Bell Labs Consulting

Next Generation IoT: Accelerate de-carbonization with AI/ML based data strategy

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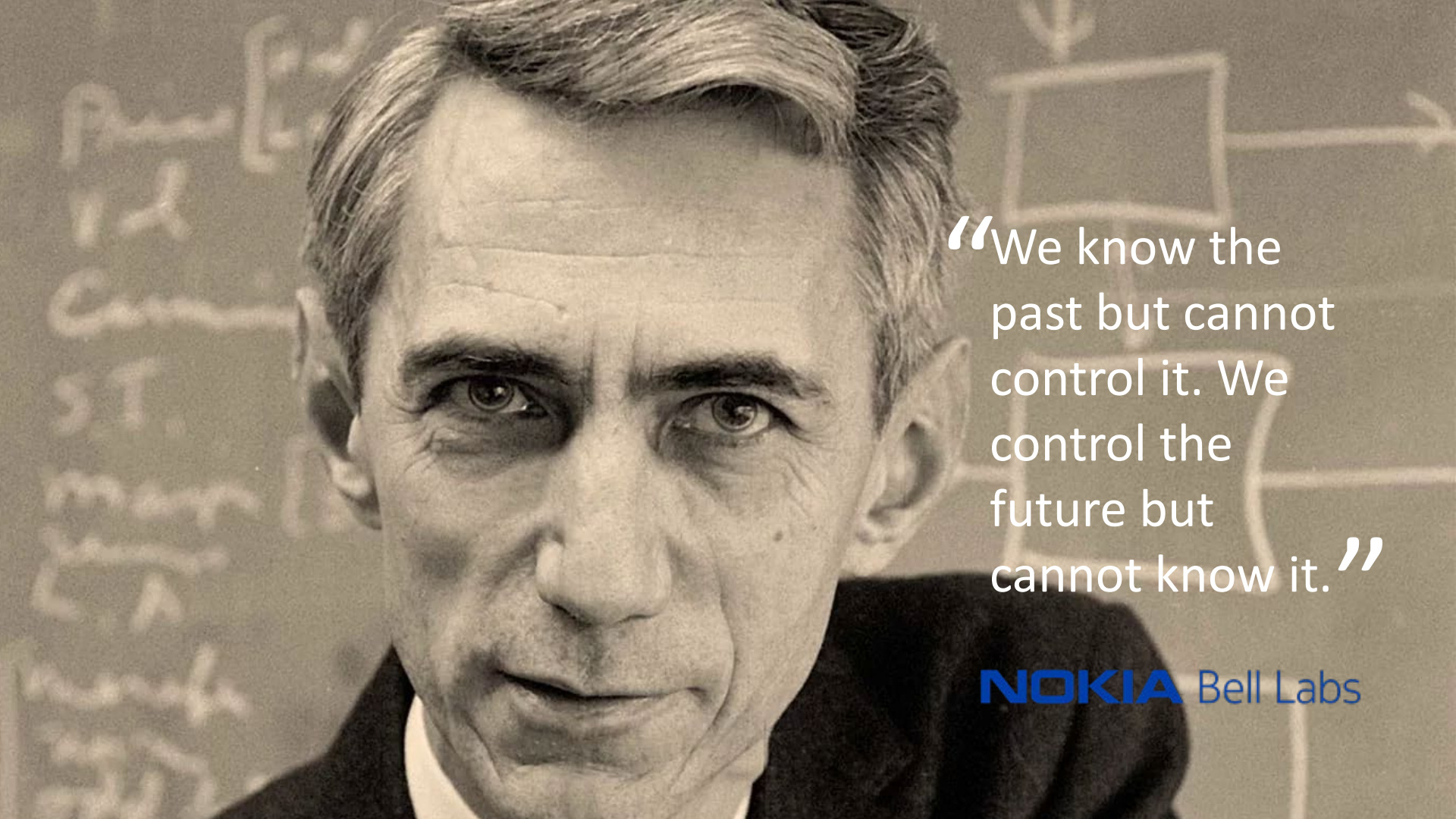
IoT Week 2022, Dublin
Herbert Mittermayr

