

# Eletricidade renovável inovação e tendências

CONFERÊNCIA APREN 2017



BEM VINDO  
AO CÍRCULO DA MUDANÇA

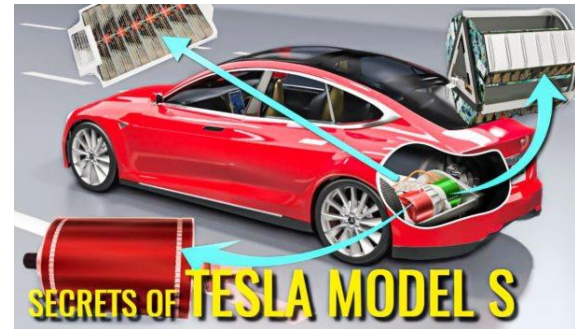


# A visão para os Sistemas Eléctricos do futuro

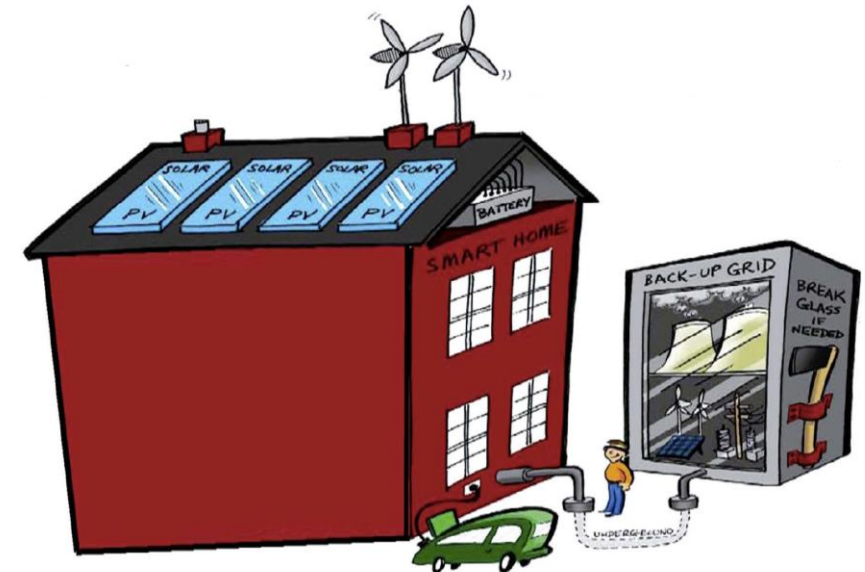
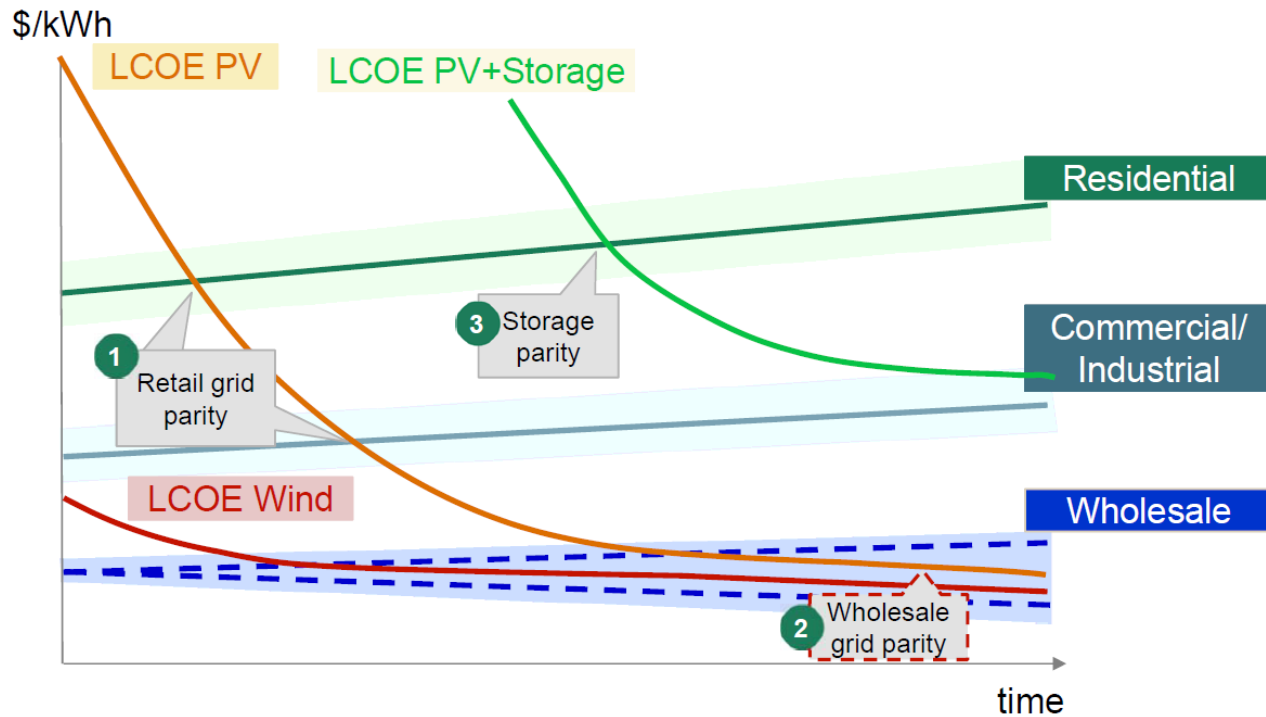
António Vidigal

