

# 4TC-Architectures de Réseaux Mobiles Mobile Network Architectures

## Part 6 – Energy Consumption

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# Telco energy consumption

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- | Very complex topic - Only operational energy consumption?  
Overall or per byte? Compensated energy?
- | As usual, statistics can be turned on any side.

# Per domain consumption

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- | Core Network: 20%
- | Radio Access Network: 70%
- | User Equipment: 10%

# Some numbers

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- | The telco industry accounts for 2-3% of global energy
- | Energy costs represent 20-40% of operational costs for a telco operator
- | A typical 3G base station uses 500W of input power to produce 40W of output RF power
- | Base station power amplifier accounts for 60% of the RAN energy
- | Air conditioning at the base station accounts for 20% of the RAN energy (and more than 50% of the technical problems)

# Trends in the 5G era

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- | A 5G base station consumes less than legacy base stations
- | 3x base stations are expected in 5G
- | Overall energy consumption is expected to increase
- | Per byte energy consumption is expected to decrease
- | 2G/3G/4G/5G infrastructures are expected to coexist (for a long time)

# User equipment consumption

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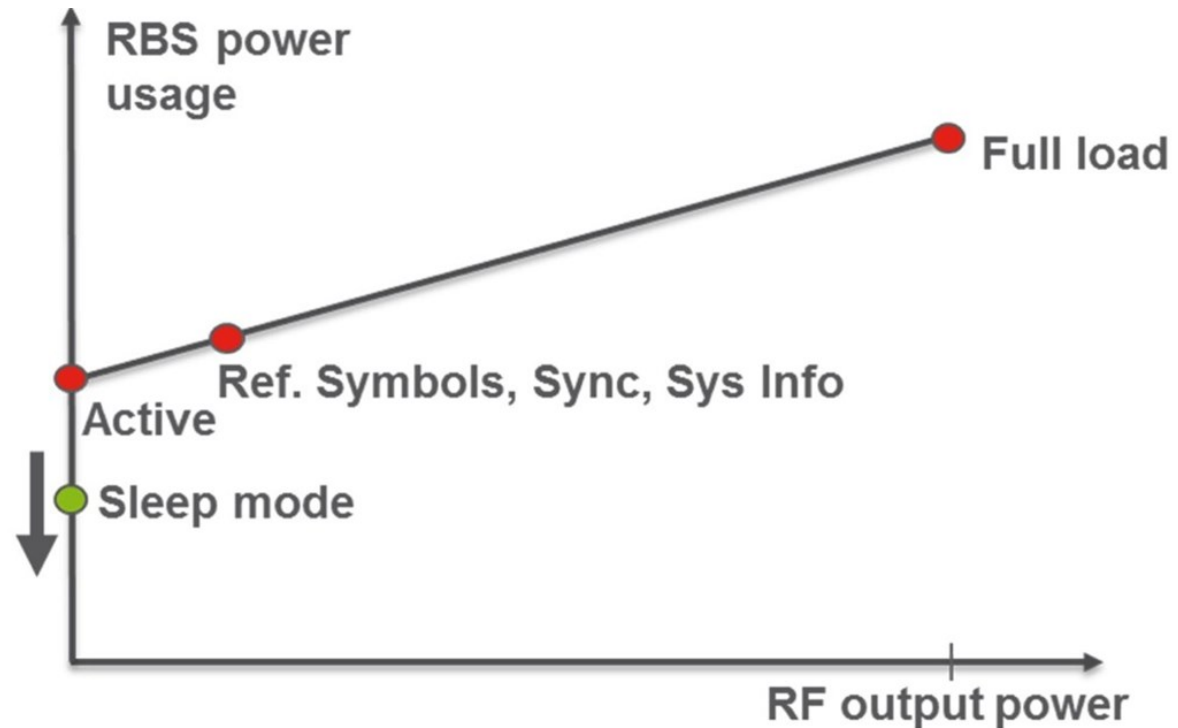
- Smartphone battery lifetime is continuously improving
- Network mechanisms (paging, RRC idle mode, DRX cycle, power management) specifically designed to save user energy
- Services are continuously evolving (more screen time, more localisation requirements)
- Heterogeneous energy sources for recharging

# Core network consumption

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- | Data plane switching and routing (50%)
- | Control plane signalling (30%)
- | Data center access (20%)
- | SDN approach in 5G will reduce data plane costs, but increase signalling traffic

# Radio access network consumption

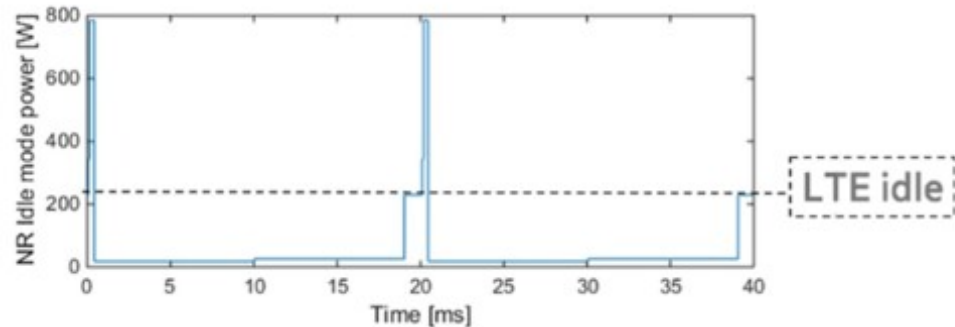
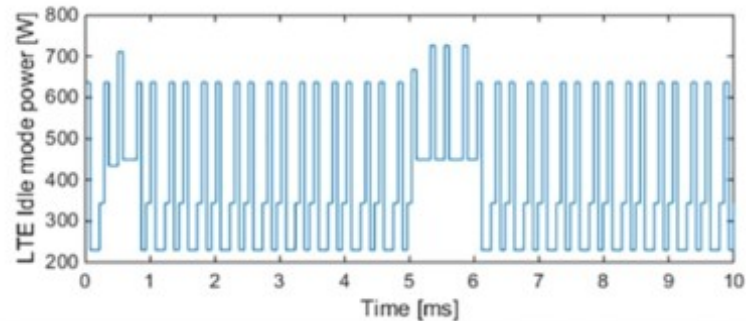


- RF power amplifier (60%), cooling system (20%), signal processing (10%), power supply (10%)



# Radio access network consumption

- Small cells consume less power, but cover reduced areas
- Operators have coverage constraints
- 5G New Radio base stations have a more efficient idle mode than LTE base stations
- RAN virtualisation (Cloud RAN) centralises processing and cooling requirements



# Use case

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- | Amendement no 2529 de l'Assemblée Nationale (09/12/2019)
- | Sommaire: *“Cet amendement vise à informer les consommateurs de la quantité de données consommées dans le cadre de la fourniture d'accès au réseau, et l'équivalent de leurs émissions de gaz à effet de serre correspondant, selon une méthodologie définie par l'ADEME, afin de mieux prendre en compte l'impact du numérique sur l'environnement”*