

UNIVERSITY OF OSLO

Norway-Canada ResCri workshop,
UiO, Kjeller, 19Oct2026

Measurable Security & Societal Empowerment

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<https://beststructured.com/intrusion-detection-intrusion-prevention-and-antivirus-the-differences/>



From Academia to Mobile Broadband

understanding the business

Jun1973: NO (Kjeller) & GB connected

Jun1986: RARE/TERENA...GEANT (NRENs in Europe)

1993 - **privatisation** of 2G (GSM)

1999 - 3G (UMTS): 3 x ROI expectation, Uni co-dev

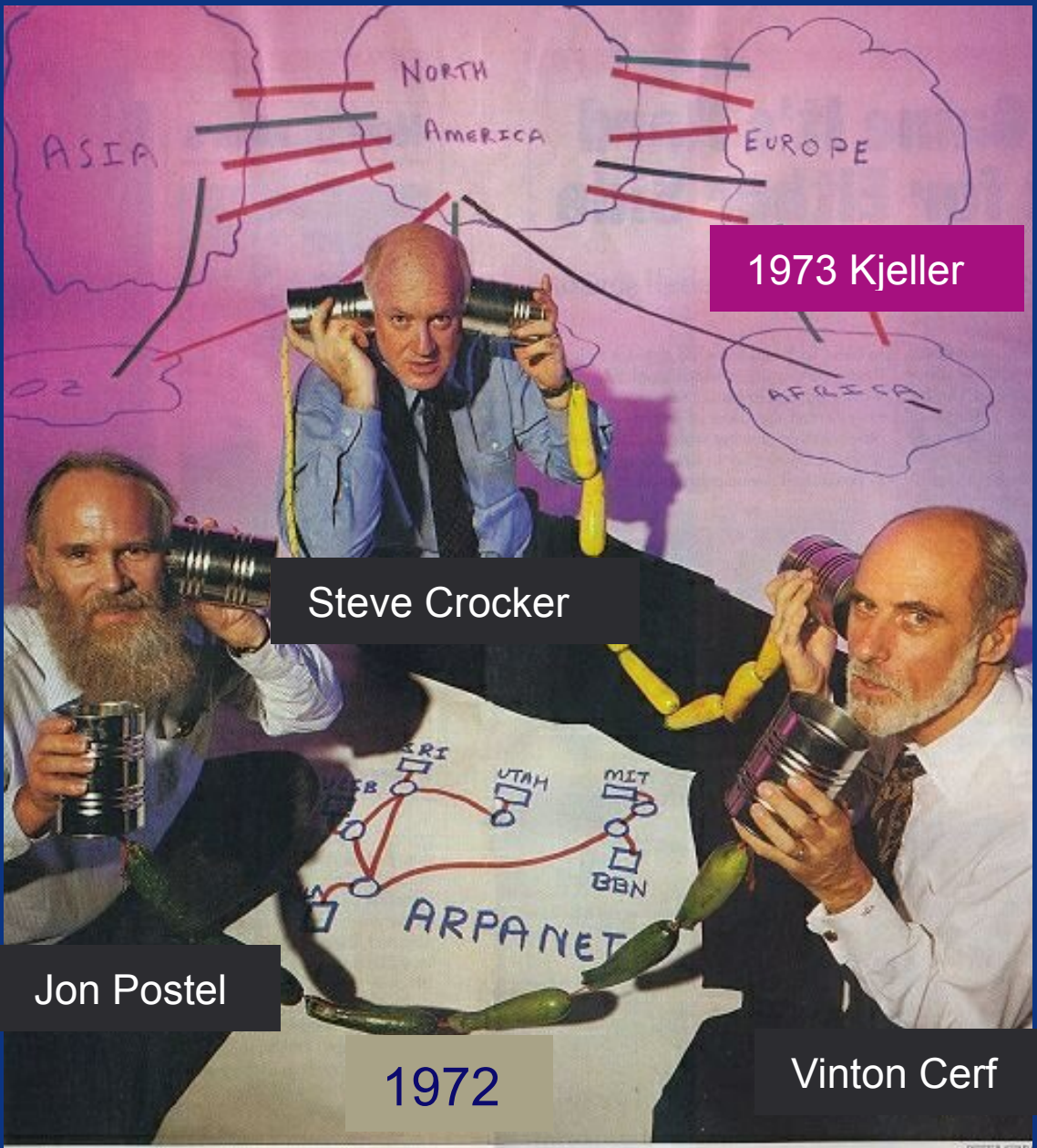
2004 - 4G (LTE): 120 km range, Supplier dev

Aug2003: Reykjavik “Cybersecurity”

Jun2020: UN “Digital Cooperation” recommendations

Basic Internet Foundation:
“The walk on the Internet”

“The mobile Internet became commercial”