EDP Inovação

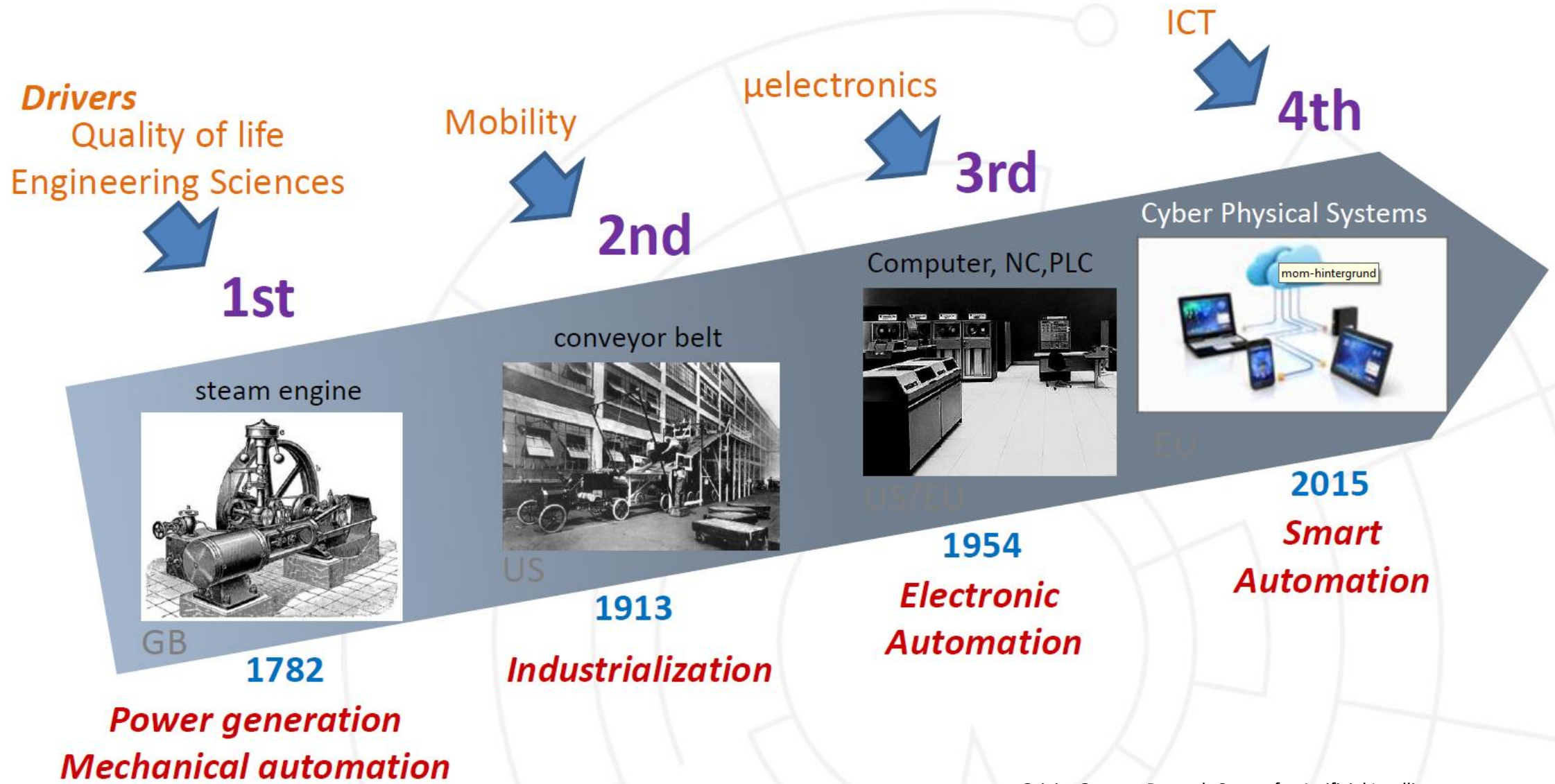
The World is changing and we tend to overestimate the short term and to underestimate the medium term



In the future PV with storage may become the most competitive solution. The grid will be a back-up to which we will pay kW instead of kWh ?

