key requirements for networks towards 2020…

Support up to 1000 times more capacity

Reduce latency to milliseconds



Teach networks to be self-aware

Flatten total energy consumption

Reinvent telcos for the cloud

Personalize network experience

…for profitability and huge gains in flexibility

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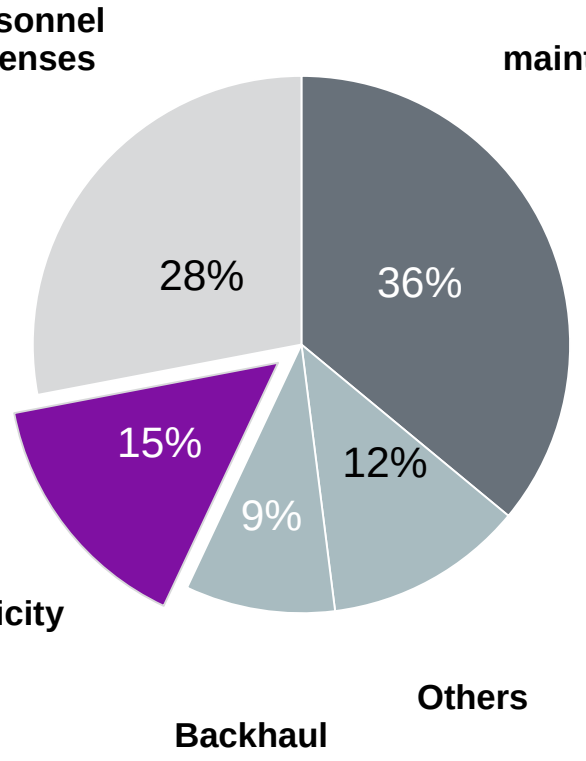
Energy costs: a significant percentage of network OPEX

Mobile operator network OPEX distribution

(in %, Example from European markets)



Energy OPEX

- 10-15% in mature markets
- Up to 50% in developing markets with high proportion of off-grid sites

Although operators are committed to energy efficiency many networks show a double digit growth in energy consumption

Source: Capgemini, Operational Cost Strategies for Mobile Operators in Europe
ABI Research, Mobile networks go green

