

UiO : **Universitetet i Oslo**

Master “Renewable Energy” Meeting, Nov2019

Research Areas: Energy (Grid, Smart Grid, IoT) for Sustainable Development



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Energy usage Norway

♦ Energy production (2018)

- ➔ 95.8% water
- ➔ 2.3% burning
- ➔ 1.9% wind



	produced [TWh]	used [TWh]	Export/ Import [TWh]			
2018	145.7	135	10			
2017	149.3		21.3/6.1			
2016	149.6					
2014						



[1] <https://www.tu.no/artikler/norge-brukte-rekordmye-strom-i-fjor/430005>

[2] <https://enerwe.no/norges-stromforbruk-okte-til-1354-twh-mens-produksjonen-falt-til-1457-twh-i-2018/166697>



TOTAL ENERGY



CRUDE OIL



OIL PRODUCTS



NATURAL GAS



COAL, LIGNITE



ELECTRICITY



RENEWABLES



CO₂ FUEL COMBUSTION



2018 Selected figures



Total energy

3.7%

China's energy consumption growth rate.



Crude oil

16.5%

Sharp rise in crude oil production in the **US**.



Oil products

-3.3%

Decline of oil product consumption in **Latin America** continues for fourth consecutive year.



Natural gas

10%

Major increase in gas consumption in the **US** (half of world increase).



Coal, lignite

11%

Surge in **Turkey's** coal consumption .



Electricity

72%

Contribution of **BRICS** to the global increase in power consumption between 2010 and 2018.



Renewables

+30 pts

Rise in the share of renewables in the **British** power mix between 2000 and 2018.



CO₂ fuel combustion

3.1%

New growth in CO₂ emissions in the **US**.



Vision and Mission

- Vision:
“Transformation to affordable zero-net energy systems for All”
- Mission:
 - ➔ Research for modern and sustainable energy
 - ➔ Create the technology vision for a renewable energy systems
 - ➔ Empower the society for sustainable development through energy systems
- Answering SDG 7 targets:
 - 7.1 By 2030, ensure universal access to affordable, reliable, and modern energy services
 - 7.2 Increase substantially the share of renewable energy in the global energy mix by 2030
 - 7.3 double the global rate of improvement in energy efficiency by 2030
 - 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies
 - 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, particularly LDCs and SIDS



Affordable Energy & Internet Lite for All

the catalysts for the goals

Showcase

“Non discriminating access” project

- funded by RCN and Mfa/Norad (14.9 MNOK for 2017-2020)
- Tanzania: digital health
- Mali: energy



Energy & Internet Lite for All
Target 7.1&7.2 Target 9.C Target 16.10

Given the fact that only few women have access to

- Smartphones and
- Mobile broadband subscriptions (internet)

Free access to Digital Public Goods is key to empowering women for entrepreneurship



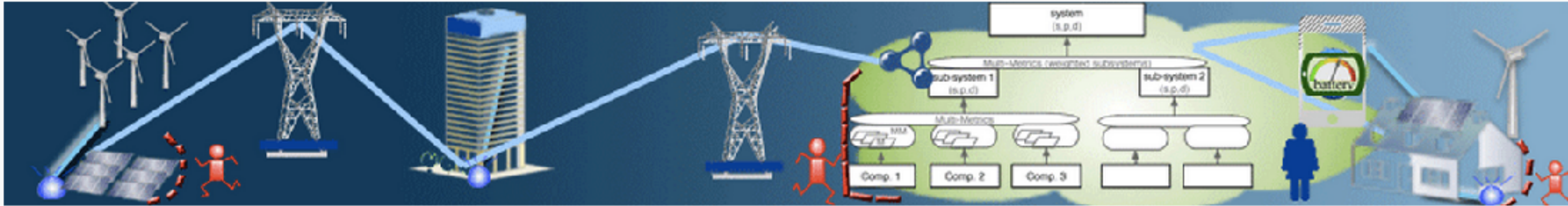
Adoption from Maslow

National initiative for a more secure future in IoT

IoTSec.no - Security for IoT for Smart Grids

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The **IoTSec - Security in IoT for Smart Grids** initiative was established in 2015 to promote the development of a safe and secure Internet-of-Things (IoT)-enabled smart power grid infrastructure. The [Research Project](#) received funding from the [Research Council of Norway](#) (RCN) to contribute to a safe information society.