Source: <http://www.michaelkaul.de/History/history.html>



Vint & Sigrid,
Nordunet 2003



UN Panel, 2019-2020

ITS cyber-society-security areas

→ Measurable Security

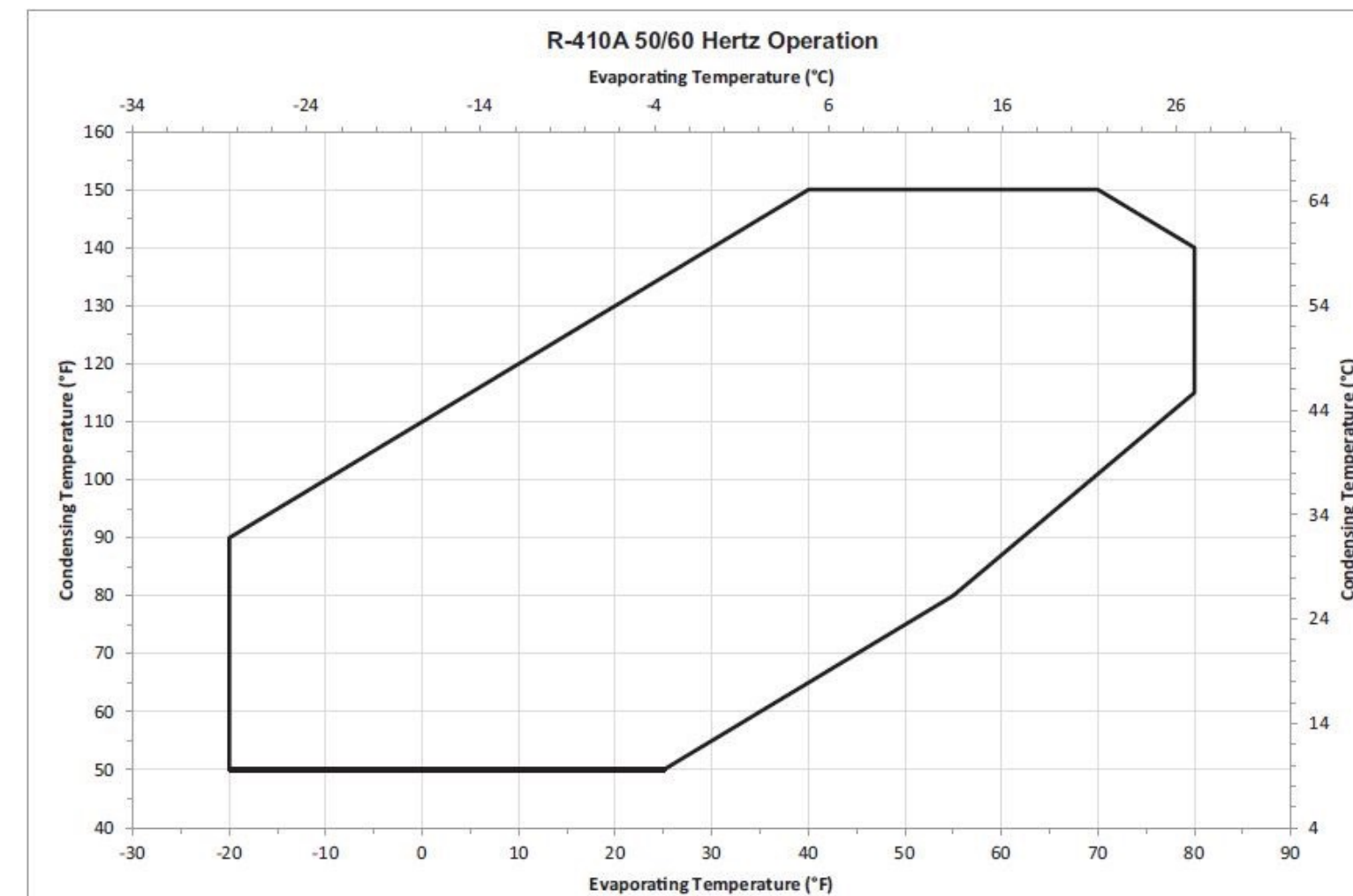
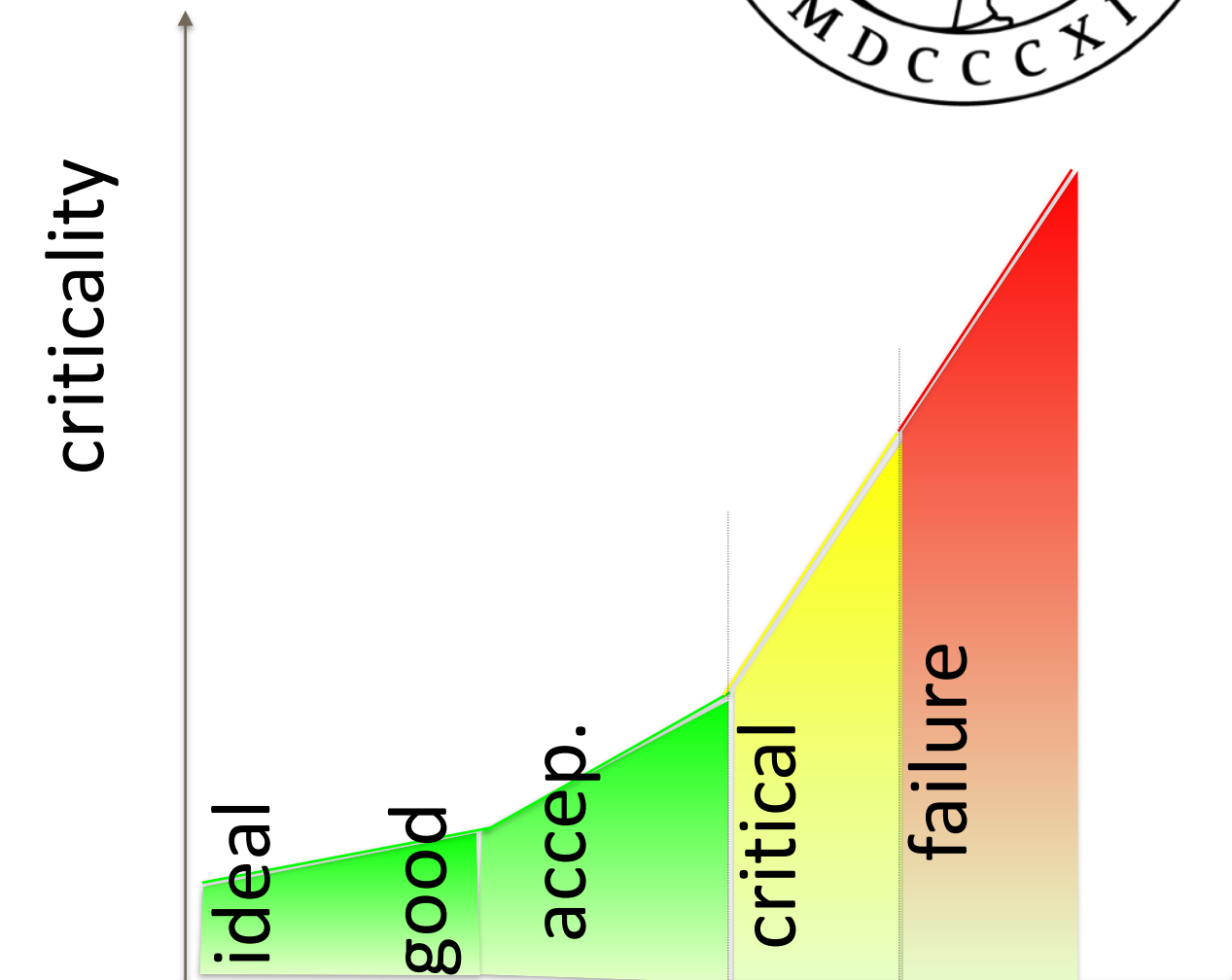
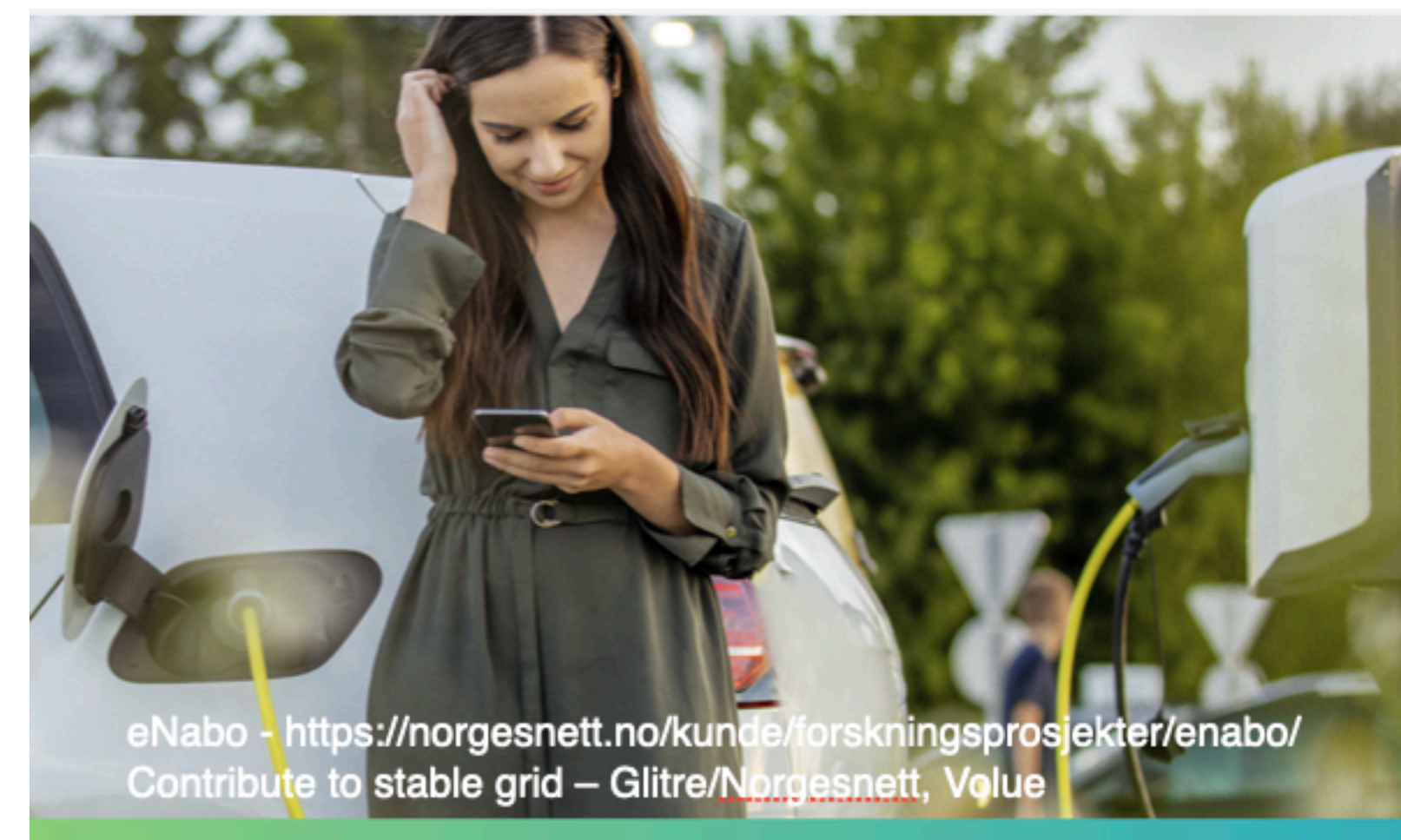
- Security classes
- Risk-Exposure Model

→ Societal Security, Trust, Digital Transformation

- “Renewable means Digital”
- Values: Capabilities of a society

→ eResilience

- decentralised, eNeighbour, eMunicipality
- Dec 2025: “Amy” 155.000 households



<https://www.vg.no/nyheter/i/wg7LoA/norge-kan-lammes-av-stroembrudd-advarer-telenor-i-sin-aarlige-sikkerhetsrapport>



Telenor: Uten strøm stopper Norge

Norge kan lammes av strømbrudd, advarer Telenor i sin årlige sikkerhetsrapport. Ekstremværet «Amy» beviste hvor sårbare vi er.