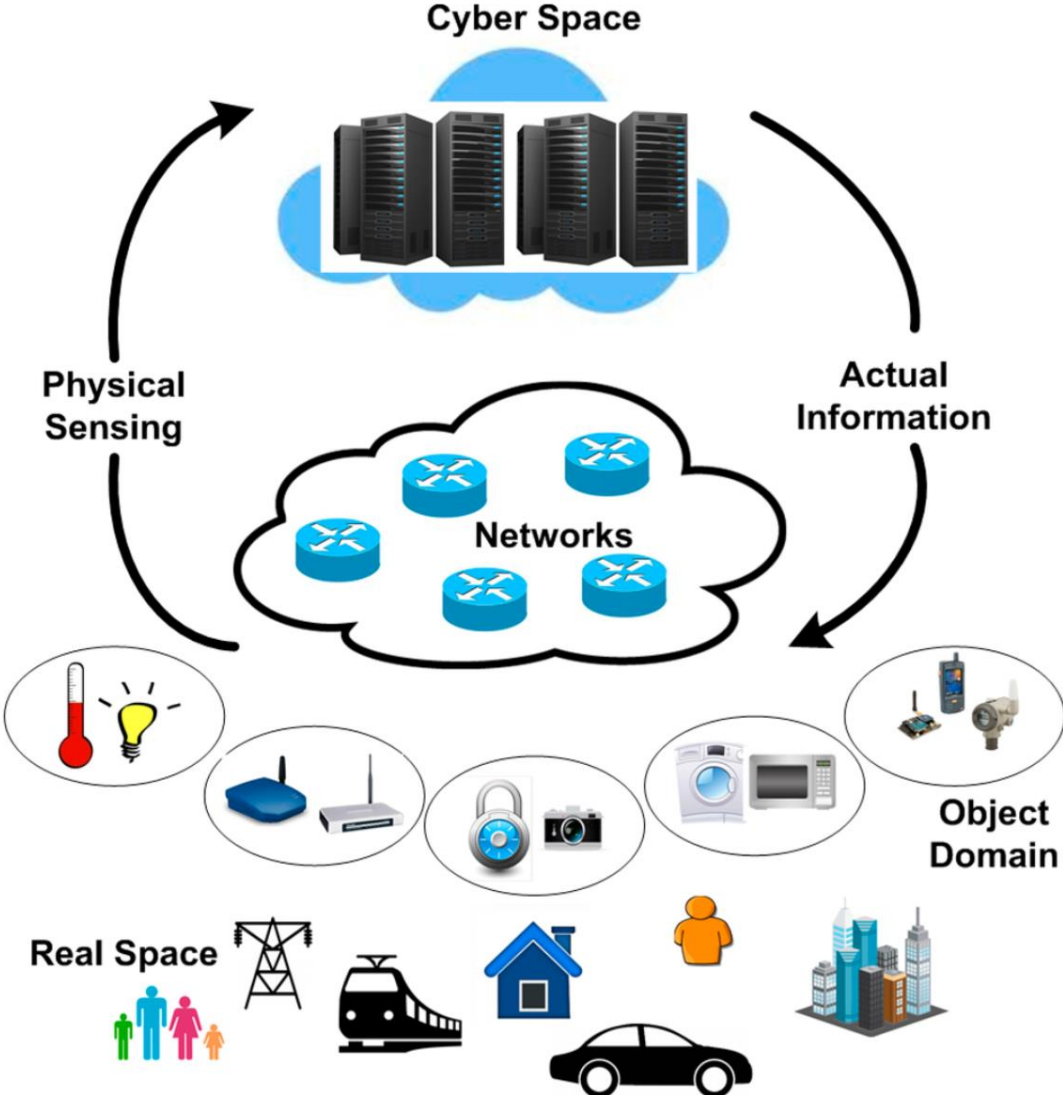


# The 4th Industrial Revolution - „Industry 4.0“



# Advanced Analytics and Big Data and AI are an important part of Industry 4.0

*Cyber-physical systems (CPS)* are engineered systems that are built from, and depend upon, the seamless integration of computational algorithms and *physical* components.

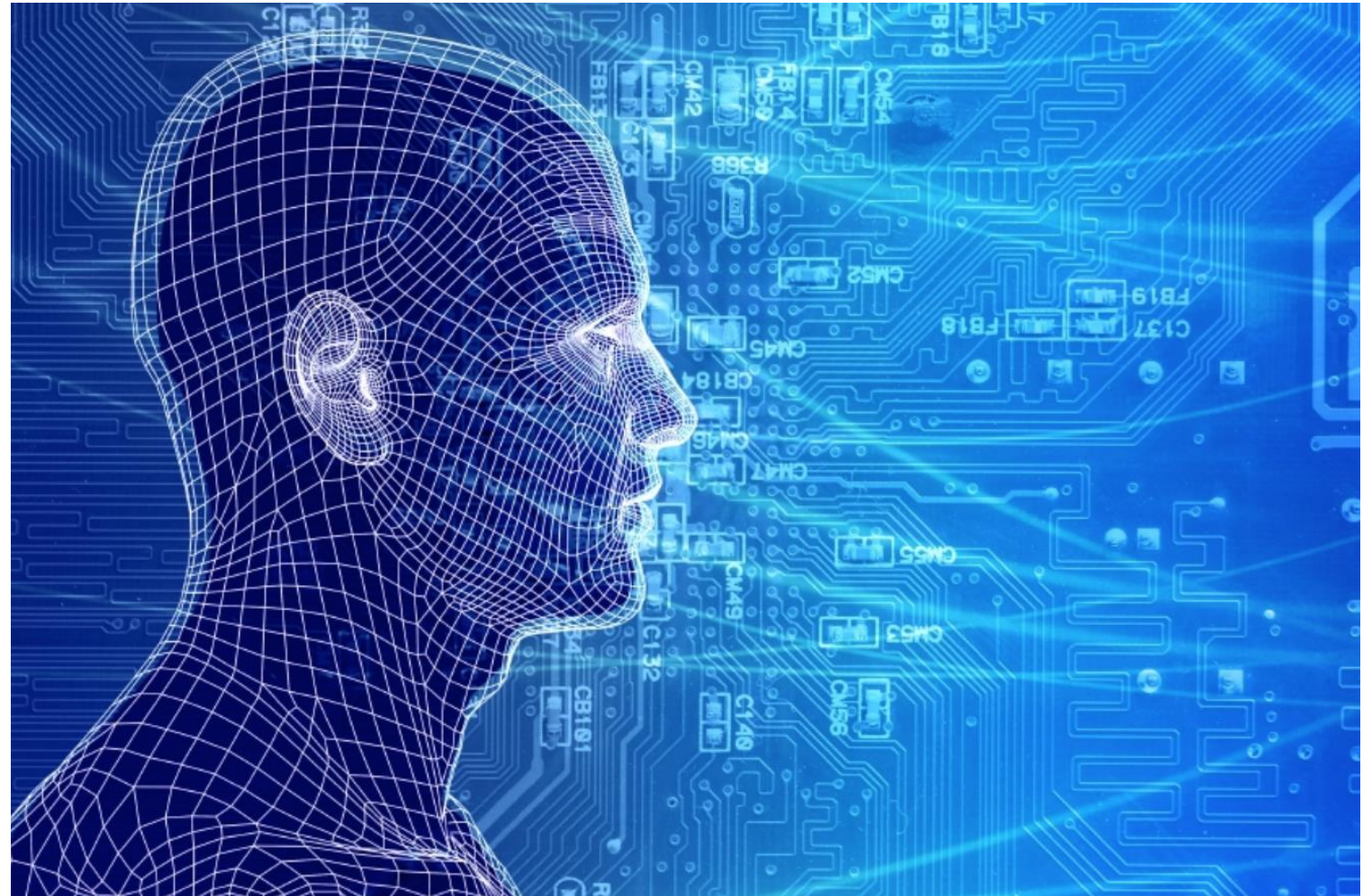
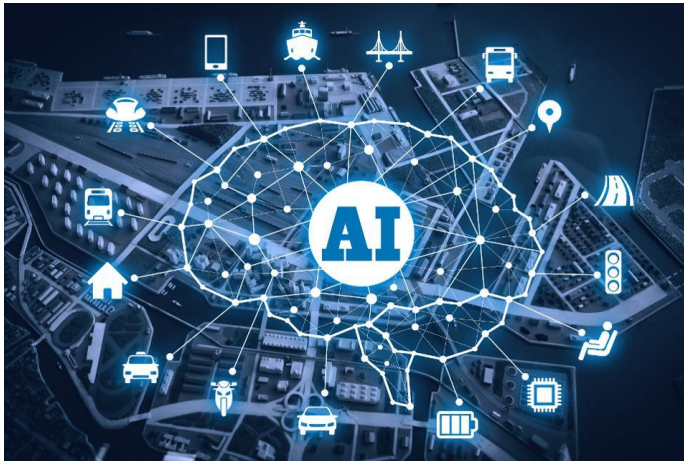


Origin: Network Challenges for Cyber Physical Systems with Tiny Wireless Devices: A Case Study on Reliable Pipeline Condition Monitoring; Salman Ali et al.

