



έξιGence

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# EXIGENCE Overview

# έξλι-Gence

# MISSION

EXIGENCE integrates measurement, optimisation and incentivisation to contribute to reduce overall energy consumption and CO2e of ICT services when provided by expected future ICT ecosystems.

MISSION

# THREE PILLARS

1



**MEASURE**

2



**OPTIMISE**

3



**INCENTIVISE**



# Project objectives

1

Design and implement a system (TRL 4) to reliably assess energy consumption and carbon footprint equivalents (CO<sub>2</sub>e) of the use phase of an ICT service execution/provisioning.

2

Explore and adapt novel, incentive-compatible energy consumption and carbon footprint reduction mechanisms, for service providers and users.

3

Transform the obtained insights into requirements and suitable solutions for the most important, typical ICT domains and systems.

OBJECTIVES

# KEY PERFORMANCE INDICATORS

3

Reduce energy consumption/  
carbon footprint for simple use  
cases (e.g., video streaming,  
i.e., eMBB/best effort transport  
service with typical)

5

Reduce energy consumption/  
carbon footprint for use cases  
with strict guarantees (e.g.,  
PNI-NPN2 with both transport  
and compute services  
guaranteed at a high SLA)



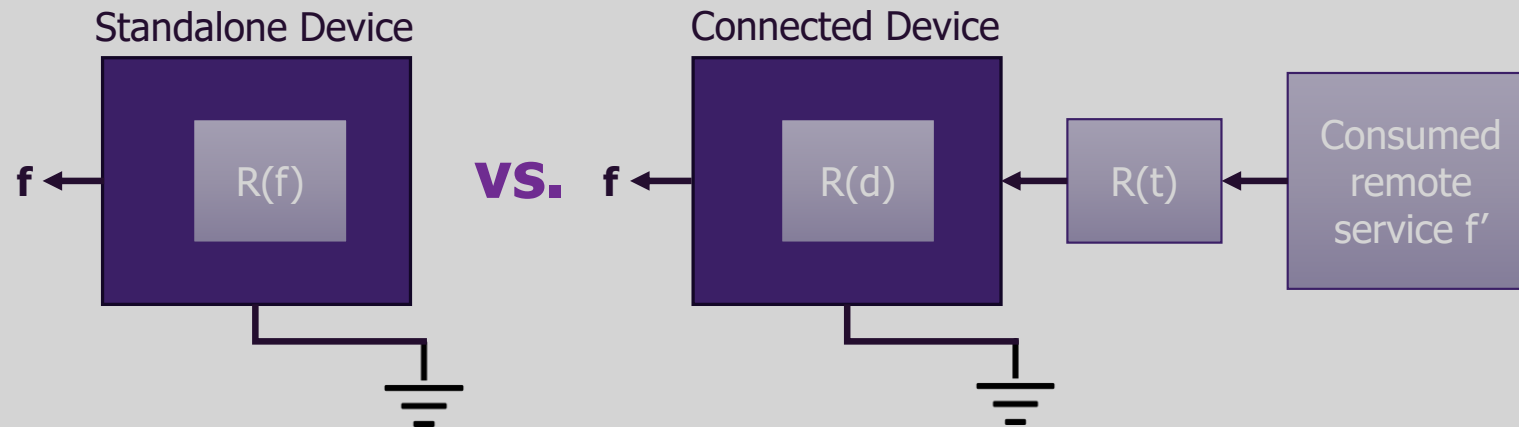
Bringing CO<sub>2</sub>e to zero for  
some realistic deployment  
options of the considered  
use cases

The background features a dark space filled with numerous thin, white, curved lines that originate from a few points at the bottom and fan out towards the top, resembling a particle simulation or a network diagram. A solid purple horizontal bar is positioned across the middle of the image, partially obscuring the lines. The text 'TECHNICAL APPROACH' is written in large, white, sans-serif capital letters, centered below the purple bar.

# TECHNICAL APPROACH



# OUR MAIN OBSERVATION



Energy / CO<sub>2</sub>e posture of a standalone device mainly depends on how it is manufactured\*.