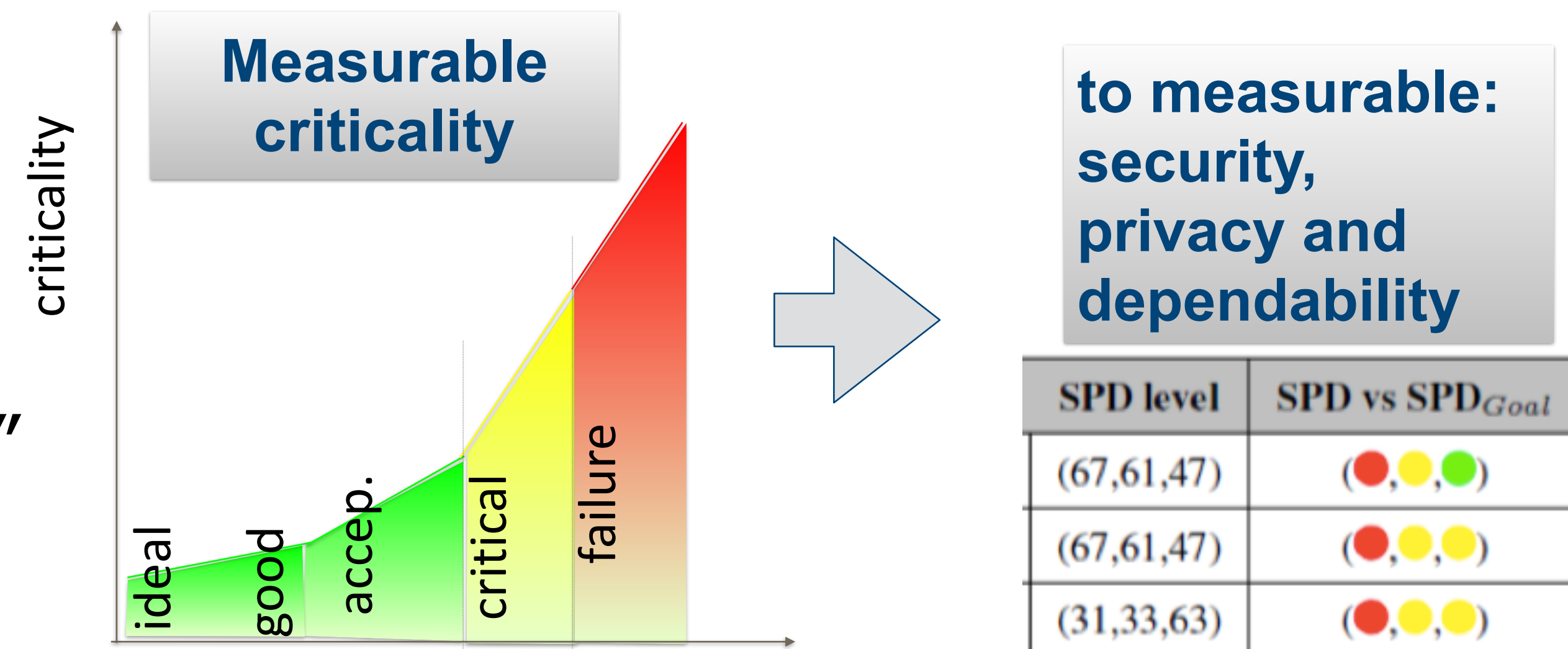
På grunn av strømbruddet under uværet «Amy» måtte familien Valstad-Frydenhaug steke de syv...

Measurable Security

- IoT related
 - home network (critical functionalities)
 - unprotected IoT devices
 - industrial use case
- Risk analysis for IoT-based infrastructure
 - Impact and Exposure (Comm. & Protection)
- Security and Privacy classes
 - operating envelope and “ideal/critical” operation

Catastrophic	A	C	E	F	F
Major	A	B	D	E	F
Moderate	A	B	C	E	E
Minor	A	A	B	D	D
Insignificant	A	A	A	C	C
Impact/ Exposure	E1	E2	E3	E4	E5

[Courtesy: Manish Shrestha, UiO, 2019]



Societal Security

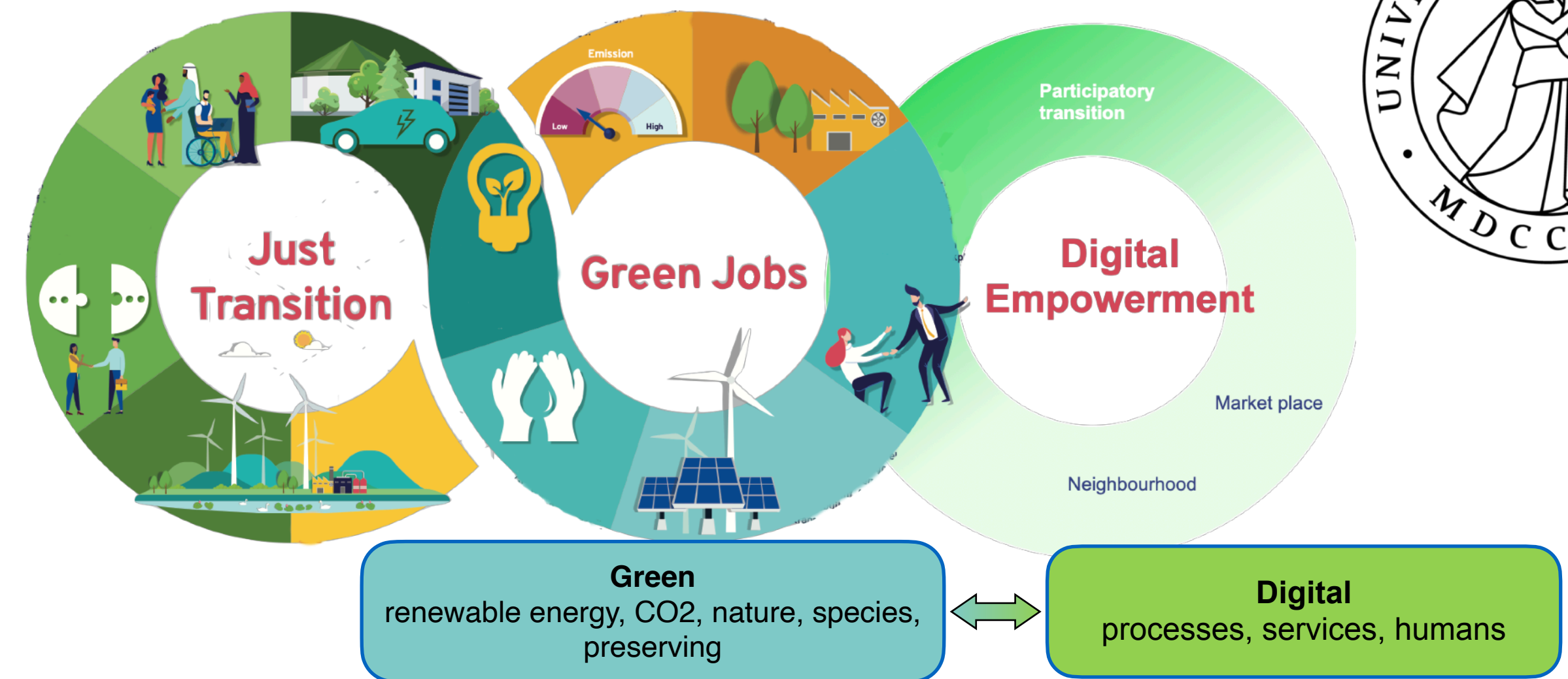


→ Digital (AI), Trust, Societal Security

- Societal Transition

→ Edge-capabilities: Neighbourhood, Society

- “Money is just a transactional entity, not a value”
- “Capability of the society is the value”



“OSI” layer model for energy



GSMA Mobile Internet 2026

KEY FINDINGS

1. **4.8 billion people (59% of the global population) now use mobile internet on their own device – but growth in mobile internet subscribers has slowed, with low growth rates across all regions.** Approximately 160 million people began using mobile internet on their own devices in 2025, down from 190 million the year before. A further **650 million people** (equivalent to **8%** of the global population) use mobile internet exclusively through **borrowed or shared devices**.
4. **In total, 38% of the world's population (3.1 billion people) live in areas covered by mobile broadband but do not use it – the usage gap.** The majority of the usage gap (70%) comprises those who do not own a device. However, the percentage of those in the usage gap who do not own a device is significantly lower when focusing on adults aged 18 and over. Only around **a third of those in the adult usage gap do not own a device.**

**59% own device with mobile internet
> 41% not**

6. **Connectivity varies significantly by and within regions and countries – 92% of the unconnected live in LMICs.** Connectivity levels vary considerably – not only between HICs and LMICs; LDCs, LLDCs and SIDS lag other LMICs substantially too. In LMICs, adults in rural areas are 28% less likely than those living in urban areas to use mobile internet, while women are 12% less likely than men to use mobile internet.