IoTSec addresses the basic needs for a reliable and efficient, uninterrupted power network with dynamic configuration and security properties. It addresses in addition the needs of businesses and end users of additional IoT services by exploring use cases for value-added services with the intent to design the building blocks for future services that consider the necessary security and privacy preconditions of successfully deployed large-scale services. IoTSec will apply the research in the envisaged Security Centre for Smart Grids, co-located with the Norwegian Centre of Excellence (NCE Smart).

About

The IoTSec initiatives drives Research for secure IoT and Smart Grids

#iotsecno

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Sikkerhet i SmartGrid #IoTSec
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«Open World Approach»
everything that is not declared closed is open



Partners and Collaborations

- UiO
- UNIK
- NR
- Simula
- NTNU

Academia

- Smart Innovation Østfold
- eSmart Systems
- Fredrikstad Energi
- EB Nett
- Movation

Industry

- Smartgrid Centre
- Norw. Data Protection Auth.
- Forbrukerrådet

Interest Org.

- EyeSaaS
- mnemonic

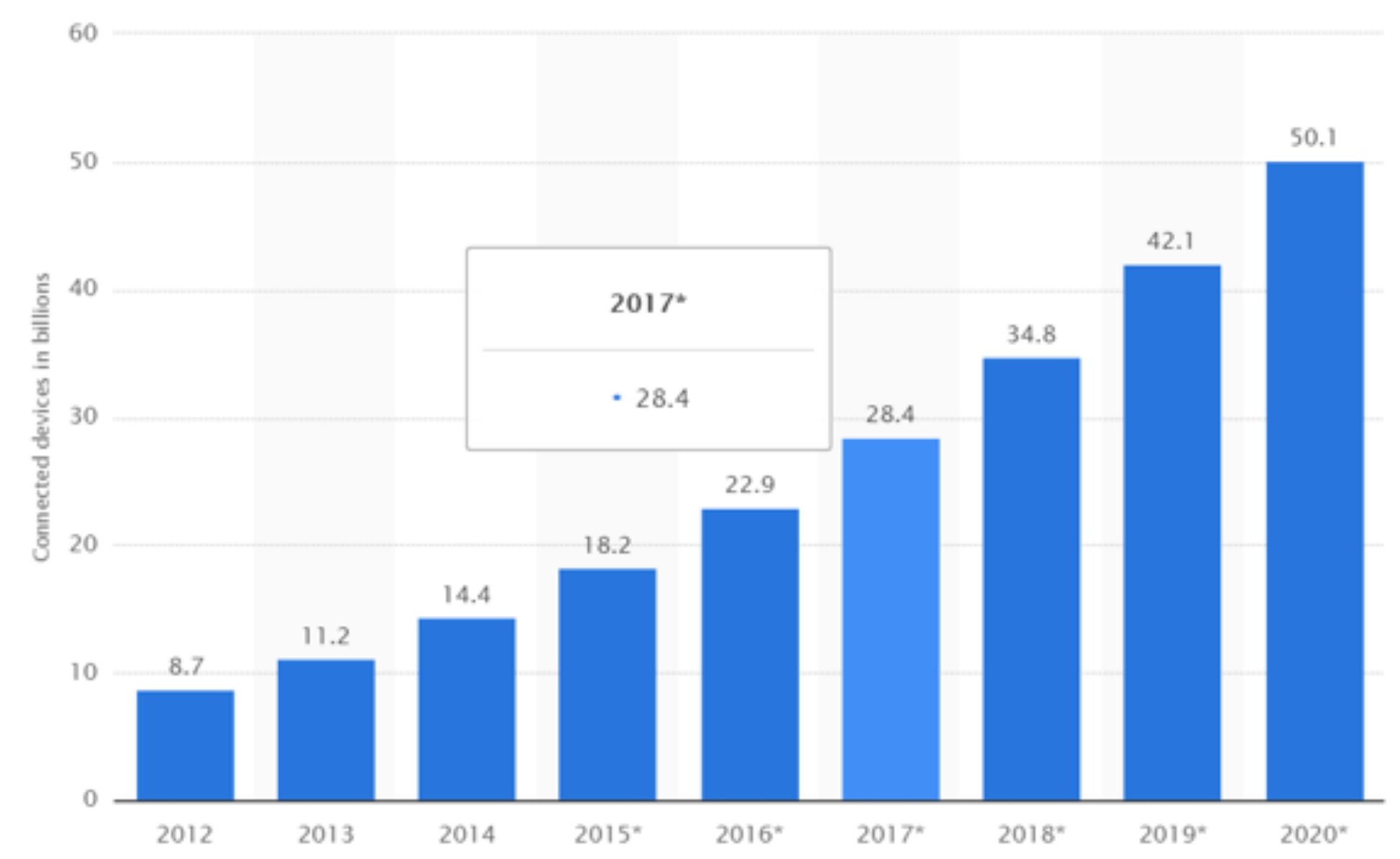
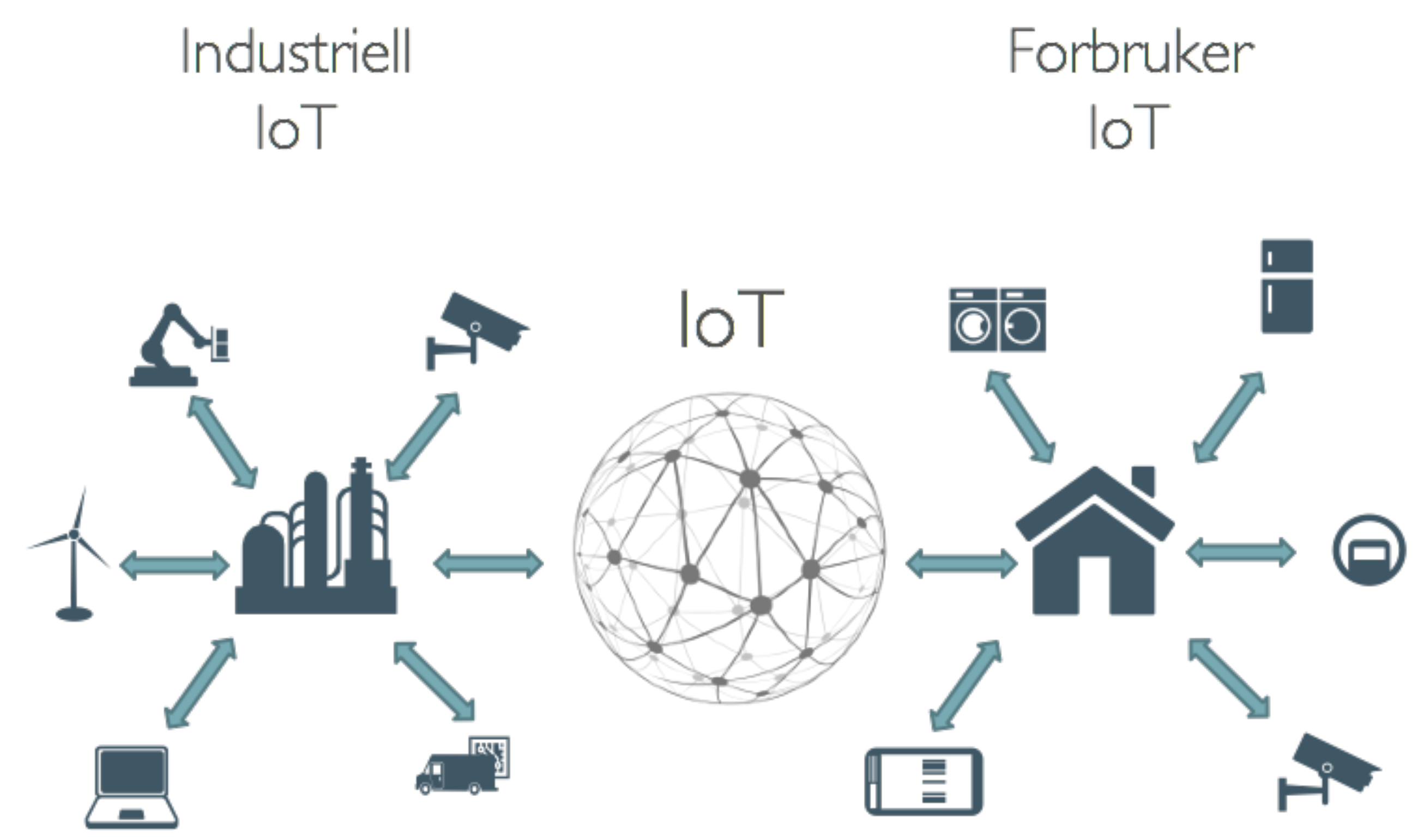
Industry

