



έξiGence

EXIGENCE Overview

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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.

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 (CO₂e) 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

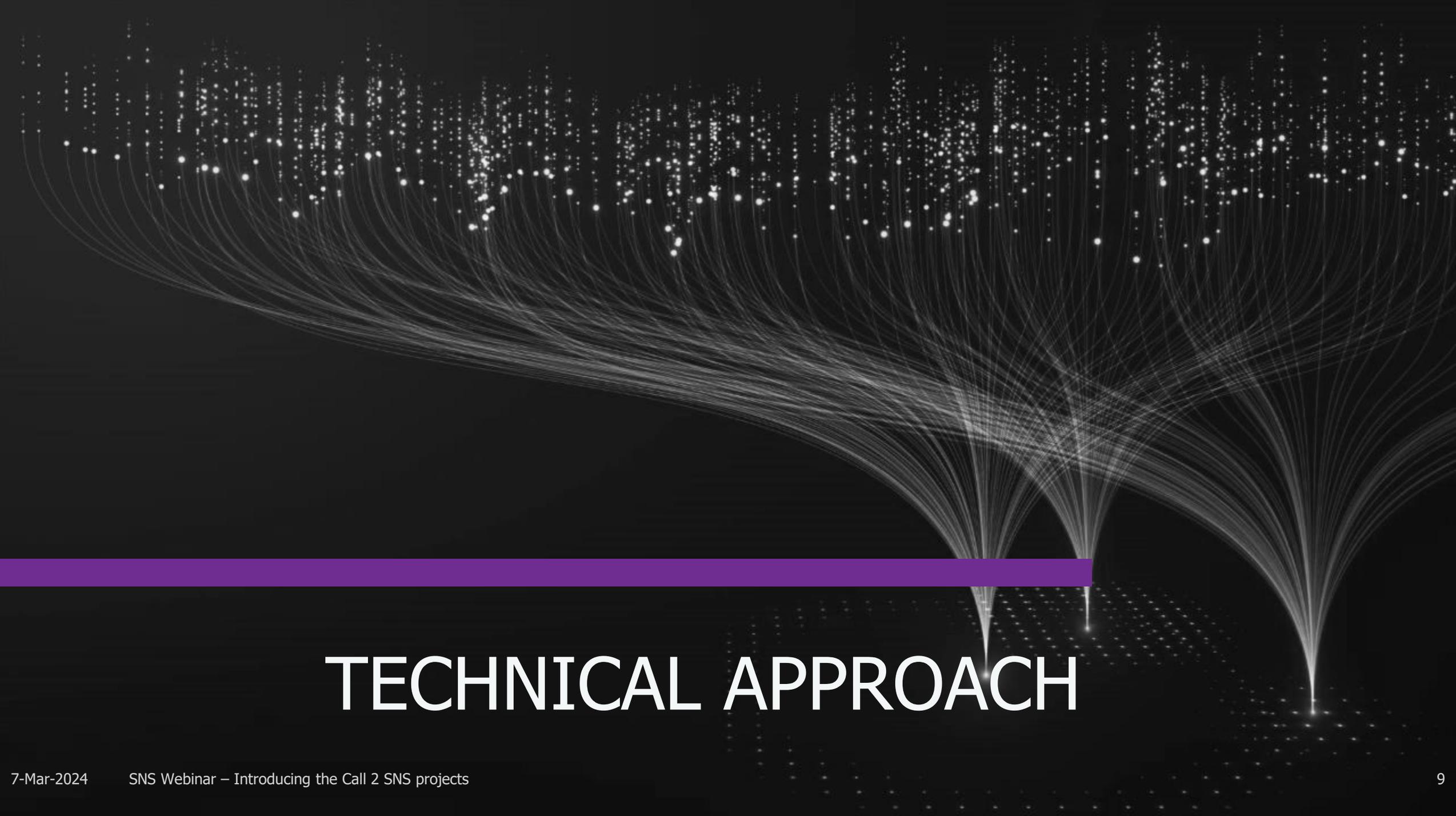
Reduce energy consumption/
carbon footprint for simple use
cases (e.g., video streaming,
i.e., eMBB/best effort transport
service with typical)

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)