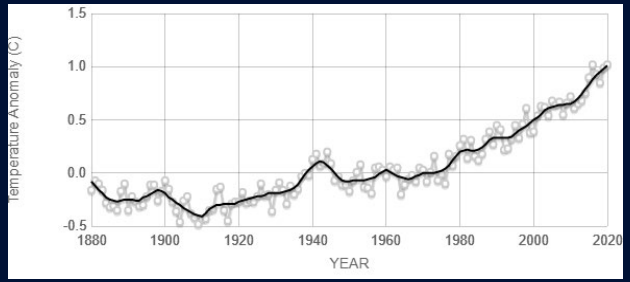

"We know the past but cannot control it. We control the future but cannot know it."
NOKIA Bell Labs

Climate change is the planet's biggest challenge
We must create sustainable societies, economies and environments

1.09°C

Earth's average temperature rise 1880-2020
Source Nasa

Global Land-Ocean Temperature Index



2020

Joint warmest year on record

19

of warmest years recorded since 2000

250x

CO2 from human activity is increasing 250x times faster than from natural sources after last Ice Age
Source NASA

90%

of GHG absorbed by oceans
Source National Geographic

Climate change will impact industries, consumers and regulations

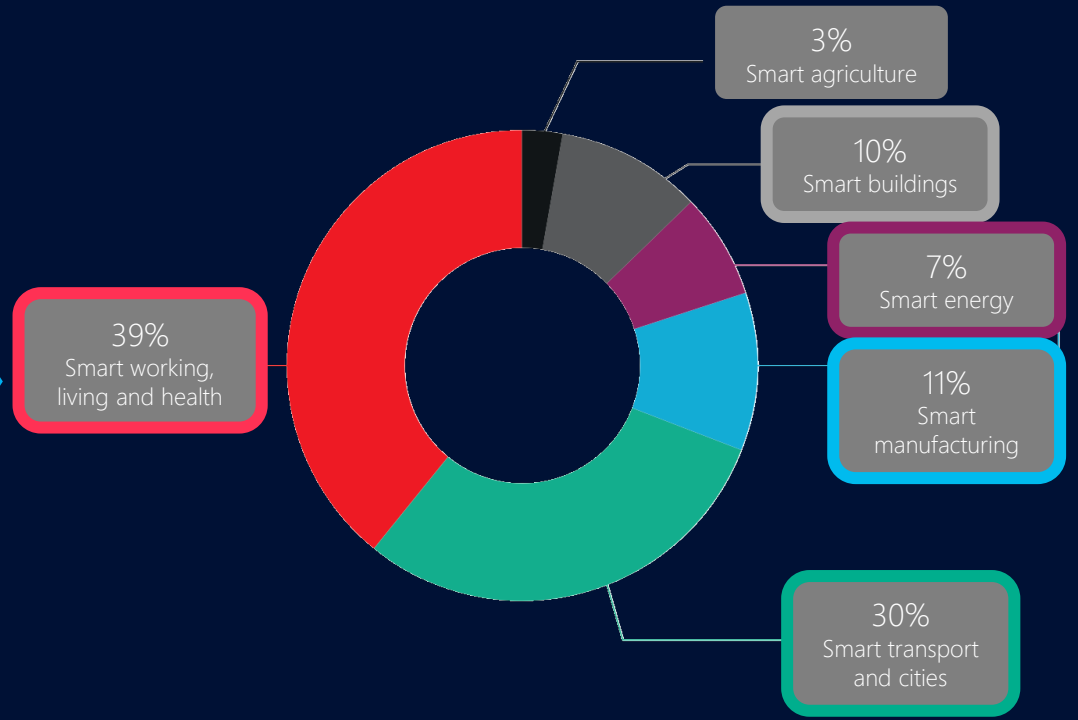
Eye opener	Following the 2016 Paris Climate Agreement, governments & businesses agreed to reduce their dependence on fossil fuels to limit the rise in global temperatures to 2 degrees above pre-industrial temperatures (and aim for 1.5 degrees). The intent is to reach net zero carbon emissions by 2050.
Loss	Governments are developing green policies and considering carbon taxes to curb emissions. Companies generating high levels of carbon emissions will see their costs increase and brands suffer.
Impact	Continued global warming is expected to reduce the places where we can safely live & work. This would impact industrial production and cause shortages and disruption.
New way	It's not enough to switch to renewable energy. We must continually reduce energy consumption, and therefore emissions, by automating operational processes and using enhanced connectivity and digital services.