- Mondragon Unibersitatea
- University of Victoria
- Universidad Carlos III
- La Sapienza
- COINS Research School
- Nimbeo
- H2020 and ECSEL projects

International

Industrial view versus Consumer view

- IoT threats on critical infrastructures

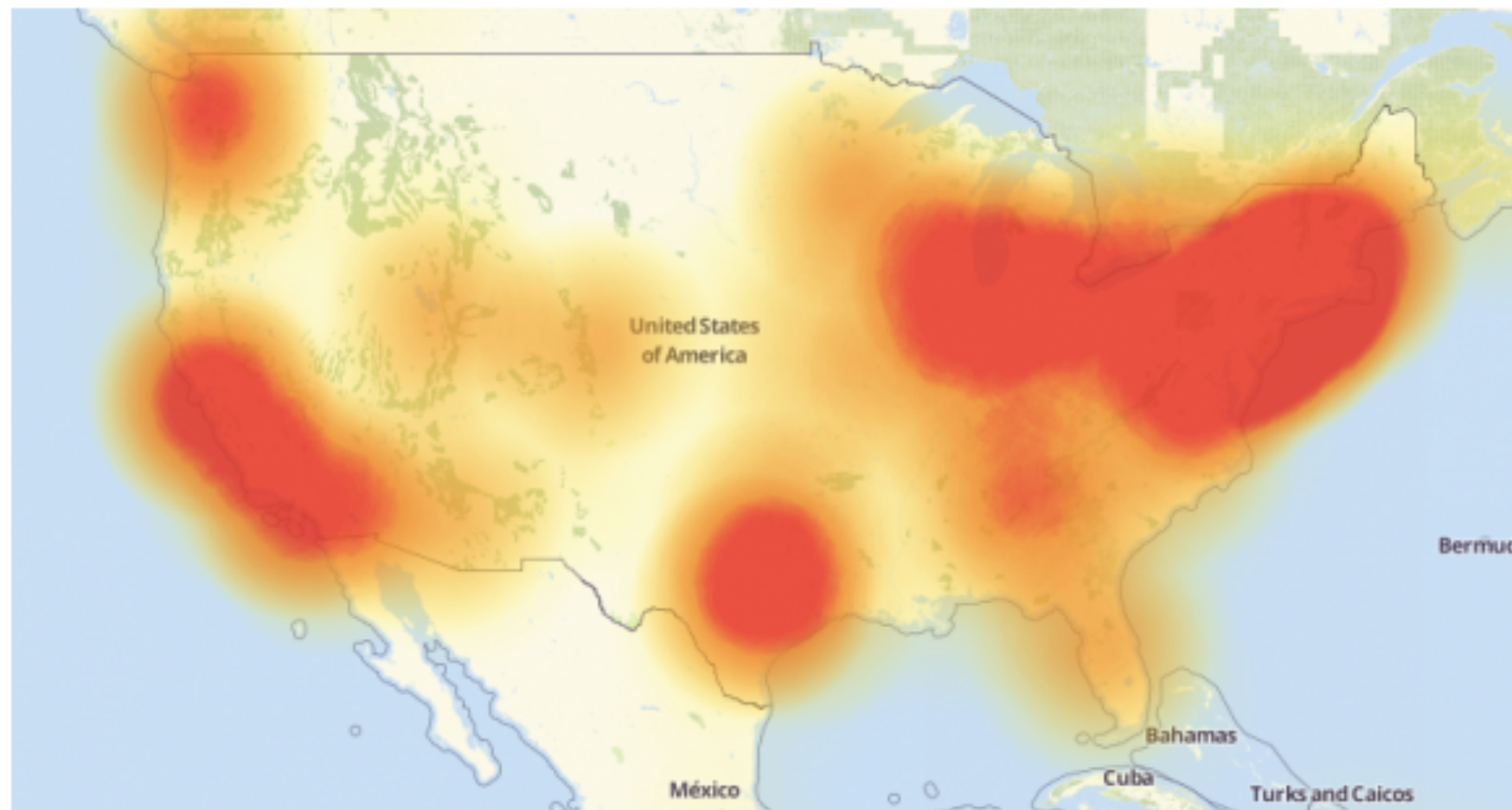


Treath examples

21 Hacked Cameras, DVRs Powered Today's OCT 16 Massive Internet Outage

A massive and sustained Internet attack that has caused outages and network congestion today for a large number of Web sites was launched with the help of hacked "Internet of Things" (IoT) devices, such as CCTV video cameras and digital video recorders, new data suggests.

Earlier today cyber criminals began training their attack cannons on **Dyn**, an Internet infrastructure company that provides critical technology services to some of the Internet's top destinations. The attack began creating problems for Internet users reaching an array of sites, including Twitter, Amazon, Tumblr, Reddit, Spotify and Netflix.



[Source: <https://krebsonsecurity.com/2016/10/hacked-cameras-dvrs-powered-todays-massive-internet-outage/>]

Computing

Ukraine's Power Grid Gets Hacked Again, a Worrying Sign for Infrastructure Attacks