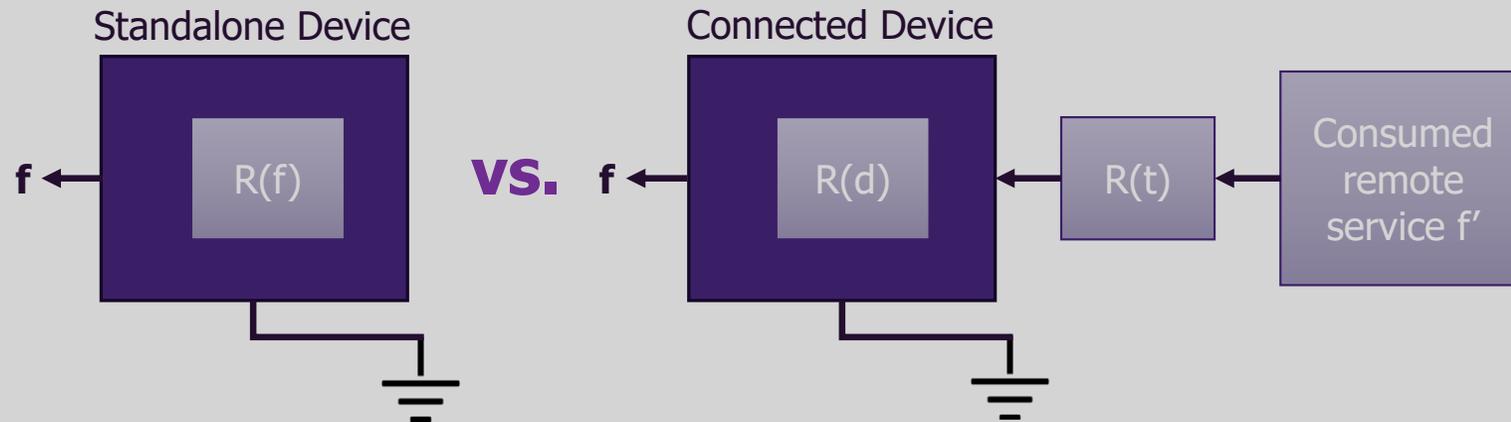


Bringing CO2e to zero for
some realistic deployment
options of the considered
use cases

The background features a dark space filled with numerous thin, white, curved lines that resemble fiber optic cables or data paths. These lines originate from several points at the bottom and fan out towards the top, where they terminate in small, bright white dots. A solid purple horizontal bar is positioned across the middle of the image, partially overlapping the lines. The overall aesthetic is technical and futuristic.

TECHNICAL APPROACH

OUR MAIN OBSERVATION



Energy / CO₂e posture of a standalone device mainly depends on how it is manufactured*.

(* cf. NextG-Alliance GreenG report

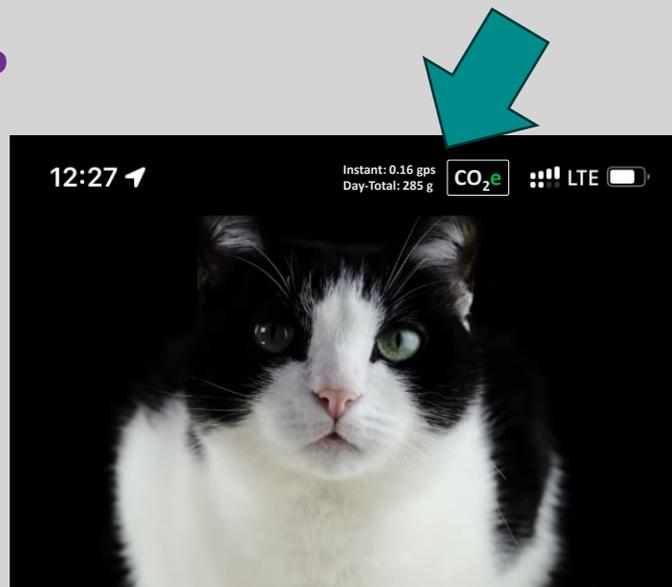
Energy / CO₂e posture of a connected device cannot be correctly assessed without assessing the use phase of services it depends on for its function. High risk for completely wrong conclusions!!!