# In 2015 Sergey Brin has stated ... All GAFAs (Google, Apple, Facebook, Amazon) are betting on Artificial Intelligence

“We want Google to be the third half of your brain.”

Sergey Brin



If Marconi came back to life he would be amazed, Edison not so much

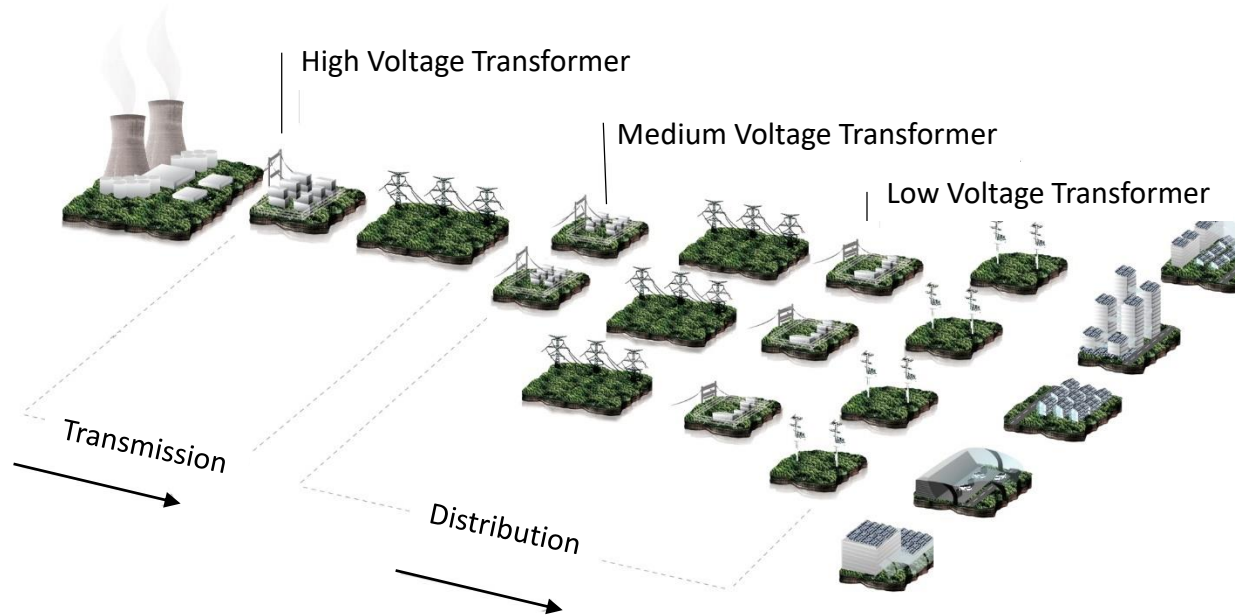


Guglielmo Marconi (1847, 1937)



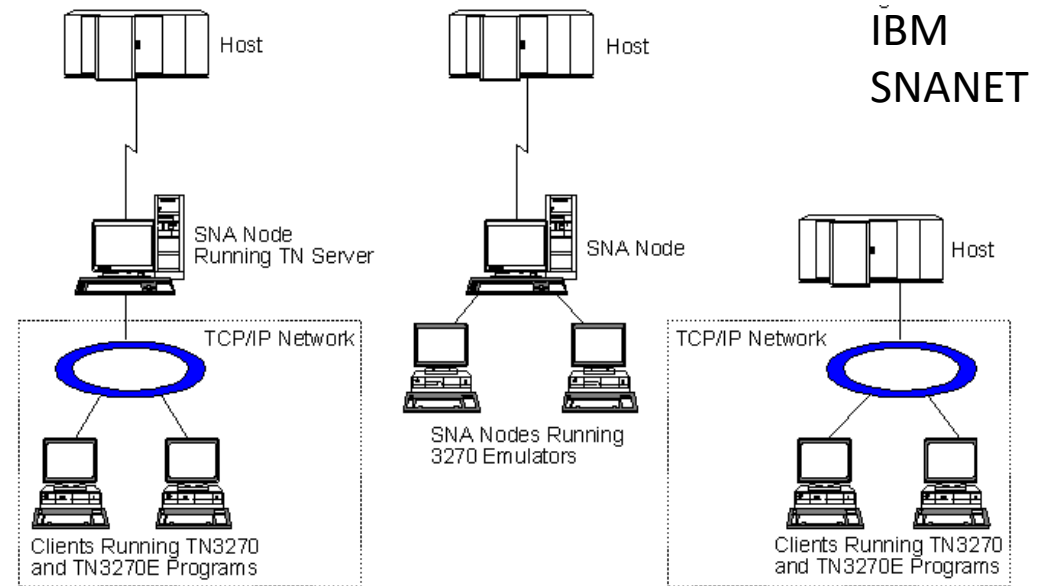
Thomas Edison (1874, 1931 )