Nokia position "There is no green without digital" – Pekka Lundmark / CEO

Solution	While communications networks generate carbon emissions, that contribution is mitigated 10x by enabling other industries to reduce their emissions through enhanced connectivity and services. There is an opportunity here for all telecommunications networks and its service providers.
Trust	In early 2021, Nokia announced it aims to reduce emissions by 50% across its own operations, its value chain & products in use by 2030. This is Nokia's recalibrated Science Based Target (SBTs) in line with a 1.5°C global warming scenario.

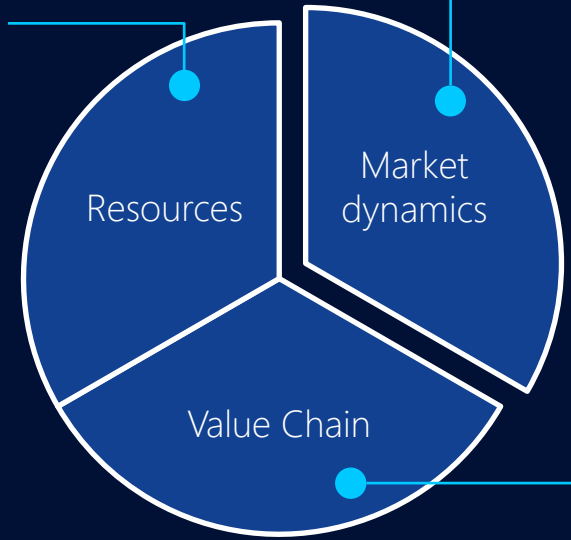
Telecommunications networks can help other industries to decarbonize

In its **Enablement Effect** report, the GSMA estimated that while mobile networks contribute about 0.4% to global emissions, the level of avoided emissions enabled today is a **10:1 positive impact**, and this is set to double by 2025.



Bell Labs Consulting aligns three strategies to ensure future networks and operational capabilities dynamically align to changes in strategy and objectives

- Network capabilities to support a complex technological and service landscape
- Organisational & leader capabilities & future structure to foster innovation & collaboration
- System of activities required enable rapid feedback and insight
- Orchestration and data to automate tasks and augment human decisions
- Strategic planning, governance and insight to facilitate good decision making



- Market opportunities
- De-carbonization goals
- Business objectives
- Customer commitments
- Types and size of business

- Value chain capabilities
- Commercial conditions to model the desired value chain behavior
- Mechanisms to promote co-innovation

The historical value shift in **electrical energy** technology since the 1930's gives a solid indication of where the future value lies

	1930s	1950s	1970s	2010s	2030s
					
Production:	Small powerplant typ. 10MW	medium powerplant typ. 200MW	More and bigger > 1GW	Many more & much smaller typ. 5kWp solar typ. 5MWp wind	Virtual Power Plants Manageable production
Distribution:	Local distribution	Local distribution and further	UHV lines >380kV HV lines, 110kV Medium 10..30kV	UHV lines >380kV HV lines, 110kV Medium 10..30kV	Microgrids Smart intelligent grid with massive IoT
Consumption:	Machinery in manufacturing Lighting in Cities Households (lamps)	For machinery in big manufacturing Households' machinery	Ubiquitous consumption	Higher variable loads e.g. BEV (10..100kW)	High loads, plus storage, e.g. BEV Manageable consumption

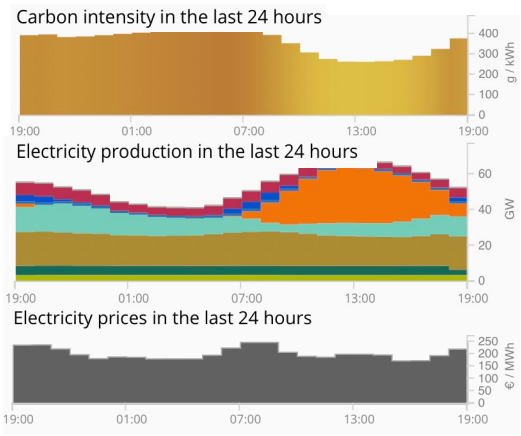
Balance electric power supply and consumption with AI/ML platform