**~3.1 billion people in LMIC are
unconnected**

**What does it mean for
the adoption of AI?**

THE STATE OF MOBILE INTERNET CONNECTIVITY 2026

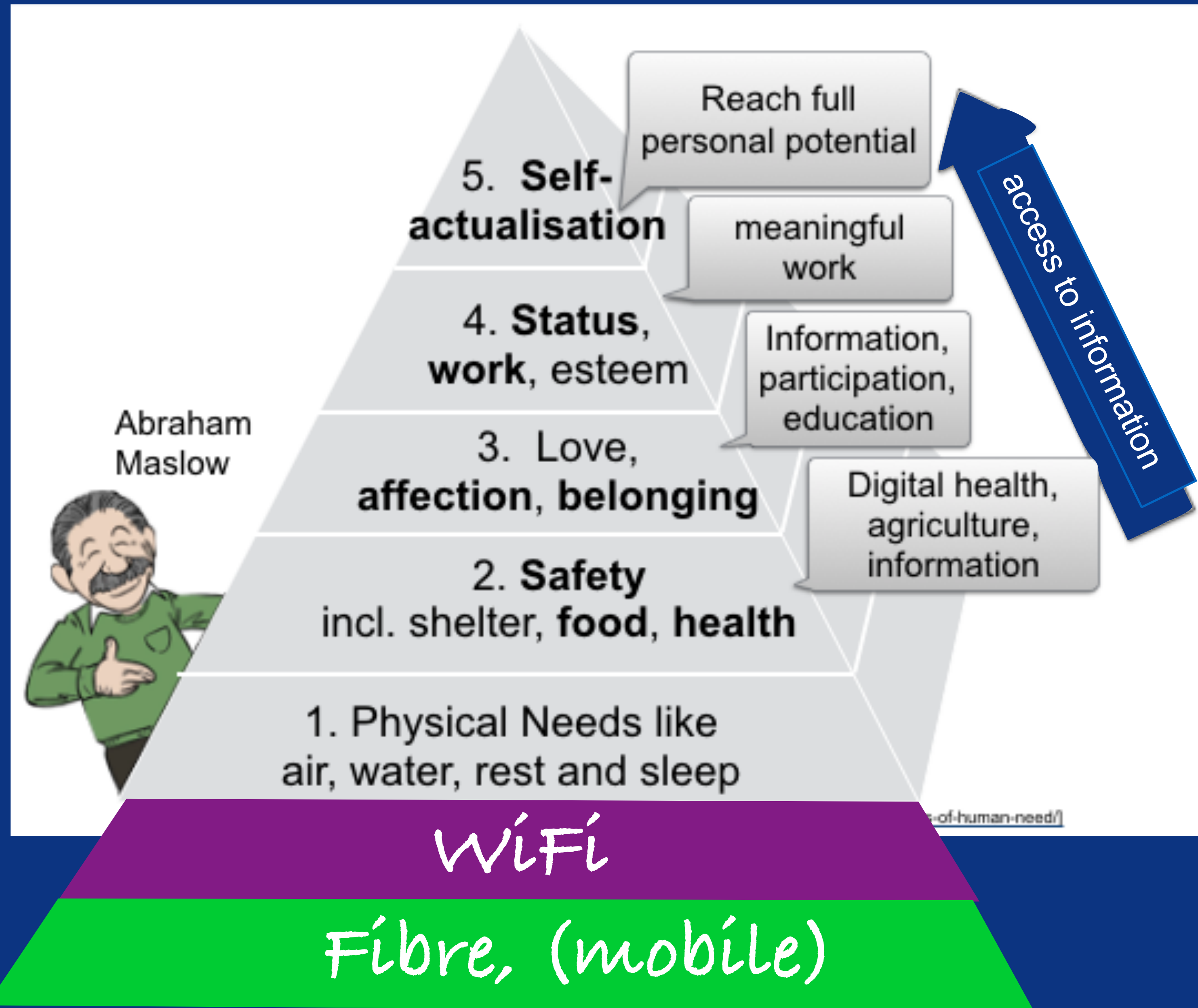


Societal transformation

**Digital Transformation,
Resilient Communities,
Empowered People**

Digital Inclusion

Societal Empowerment



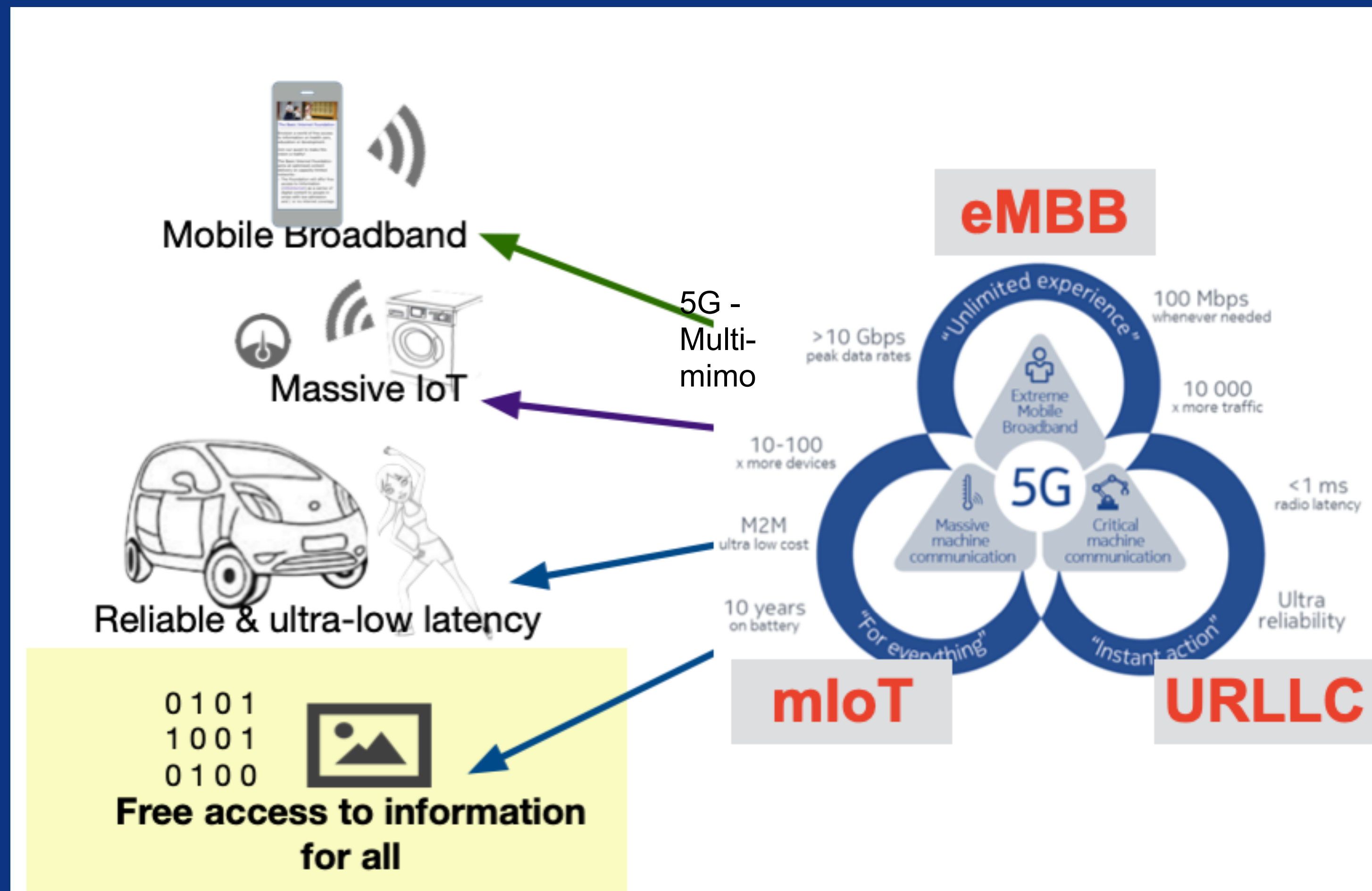
Revisit Access

Road model: pedestrians & cyclists

Digital pedestrians, digital cyclists vs digital cars (broadband)