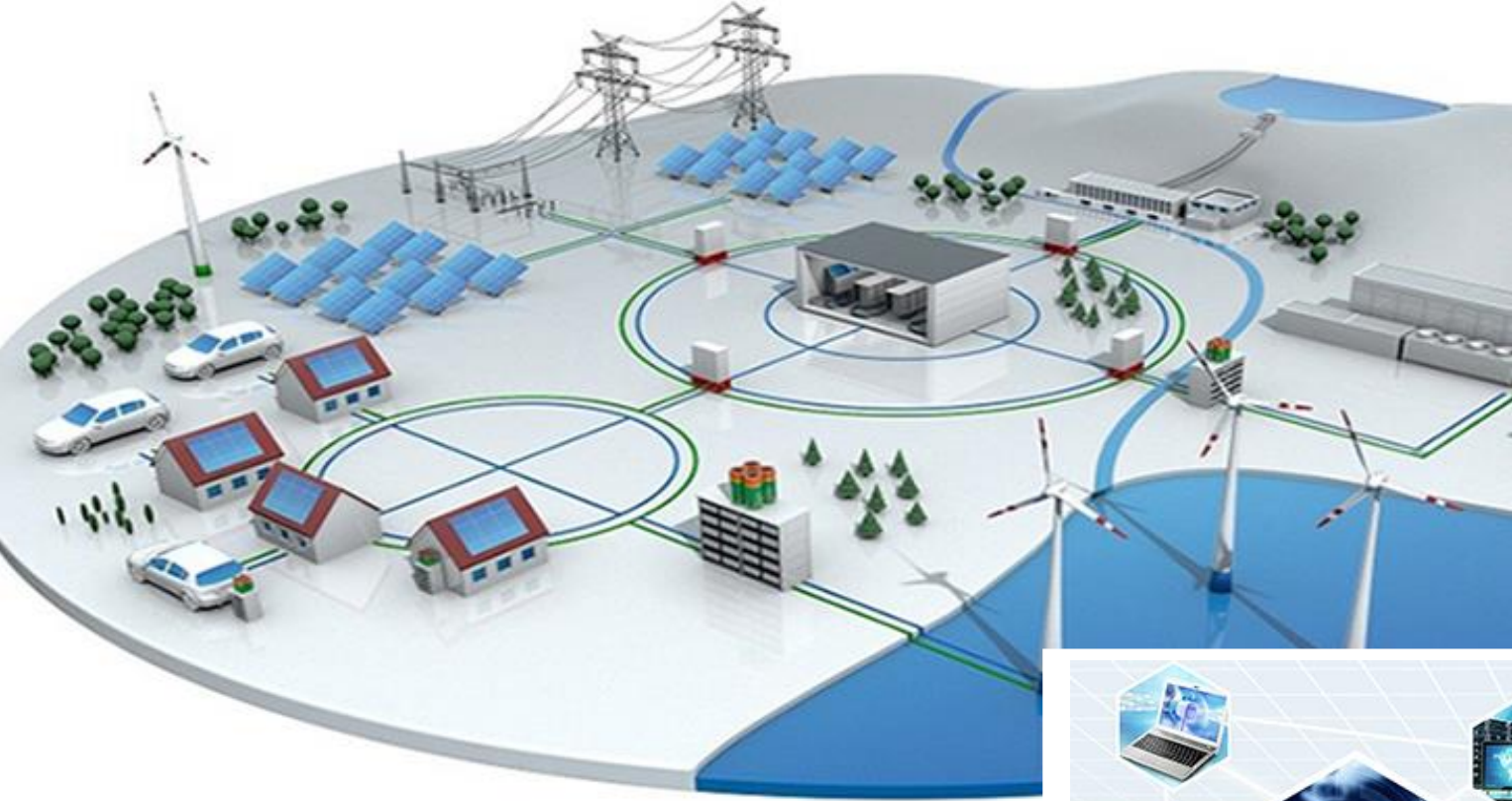




Very predictable,  
 high performance,  
 but not flexível,  
 difficult to innovate

Everything centrally  
 defined





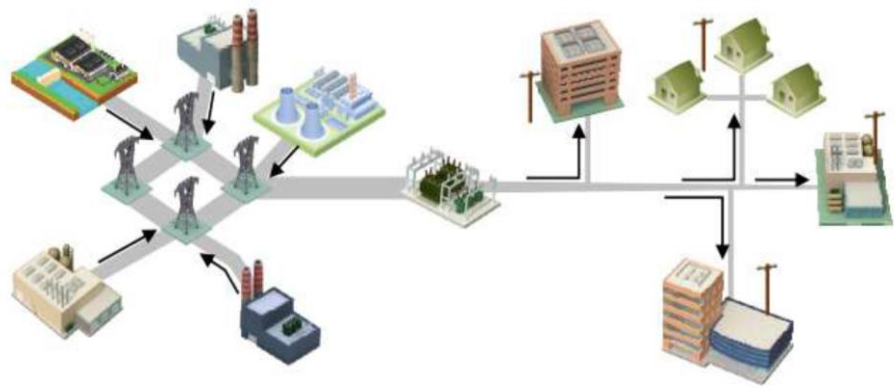
Less  
predictable  
but more  
flexible and  
resilient

Energy Web:  
“Plug and Play” and  
“Peer to Peer”