Avoid carbon intensity and optimize demand-supply

3 green power challenges

- The move to renewables increases the installed (peak) power capacity
- However, energy production dynamics increases as well, and
- Variation in consumption increases, with bigger loads (BEV)

With increasing volatility



Variabilities over 1 day (a snapshot):

- Carbon intensity 1,6.1
- Electricity production 1,75:1
- Electricity prices 1,7:1

Enabling technologies

Control layer

- **Massive IoT** allows control both at production power as well as on energy consumption loads

Data layer

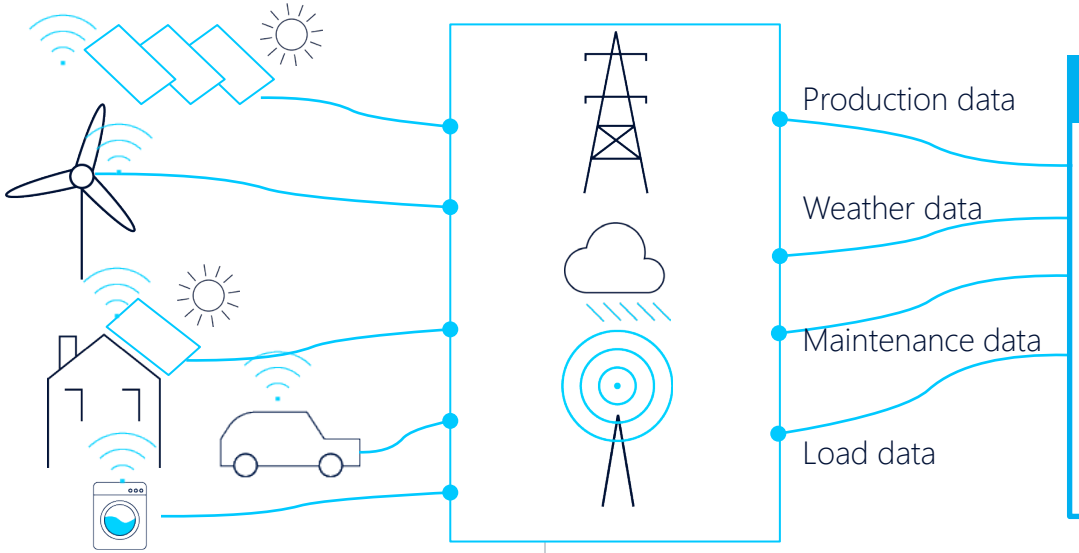
- **Intelligent forecasting** predict renewable productions, depending on weather
- Intelligent **load control** with IoT connected e.g., via telcos IoT-network
- **Network-as-a-sensor** for predictive power production estimation

Intelligence layer

- AI/ML based **optimization** between demand, supply and external factors
- Operation with **monetizing data and algorithms** in an aaS knowledge base model

AI/ML platform need to balance electric power supply and consumption

Green energy optimization platform in an aaS-model



Green energy optimization

- Metaverse trading platform
- Ubiquitous data lake
- Massive IIoT, incl network-aaSensor
- AI/ML based optimization
- Balancing demand-supply
- Planning predictive maintenance

→ Green energy aaS model

Telecommunications network

Leverage network assets and IOT for optimizing on electricity costs and even generate revenue