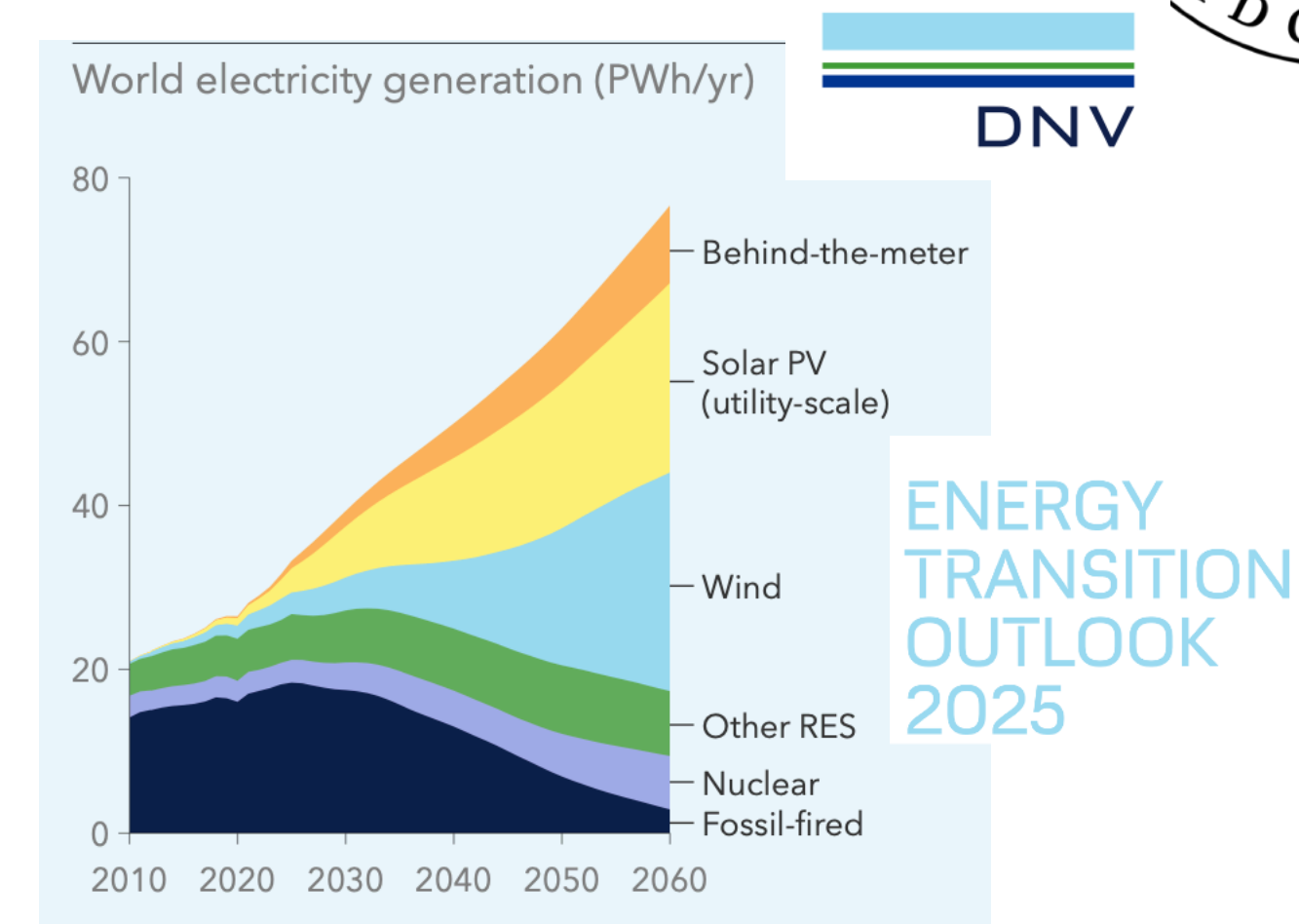
Internet Lite
as a Digital Public Good (DPG)

5G/6G large cells
to achieve coverage



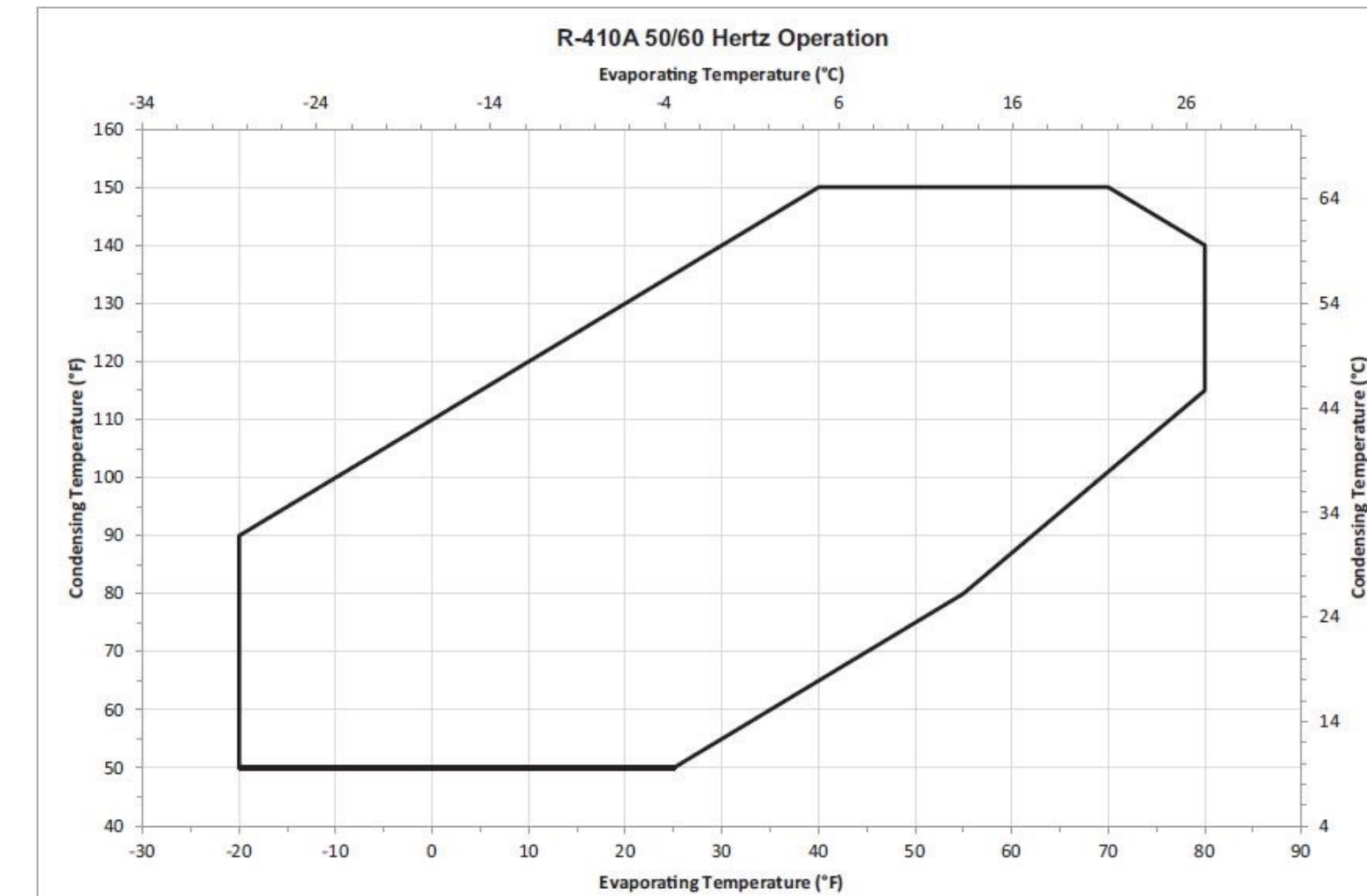
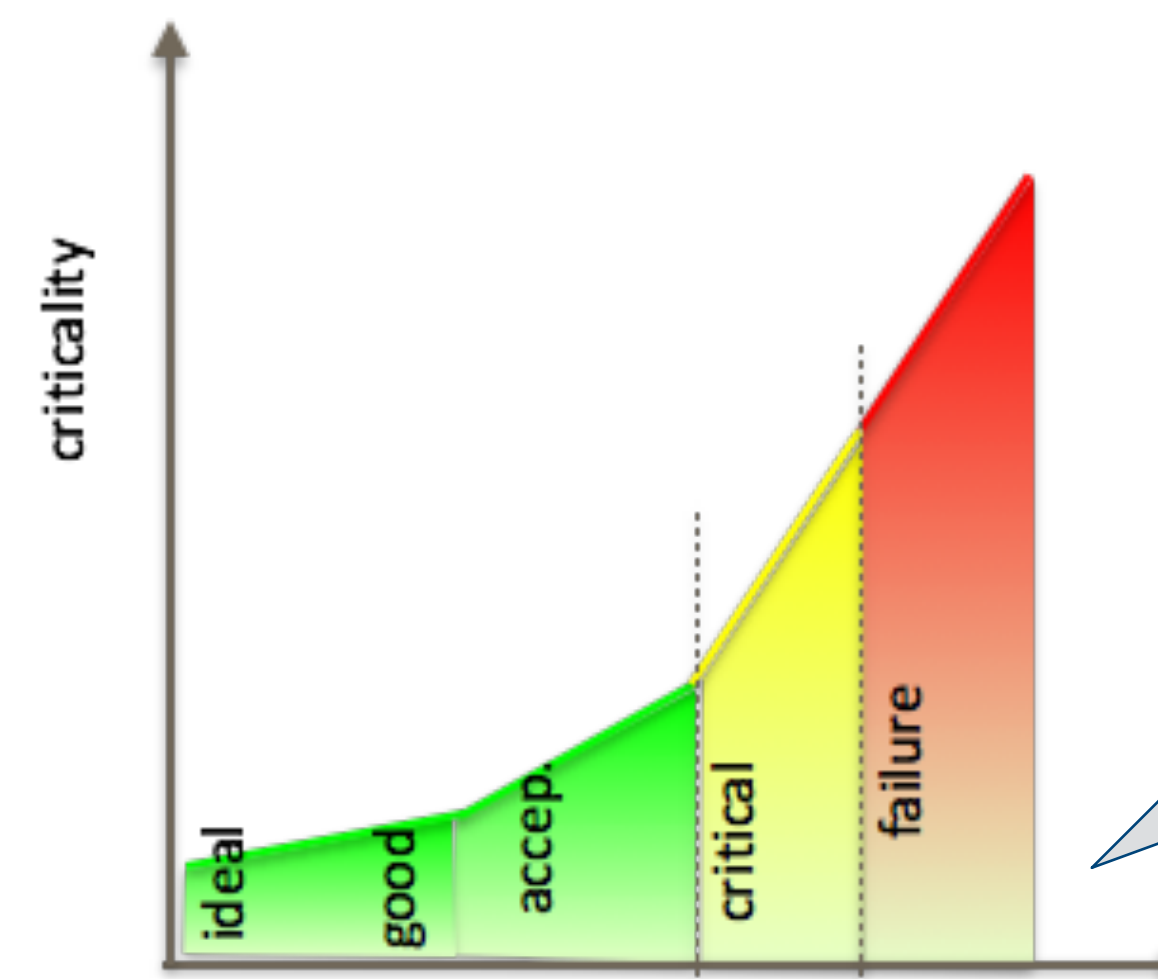
Resilience of the electrical grid