## Old Grid (Most Prevalent Model – Even Today)

One-way Flow, Central Generation & Management

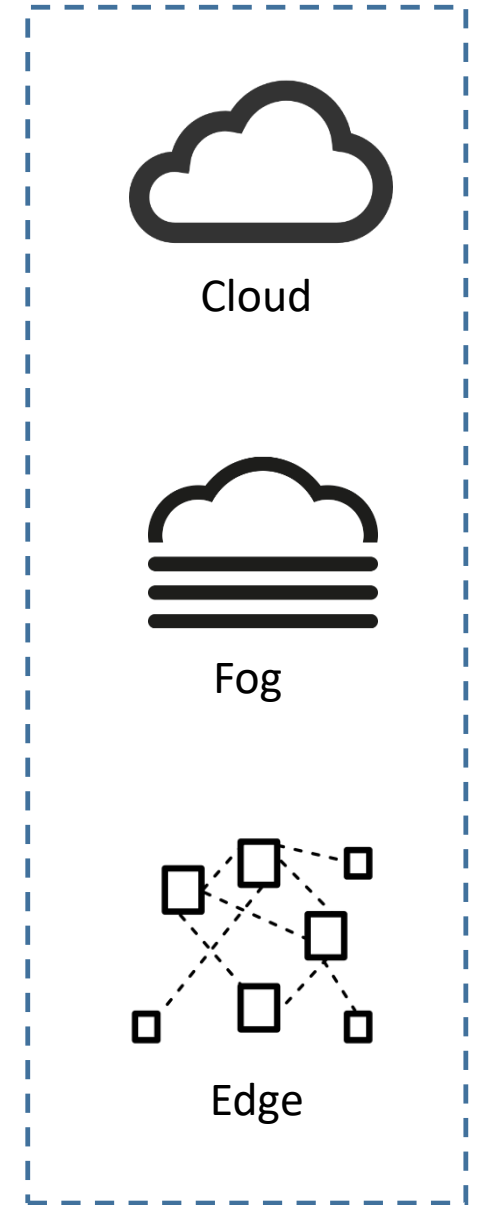
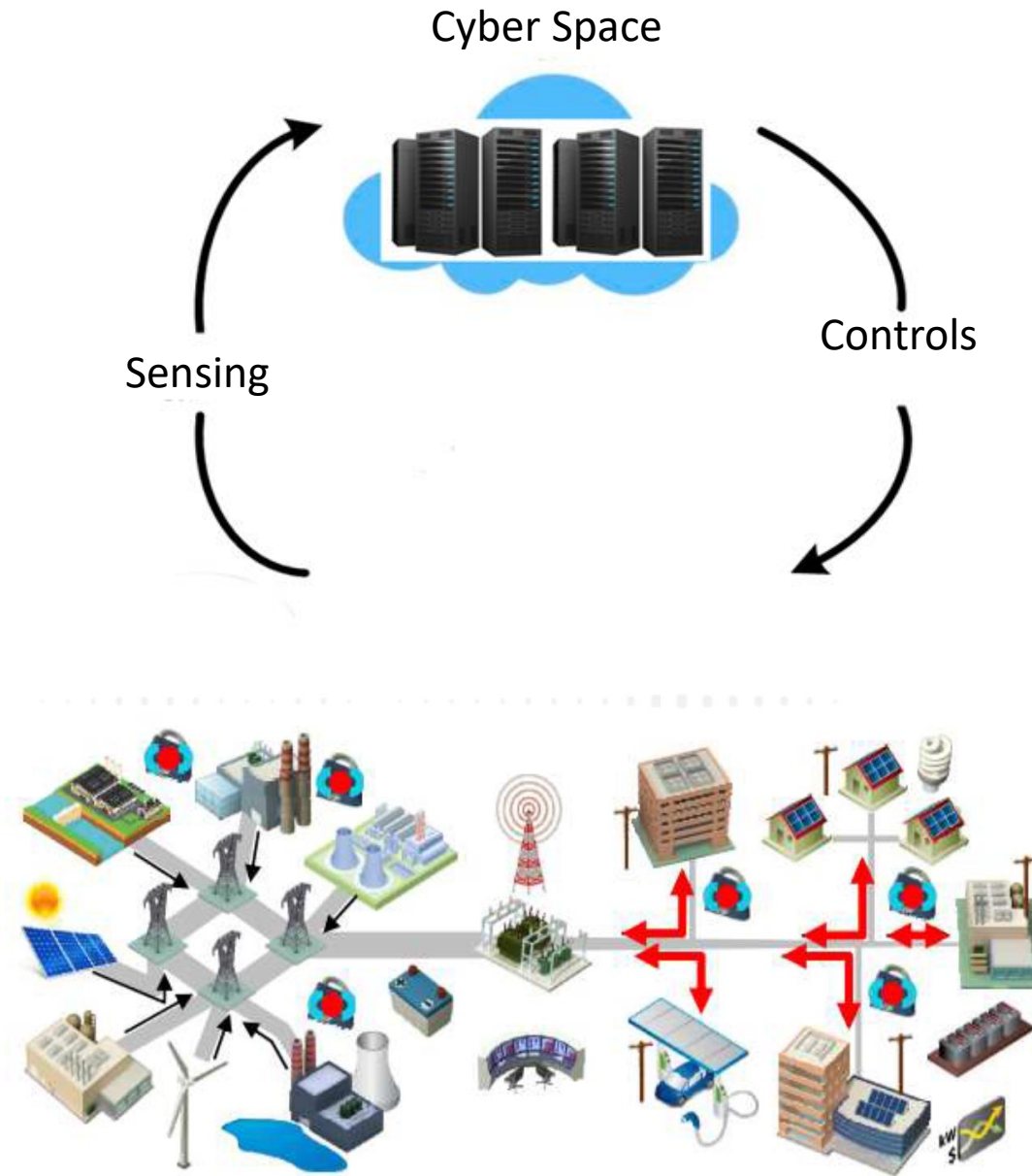