- ➔ 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

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

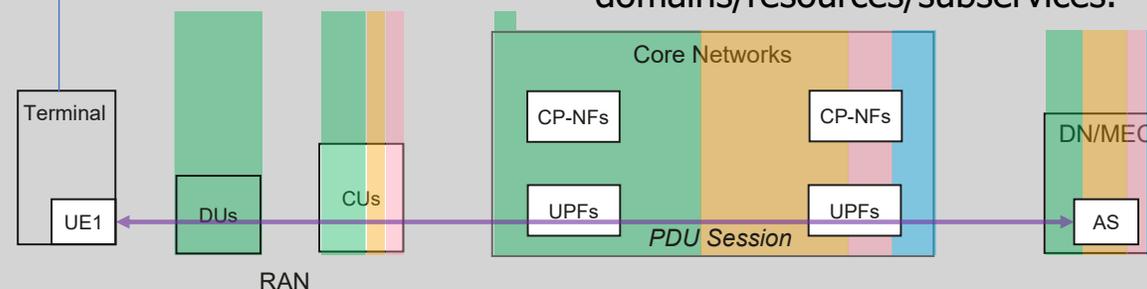


incentivise



optimise

system



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

MEAASURE: enable assessment at the respective service level

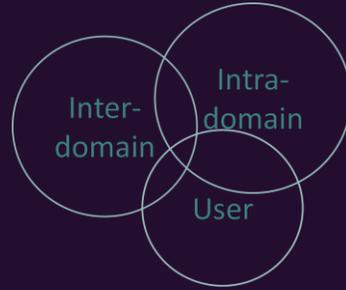
OPTIMISE: minimise resource footprints on per-domain base

INCENTIVISE: 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

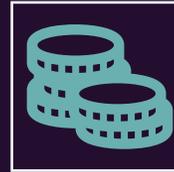
Key Results



Energy-aware ICT
metering solution



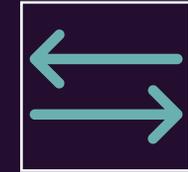
Energy-aware
orchestration
product



Incentive-compatible
Energy Reduction
Mechanisms



6G-relevant 3GPP
contribution



Dependable inter-
domain energy
metric exchange

Testbeds

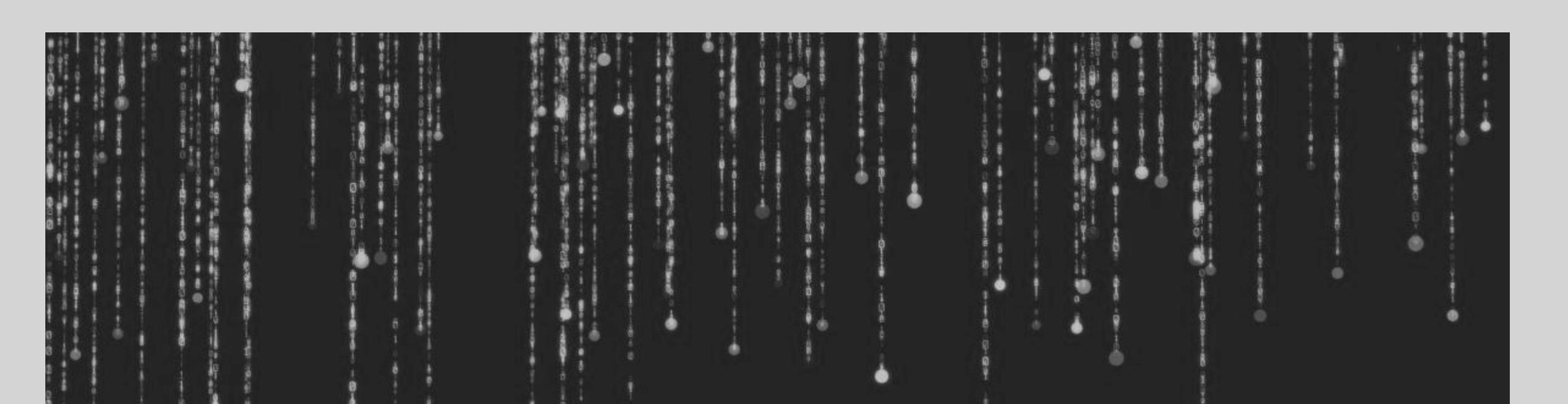
1

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



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