- edge empowerment, distributed grid
- elNeighbourhoods, minimum energy, smart usage,
- AMS2.0 pathway to resilience
 - New AMS in Hvaler (2028?)
- industrial transformation (2x energy)
 - Dec2025: 59% more request (Elvia)



Security Semantics - decentralised

- ➔ IoT System components, Security functionality & Security attributes
- ➔ IoT Lifetime security functionality
 - Operations
 - Development, Audit, Maintenance
 - Decommissioning
 - Mechanisms, Humans, Physical, Privacy protection
- ➔ Internet, Things, Semantics
 - Semantics vs Syntax
- ➔ Operating envelope
 - Meaning, examples
 - communication



- 1) How does the Operating Envelope look like applying criticality?
- 2) How can the criticality be applied for SPD?

Risk-Exposure Model

- Why not Impact & Frequency/Likelihood risk analysis?
- Risk-Exposure model components
 - Exposure: Connectivity & Protection level
 - Connectivity: C1 (isolated) ... C5 (full Internet)
 - Protection level: P1 (lowest) ... P5 (highest)
- Protection: data encryption, communication protection, SW security, HW security controls, Monitoring, Access control, Cryptography, Physical security
- Home control, explain
 - external supervision vs in-house solution

Catastrophic	A	C	E	F	F
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[Courtesy: Manish Shrestha, UiO, 2013]

Multi-Metrics (MM) Method

→ Accountable security - MM

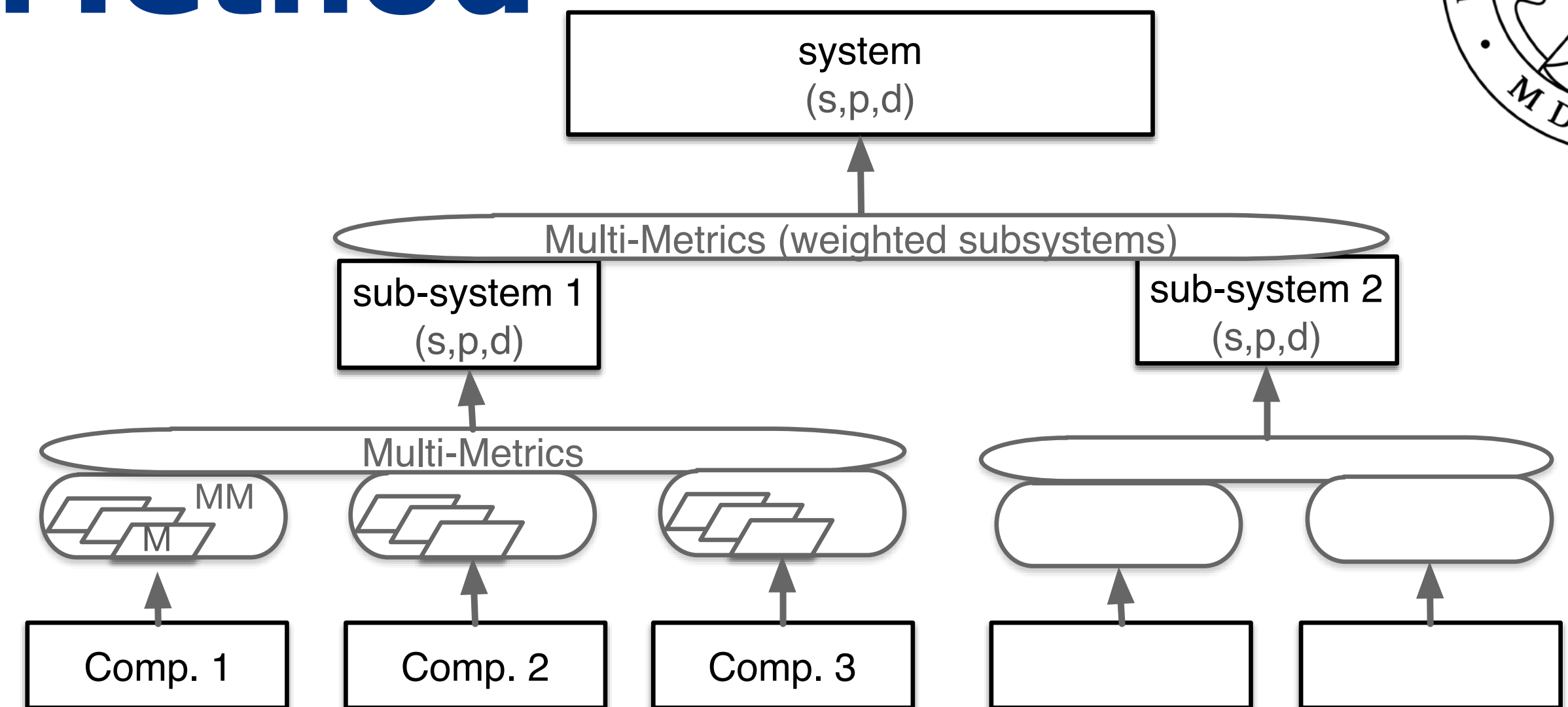
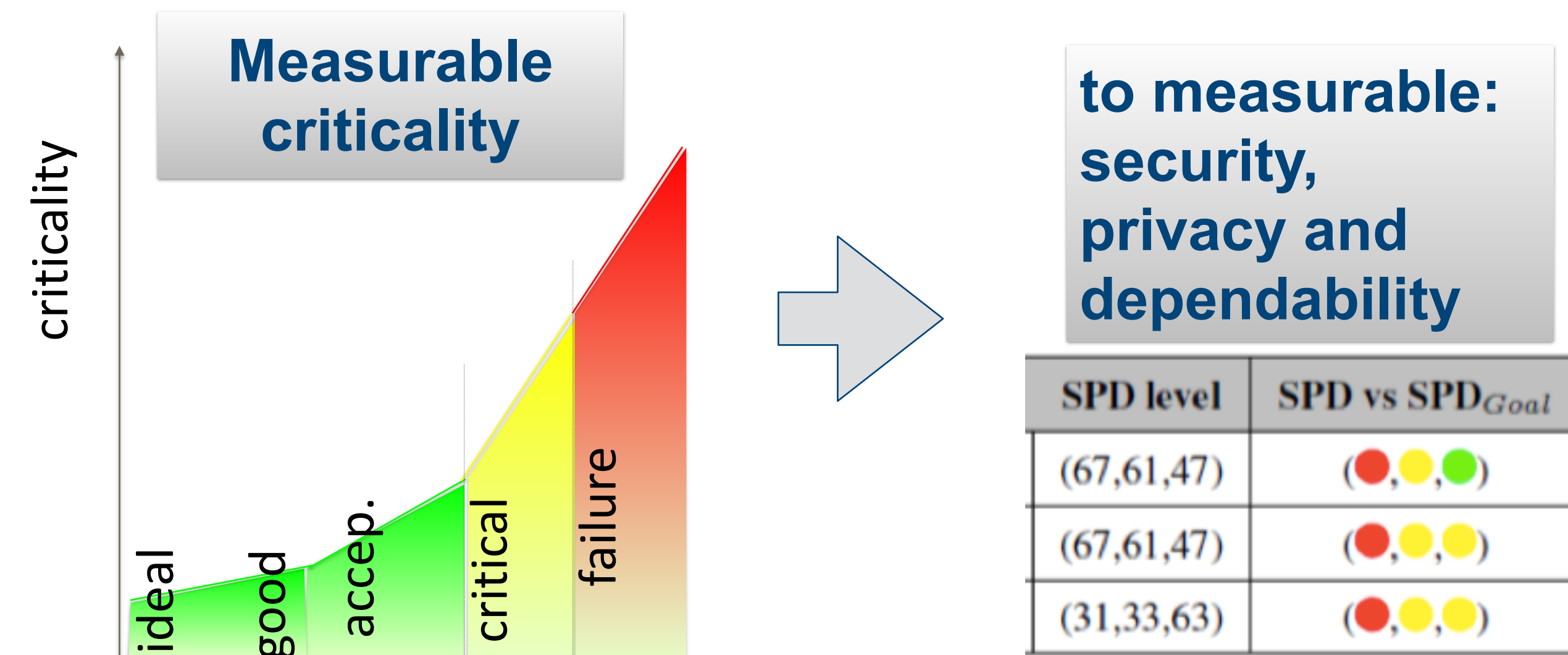
- principle operation