## 21<sup>st</sup> Century Grid – Modernized Infrastructure

Diverse Generation, Advanced Controls, Two-Way Flows...  
and Responsive Assets

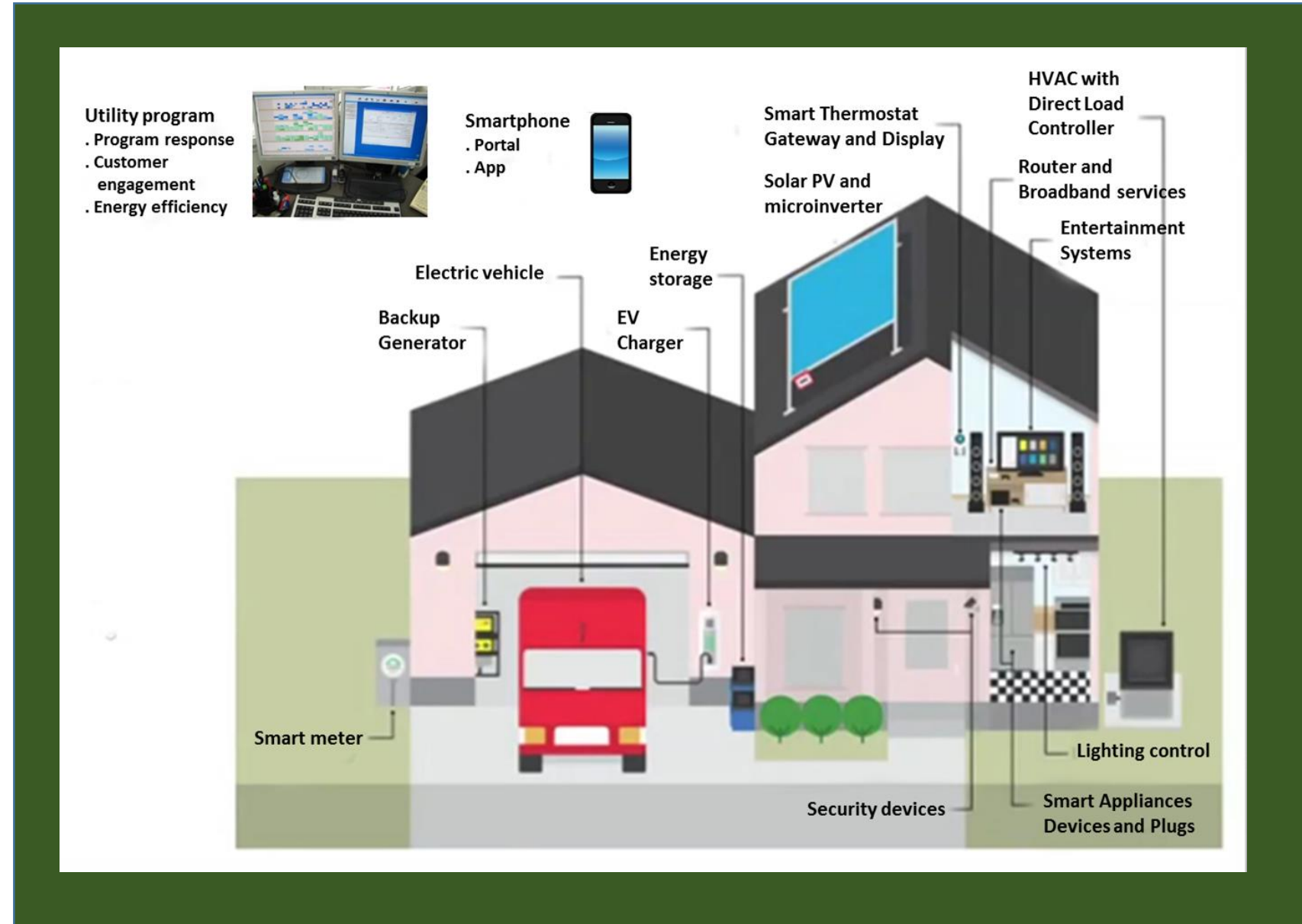


**Cyber-physical systems (CPS)** involving the seamless integration of computational algorithms and **physical** components will be one of the basis of Energy 4.0 as it is for Industry 4.0.












# IoT is becoming part of our lives ...

- **New Rate Structures to drive behaviour**
- **Responsive demand**
- **The Internet of Things based on embedded computing power in devices**



...but requires solutions not available in the market, which lead EDP to develop their own package. HW and SW were made by Portuguese SMEs

### What makes up re:dy?

	<b>re:dy platform</b>	The platform that discovers how to make you feel good at home. Website and app available, with real time info	
	<b>re:dy box</b>	Core of the product, the brain that understands when you should charge your EV, when to consume from your batteries or directly from your solar PV	
	<b>re:dy plug</b>	Allows appliance control and monitoring plus production injection to the grid	
	<b>re:dy meter</b>	Can replace your smart meter if you don't have one or control up to two circuits	
	<b>re:dy switch</b>	Simple device, turns on/off single circuits in your home (boilers, lighting, pool pumps)	
	<b>re:dy modem</b>	The way to communicate with several distant devices, such as solar inverters and battery controllers	
	<b>re:dy IV plug</b>	A re:dy plug that also controls your A/C system	
	<b>IFTTT recipes</b>	Create simple interactions between apps and the devices connected to the re:dy box	H2 2016
	<b>re:dy safe</b>	Security add-on to be managed by the re:dy box	2017

In development

Expected release

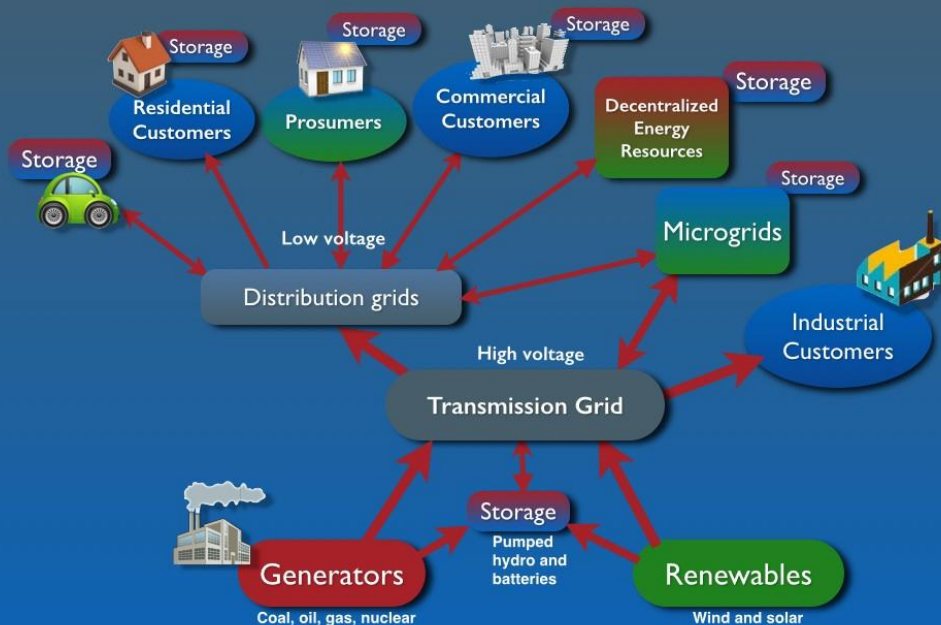
We are beginning to share a vision of what the "Smart Home" is going to look like.



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## Transactive Energy

The term "transactive energy" is used here to refer to techniques for managing the generation, consumption or flow of electric power within an electric power system through the use of economic or market based constructs while considering grid reliability constraints. The term "transactive" comes from considering that decisions are made based on a value.