Data lake Operator

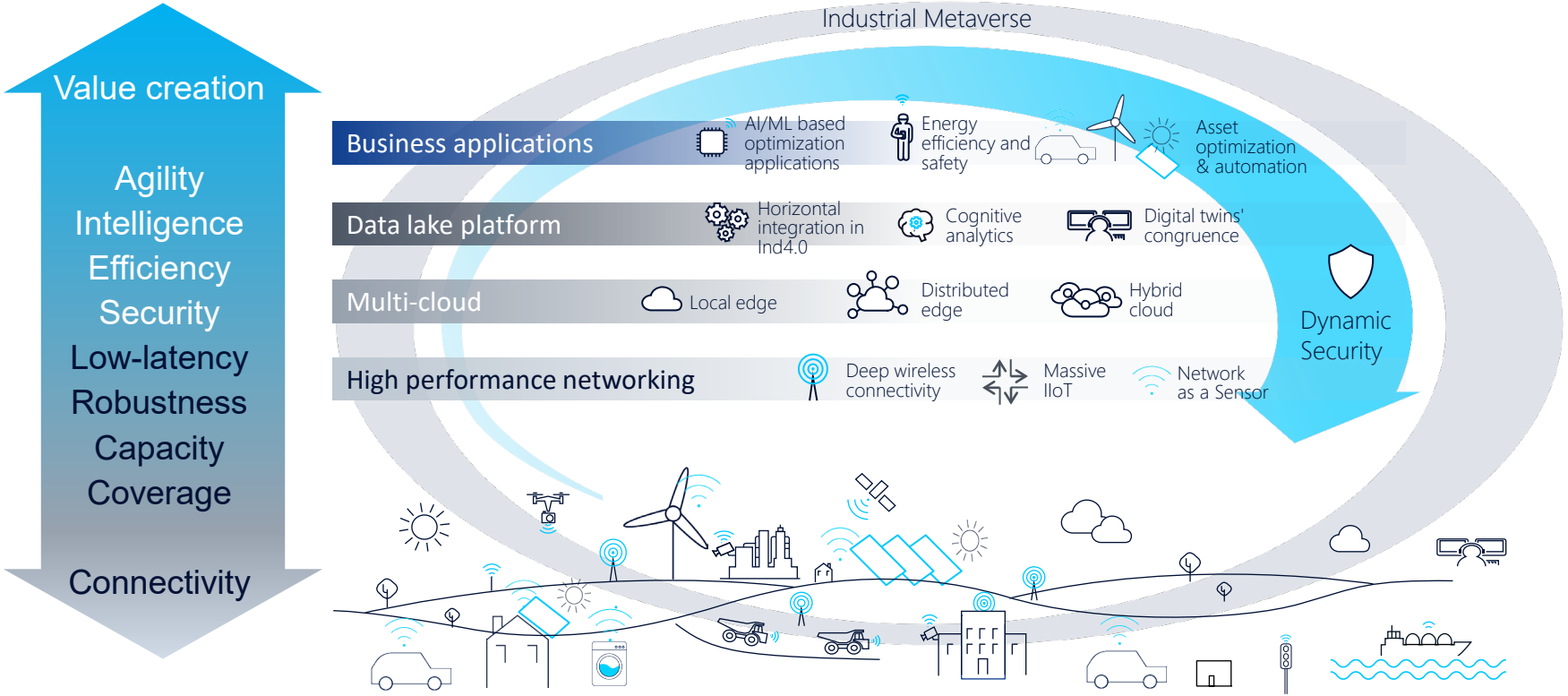
Create a telco-grade AI/ML solution offering aaS model for electric power supply-demand balancing

Grid Operator

Extend virtual power plants and grid control with IoT control, based on ML algorithms

Bell Labs future architecture for green energy optimization

End-to-end networking for green energy digital transformation journey



https://www.bell-labs.com/institute/white-papers/utility-of-the-future-a-bell-labs-perspective

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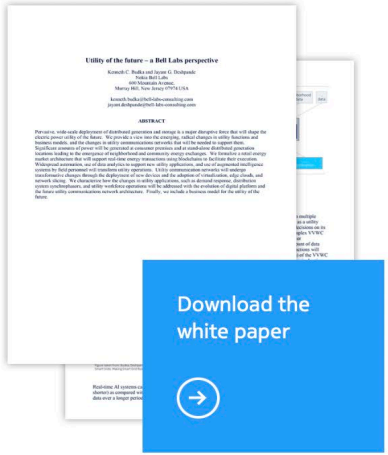
Utility of the future – a Bell Labs perspective

To envision the electric grid of the future, it is helpful to look at the forces that have shaped the electric grid to date and envision how changes in the underlying economics and capabilities of grid technologies will shape its future.



Executive summary

Pervasive, wide-scale deployment of distributed generation and storage is a major disruptive force that will shape the electric power utility of the future. Significant amounts of power will be generated at consumer premises and at stand-alone distributed generation locations leading to the emergence of neighborhood and community energy exchanges. We

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