→ Privacy: Loan of vehicle

- difference of scenarios 1-3 (privacy, speeding, crash)

→ Privacy labels

- which data, sharing
- integrity, storage
- ownership, further distribution



Multi-Metrics (MM) Method

- ➔ Applications: Smart Meters
- ➔ Communication: Smart Meter System
- ➔ SPD
 - from components and functionalities
 - to SPD functionalities
- ➔ Operation envelop
- ➔ Weighting in MM
- ➔ Combining sub-systems through MM

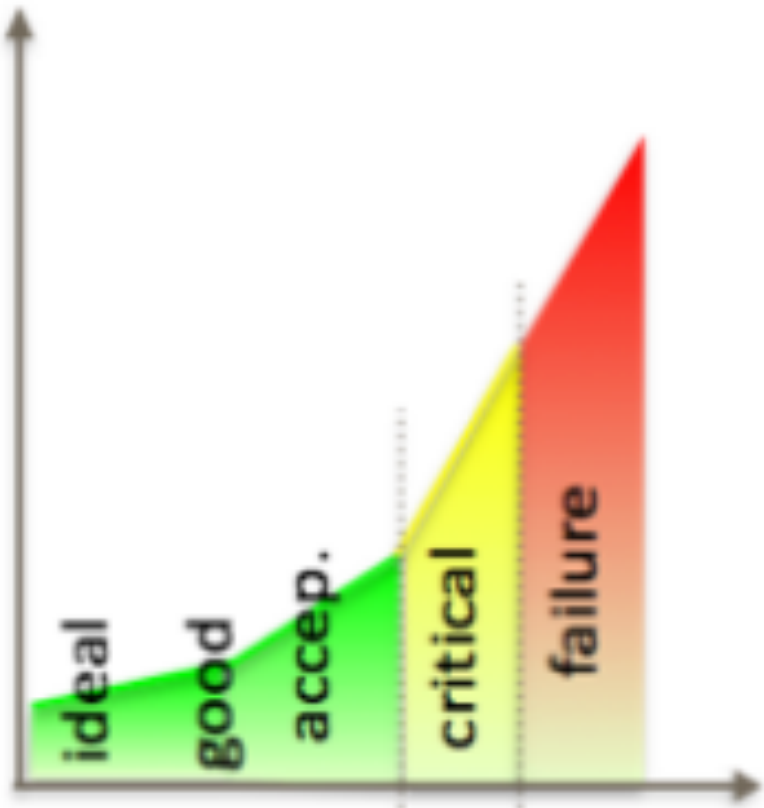


Table 8 Sub-systems and components weights

Sub-system	Sub-sys. Weight	Component	Comp. Weight
AMS	80	Remote Access	70
		Authentication	80
		Encryption	80
Radio link	50	Mesh	60
		Message Rate	80
		Encryption	40
Mobile link	20	Mobile link	70
		Encryption	40

Energy transformation is Societal transformation

- Starting from Municipalities
 - Lokal energy demand
 - Operational flexibility/reserve
- towards a supportive transition
 - psychology, involvement, organisation



Klimanøytral kommune: Slik skal vi få det til

Vi står overfor en viktig omstilling: Innen 2027 skal Lillestrøm kommune oppnå klimanøytral drift. Dette betyr at vi skal kutte utslippene våre så mye som mulig og kompensere for dem vi ikke kan fjerne.

- “Integrated approach across disciplines”

Distributed and decentralised



[Source: TU Oct2024, Willy Kramer]

**DE: 1.6 Million
+ 5 Million roofs**



BG: #1 battery = 16% of energy production



**Syria: 10x growth solar
PK: #1 PV/person**

Energy transformation

→ Future of work

- need more electricity (Elvia: need 51% more power **today**)
- innovation, new businesses, transformation

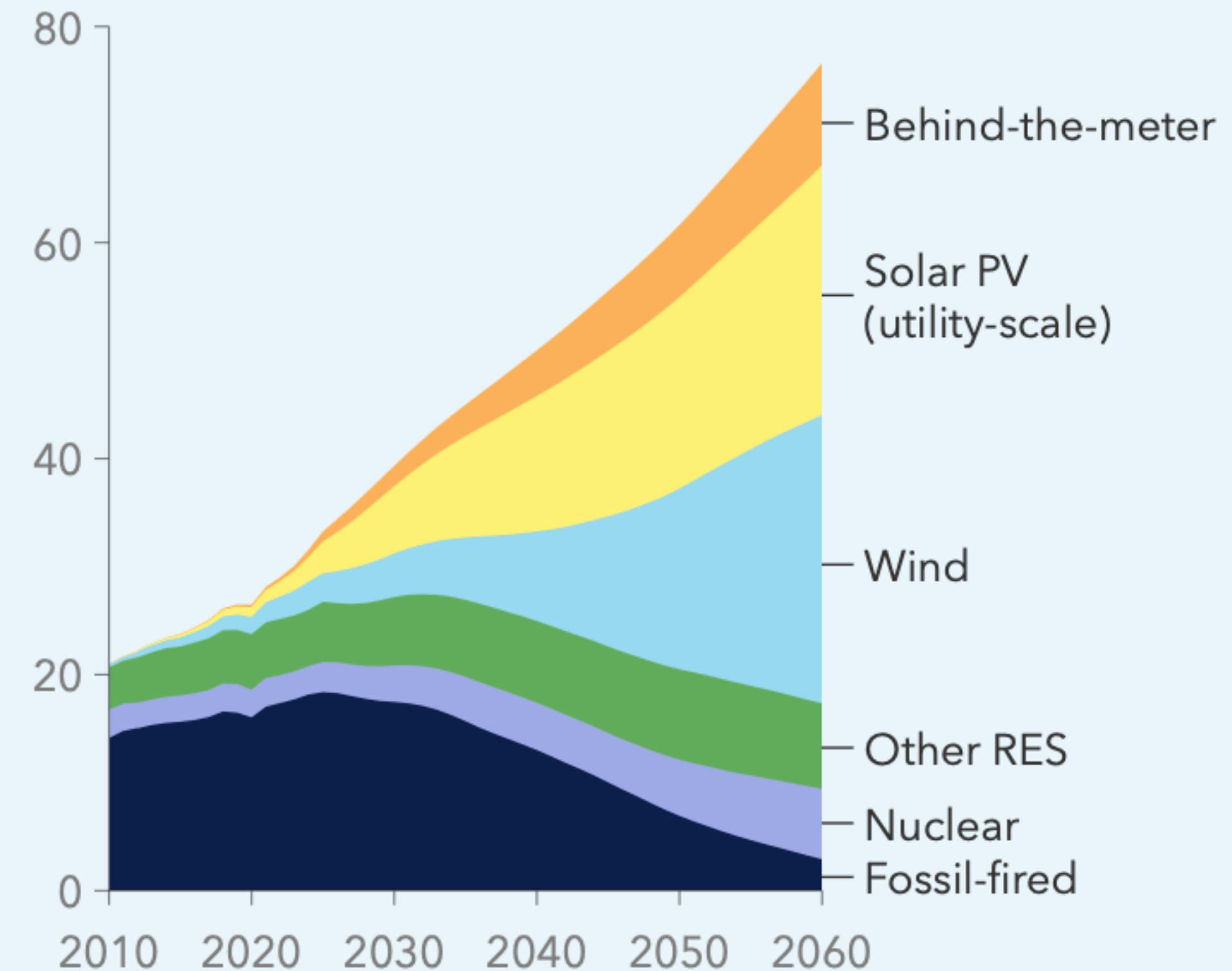
→ Growth potential

- comes from “behind the meter”, solar and wind
- price drop in Europe: 80-85 €/MWh (2024) down to 50 €/MWh (2050) due to renewables and **flexibility**. (Statnett, 2025)