(\*) cf. NextG-Alliance GreenG report

**Energy / CO<sub>2</sub>e posture of a connected device cannot be correctly assessed without assessing the use phase of services it depends on for its function. High risk for completely wrong conclusions!!!**

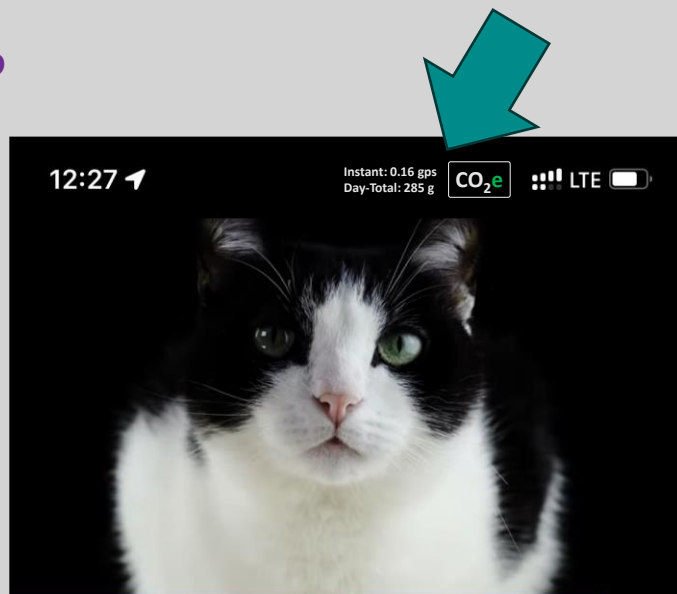
- ➔ Use-phase measurements of the energy posture of running ICT services are required
- ➔ We need and require measurements at the service level





# Measured Ecodata as 6G Feature

## MOCKUP



service

system

For connected devices, green labels must account for the remote part of the service realisation (e.g. video streaming on a smart TV). EU's SPI targets explicit use phase accounting.

However, in a cross-domain scenario, figuring out an energy-saving solution requires:

- Credible, accountable and traceable measurement data gathered from different parties.
- Technical means to act on the relevant domains/resources/subservices.



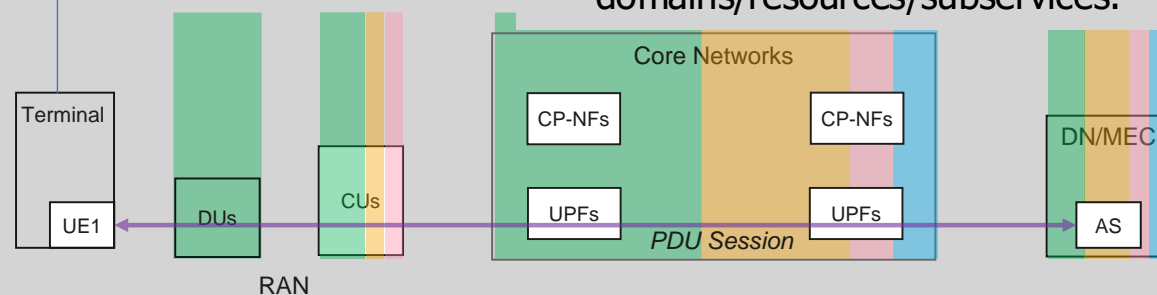
**measure**



**incentivise**



**optimise**



*Different colors represent different authority domains*

domains: both technical and authoritative

# THREE PILLAR APPROACH

01

Enable “eco-data” measurements at the service level (not domain level)

02

Resource-optimize service provisioning

03

Enable all players to redeem the non-expenditures on the carbon market

**M**EASURE: enable assessment at the respective service level

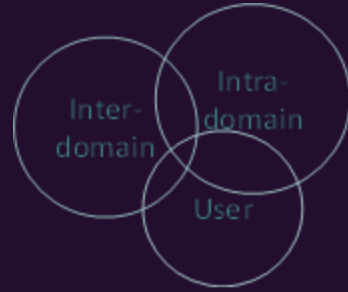
**O**PTIMIZE: minimise resource footprints on per-domain base

**I**NCENTIVISE: provide data and economic incentives to respective service consumers

APPROACH

# Assessing sustainability at the service level

## Required technological capabilities

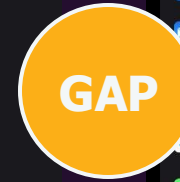


- **GLOBAL (M)**
  - Common ICT service level metrics (→ ETSI)
    - Must be additive/aggregable - not difficult but needs to be defined (e.g. in J)
  - Clear progress beyond 5G!
- **INTRA-DOMAIN CAPABILITIES (MO)**
  - Metering, with per-flow/per-service attribution
  - Including virtual entities and distributed entities
  - For 6G: Precise per-service eco-accounting (J/W and CO2e)
    - Per-session eco-accounting (→ 3GPP: SA1, later SA5 and then SA2)
  - Green orchestration + runtime selection of suitable entities
- **INTER-DOMAIN DATA EXCHANGE (OI)**
  - Time- and flow-annotated: channels, protocols, formats
  - For authoritative domains: verifiable, trustworthy (→ ETSI PDL)