Russian hackers may be behind attacks leveled at the nation's power grid and artillery. The West should take note.

by Jamie Condliffe December 22, 2016

[Source: <https://www.technologyreview.com/s/603262/ukraines-power-grid-gets-hacked-again-a-worrying-sign-for-infrastructure-attacks/>]

NB-IoT in praxis - Monitoring the Grid (heimdall.no)

- ✦ Until now: no control of electricity
- ✦ With Heimdall “neurons”, measure
 - ➔ power, line inclination, line vibration,
 - ➔ snow load and wire temperature
- ✦ Science: vibration amplitude is linked to energy flow [1]
- ✦ Communication through NB-IoT [2]



[1] https://www.researchgate.net/publication/282956268_Measurement_of_vibration_characteristics_of_power_cable_line_under_typical_laying_conditions

[2] <https://www.telia.no/magasinet/norsk-oppfinnelse-kan-lose-arhundrets-stromutfordring/>

“Internet Lite & Affordable Energy for All”

Starting with
one Information Spot
per village

- | Energy, Digital & Health, the building blocks for societal empowerment
- | Freemium model for access
 - ➔ Free: text, pictures & local video
 - ➔ Premium: broadband services
- | Build Village Information Spots
 - ➔ Free access to information
 - | Energy usage
 - | Health
 - | Education
 - | Entrepreneurship, e.g. Agriculture