→ Flexibility challenges for Statnett

- society that stops the transition (infrastructure)
- de-industrialisation of Norway (too little energy)
- political insecurity

World electricity generation (PWh/yr)

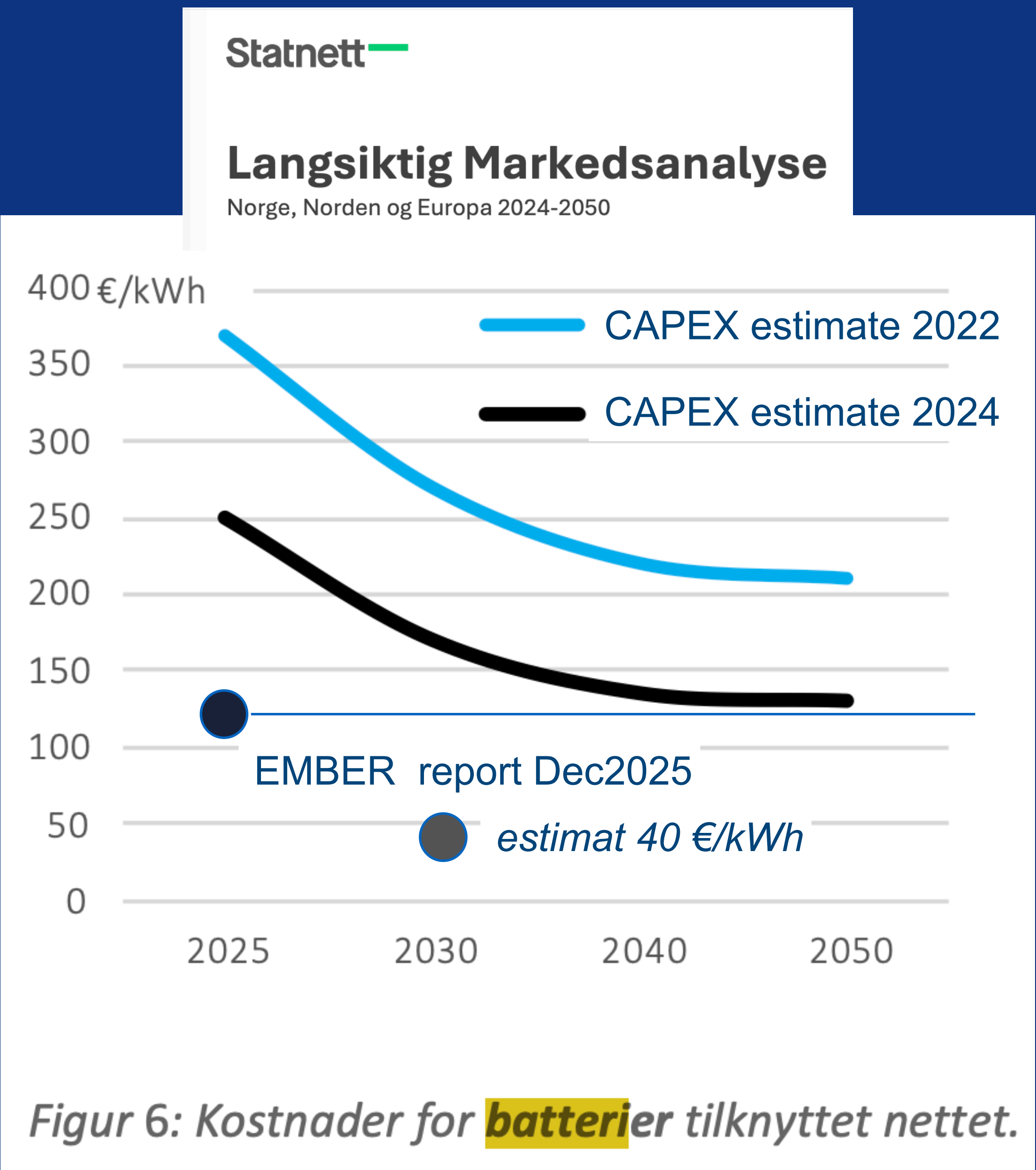


ENERGY
TRANSITION
OUTLOOK
2025



(Statnett 2025) Julie Larsen Gunnerød et al., Langsiktig Markedsanalyse 2024-2050, Statnett, 2025

Realitetssjekk Batterikostnader



EMBER

Dec 2025

Kostantsa Rangelova
Senior Battery Analyst
Ember

Dave Jones
Chief Analyst
Ember

Summary

1. All-in BESS projects now cost just \$125/kWh as of October 2025
2. Capex of \$125/kWh means a levelised cost of storage of \$65/MWh
3. With a \$65/MWh LCOS, shifting half of daily solar generation overnight adds just \$33/MWh to the cost of solar

Calculator: Levelised cost of storage (LCOS)

<https://ember-energy.org/latest-insights/how-cheap-is-battery-storage/>

Economy of Scale: Statnett “15 år feil”



Societal aspects of energy transition

- ➔ Shift people's self-conception from passive consumer to active participants (Dütschke, et al. 2021, Frontiers in Psychology)
- ➔ "domestic pathways" from small-scale renewable (Juntunen 2014)
 - attitude, economic incentives, age
- ➔ Escalator effect - lowers threshold for further engagement
- ➔ real decision-making power of renters and apartment dwellers (Lennon et al. 2019)
- ➔ intakt "engagement chain" (Lowitzsch et al. 2016)



Government drives to make 'plug-in' solar available in shops as part of clean power mission

- 'Plug-in' solar panels to be in shops within months, offering households chance to significantly cut energy bills

<https://www.gov.uk/government/news/government-to-make-plug-in-solar-available-within-months>

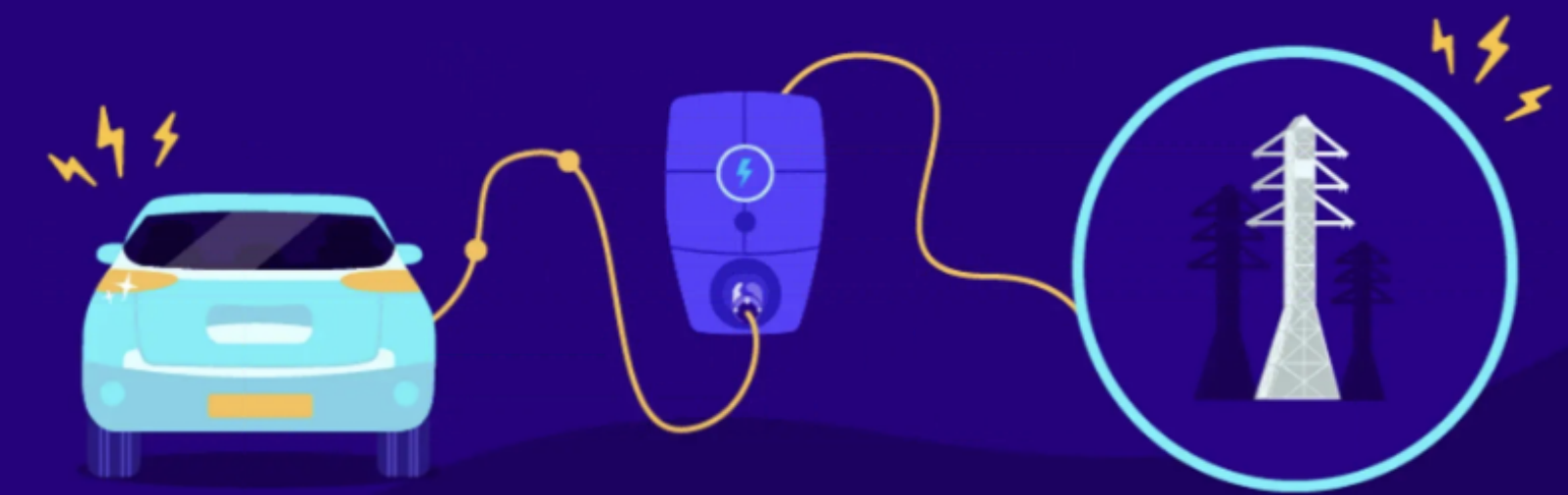
Energy transformation

eResilience, flexibility and regulations

- Hvaler: Preparedness including EV charging and Municipality infrastructure
- Lillestrøm: Top-system for 240 buildings, 19 swimming pools++
- Grenland: industrial transition, massive energy need
- Kristiansund: “energy emergency on the island”
- real-world island operations (shortcoming or outage)

Power Pack Bundle

Free home charging for your entire lease with Octopus Energy. (Mileage limits apply.)



And put energy back into the grid

<https://octopusev.com/power-pack-bundle>

UK – Octopus, Zaptec Pro, BYD – free home charging
plug in your EV for around 12 hours a day, 20 days a month