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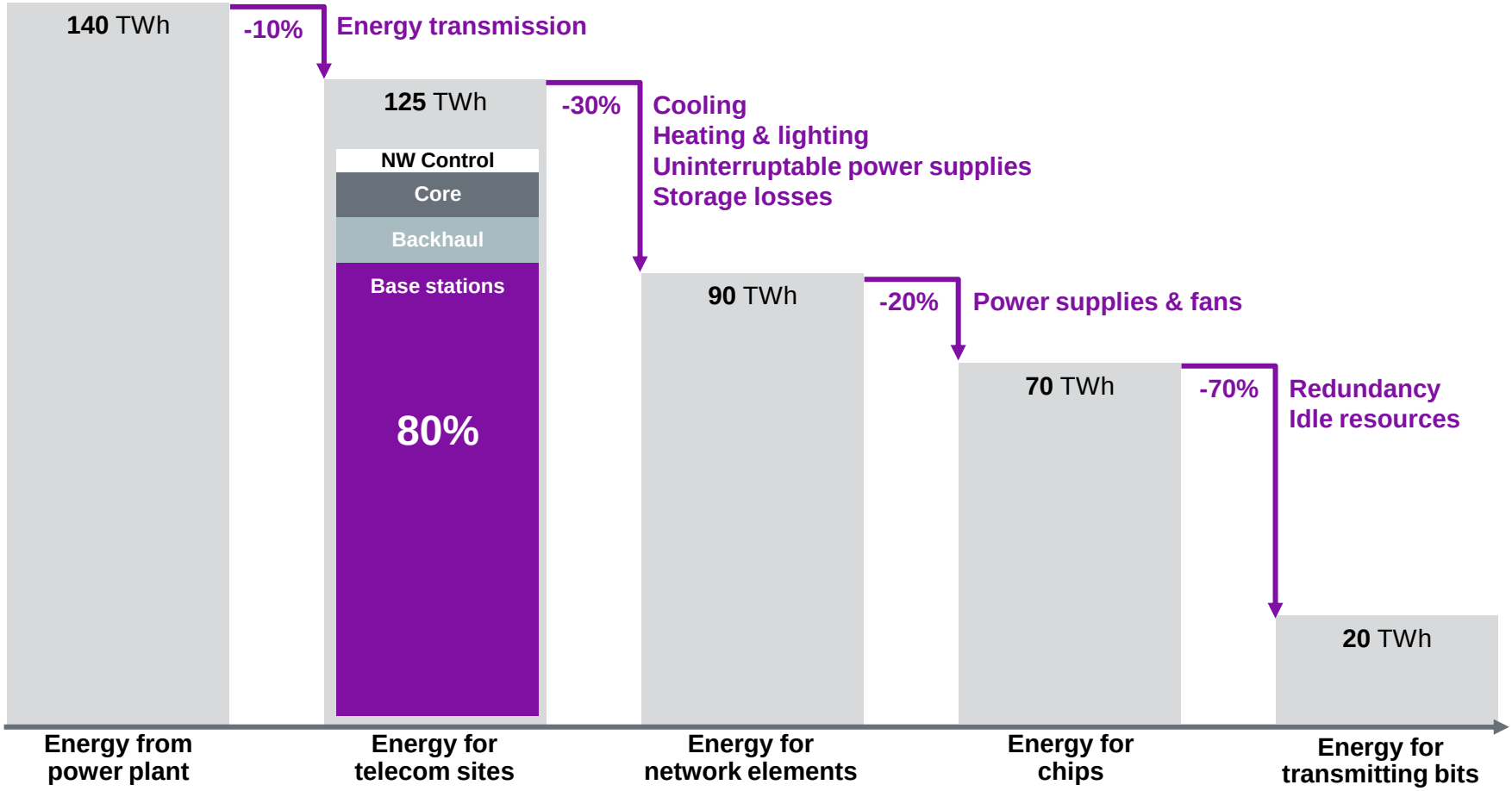
Where does the energy go?

Only 15% used to transmit bits



Source: NSN calculations based on published operator figures in 2012

Opportunities to improve energy efficiency

Base station efficiency

Site optimization

Network architecture evolution

Network management and control

Network modernization

Base Station Efficiency

New semiconductor technologies drive **peak efficiency** to the limits

Peak power amplifier efficiency reaches a practical limit at around 60%

New power amplifier architecture will further improve **average efficiency**

Baseband efficiency does not follow Moore's law

Restricted by constraints in gate capacities and input voltage reductions

Smaller structures enable **System-on-chip (SoC)** integration and hardware acceleration

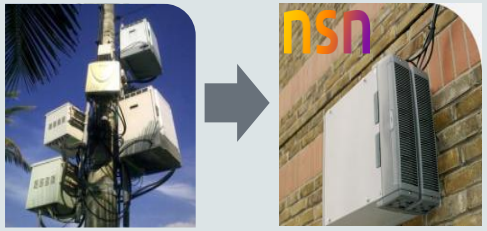
Site Optimization

Battery	Generator	Solar	Fuel Cell
• Relatively low cost for standard backup • Different technologies	• Readily available fuel • Varying sizes and capacity	• Relatively established solution. • Benefits from MNRE	• Site becomes DG Free • Quiet operation • Highly scalable • Minimal maintenance • Low environmental impact • Hydroplus (Fuel) widely available

Network architecture evolution: energy-efficient capacity with HetNets

Multi-radio: Single RAN BTS

- Phase out legacy technologies where possible
- Efficient sharing of resources by concurrent operation of GSM, HSPA and LTE

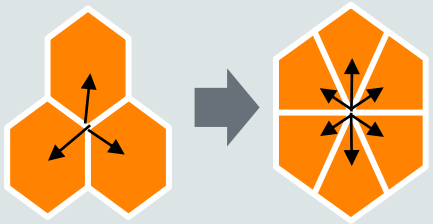


Densification

- Adding capacity with small cells only where needed
- Increases average resource utilization