### Network-side:



### Terminal-side:







# RESULTS

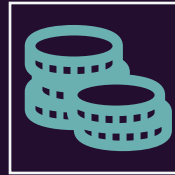
# Key Results



Energy-aware ICT  
metering solution



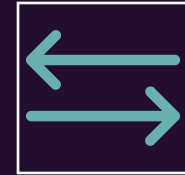
Energy-aware  
orchestration  
product



Incentive-compatible  
Energy Reduction  
Mechanisms



6G-relevant 3GPP  
contribution



Dependable inter-  
domain energy  
metric exchange

# Testbeds

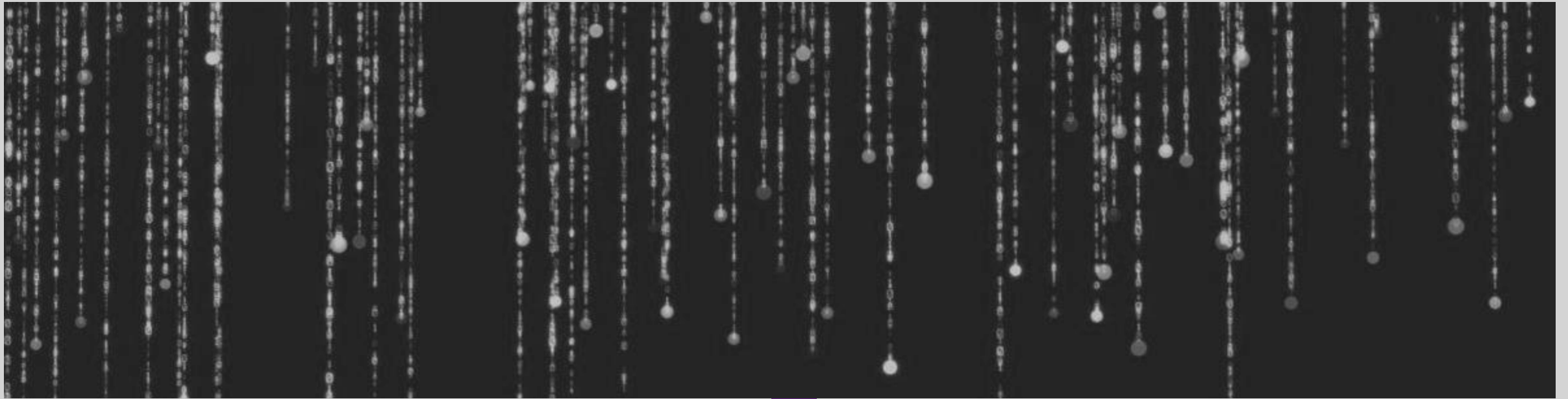
1

**Ljubljana, Slovenia:** Non-public 5G network, operating in 3.8 GHz band, edge node, far-edge nodes and 5G user devices. 5G network can be deployed either on an IaaS platform or in the cloud.

2

**Aveiro, Portugal:** Commercial-graded stand-alone 5G mobile network with radio units in several locations, and a mobility testbed with 24 fixed and a high-speed mobile node.





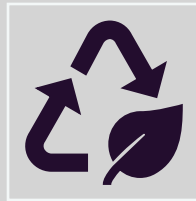
# Target groups

ICT technology providers and consumers  
Telecom Industry Organizations  
Research community  
National and EU organizations  
Policy-making entities

# Target impact areas



**Energy efficiency:**  
efficient energy usage  
across the entire service  
chain of the  
telecommunication  
networks.



**Green energy:**  
optimal usage of green  
energy sources already  
available and distributed  
over the network, today  
usually closer to edge and  
deep edge resources.



**Energy metering:**  
promote advanced energy  
metering methods and  
enable service-level  
energy measurements,  
including amounts and  
types of consumed  
energy.



**Energy business  
models:** create an  
economic model in which  
all players act as to  
consume energy  
responsibly.

## INDUSTRY

### OPERATORS



### IT AND CT VENDORS



### VALUE-ADDING SMES



### TECHNOLOGY CONSULTANCY



## RESEARCH

### UNIVERSITIES



### RESEARCH INSTITUTES





# έξιGence



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