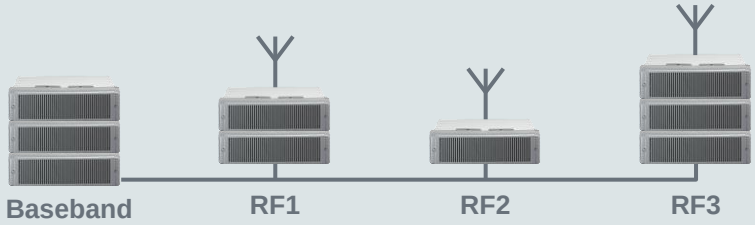
Beamforming to increase capacity

- Efficiency improvements through interference reduction
- Active antennas and sectorization



Distributed base stations

- Baseband pooling increases resource utilization
- Reduction of RF cabling losses



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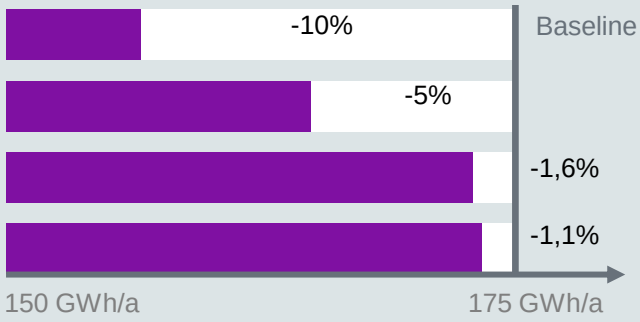
Network management and control: Teach networks to be energy aware

Advanced dormancy concepts

- Disable parts of the network based on time of day or load conditions
- Biggest impact for low load conditions and coverage part of the network

Example levers to intelligently adapt network energy consumption

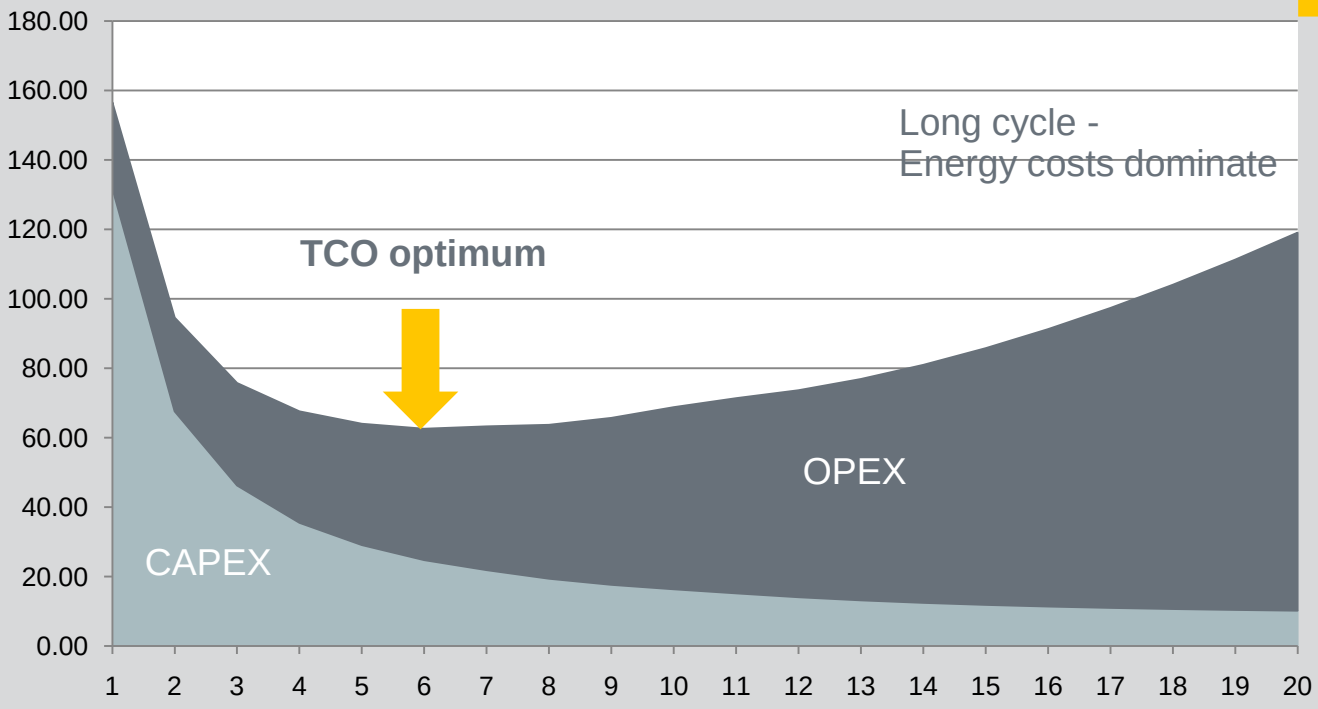
	Peak savings
Shutdown of carriers	150-350W (GSM-LTE)
Switching off MIMO functionality for LTE	180 W
Shutdown of a small cells	95 W
Shutdown of cells belonging to single RAT	150-350W (GSM-LTE)



*) Source: NSN analysis together with major European operator based on real network configuration

Network modernization: phase out legacy technologies

CAPEX and energy OPEX vs. network modernization cycle



Energy savings justify network modernization

Assumptions:

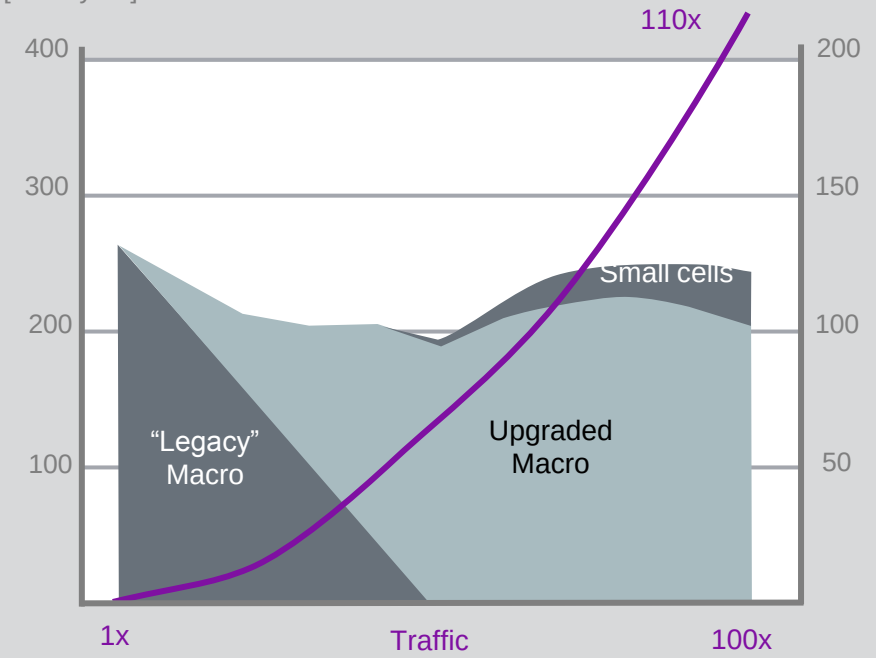
OPEX: 2.5kW initial energy consumption, 0.1€/kWh, 20% YoY efficiency improvements

CAPEX: 10k€ BTS and site modernization costs, 5% YoY price erosion

Steps to reducing network energy consumption

- Base station efficiency: reduce average power consumption
- Site modernizations with Flexi Multiradio 10 BTS and Multicontroller
- Network architecture: evolve to heterogeneous networks
- Network management and control: teach networks to be energy aware
- Network modernization: phase out legacy technologies

Energy efficiency can beat traffic growth



Source: NSN analysis, example radio access deployment scenario with 20k Macro sites, 30m subscribers, 200MB/month/user initial traffic. 5 years equipment lifetime and rollout of key technology improvements & small cells.

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the best mobile broadband experience

Thank You

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