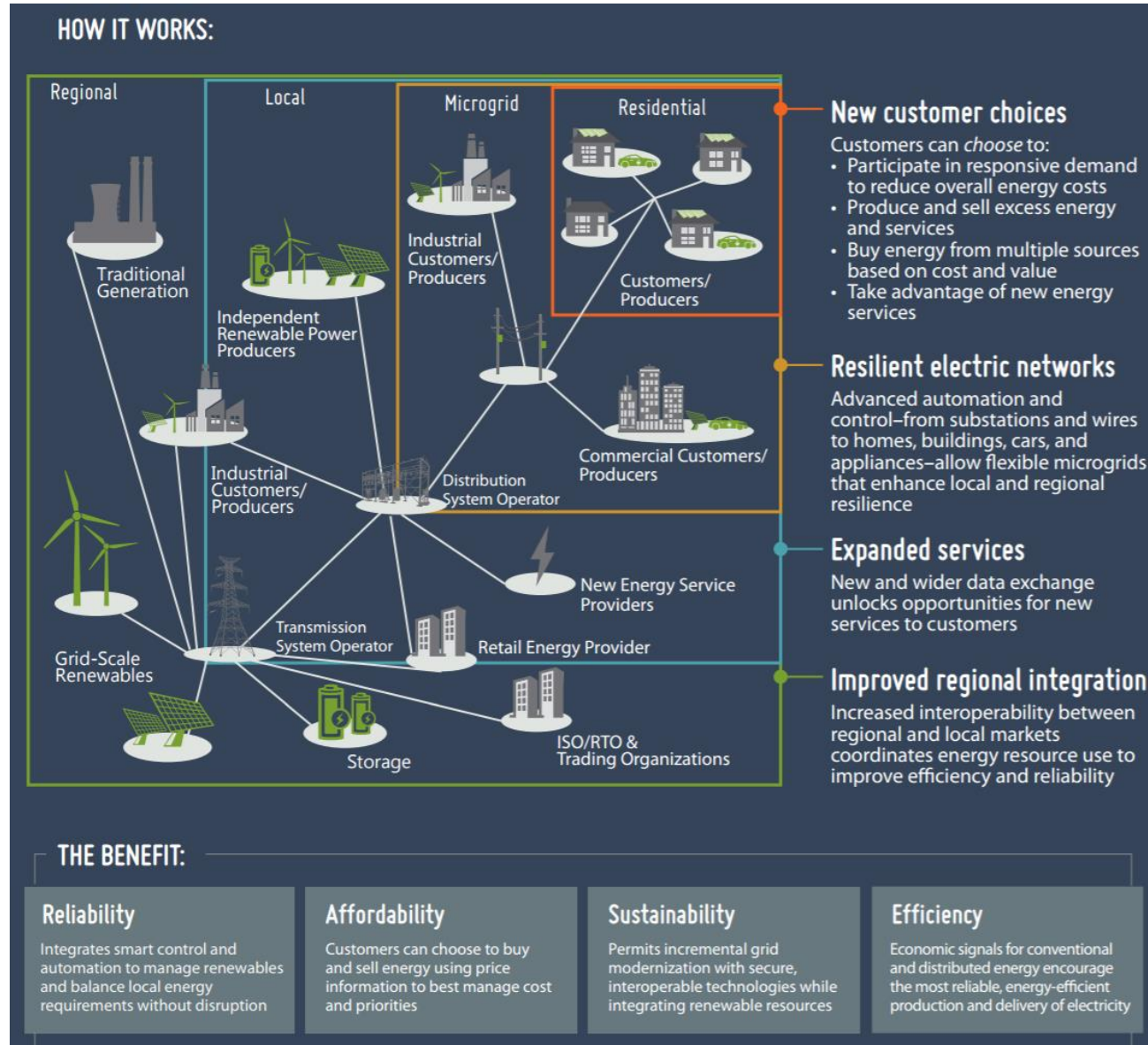
# Transactive Energy

A Sustainable Business and Regulatory Model for Electricity

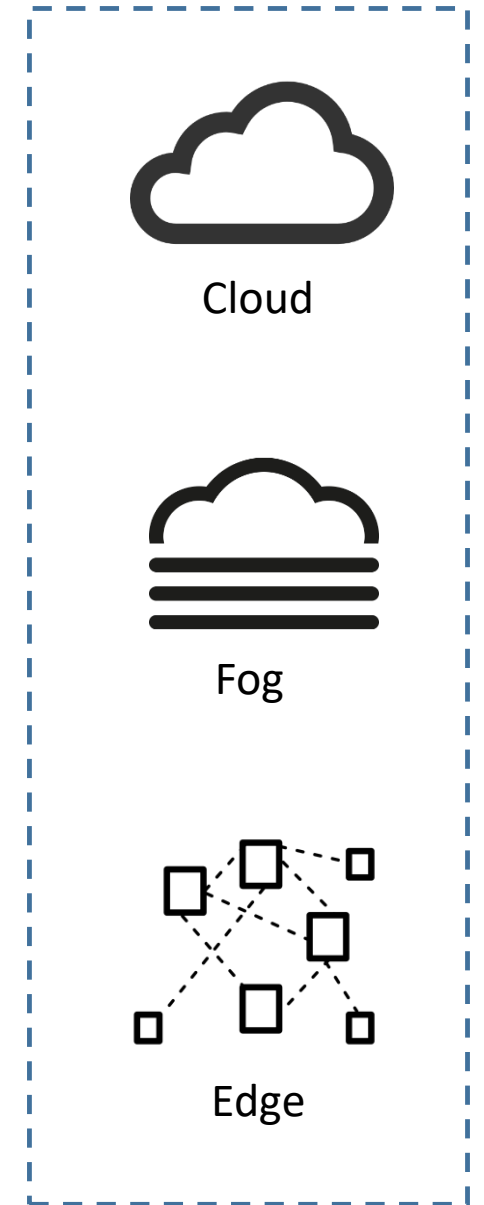
Stephen Barrager, Ph.D.  
Edward Cazalet, Ph.D.

BAKER STREET PUBLISHING

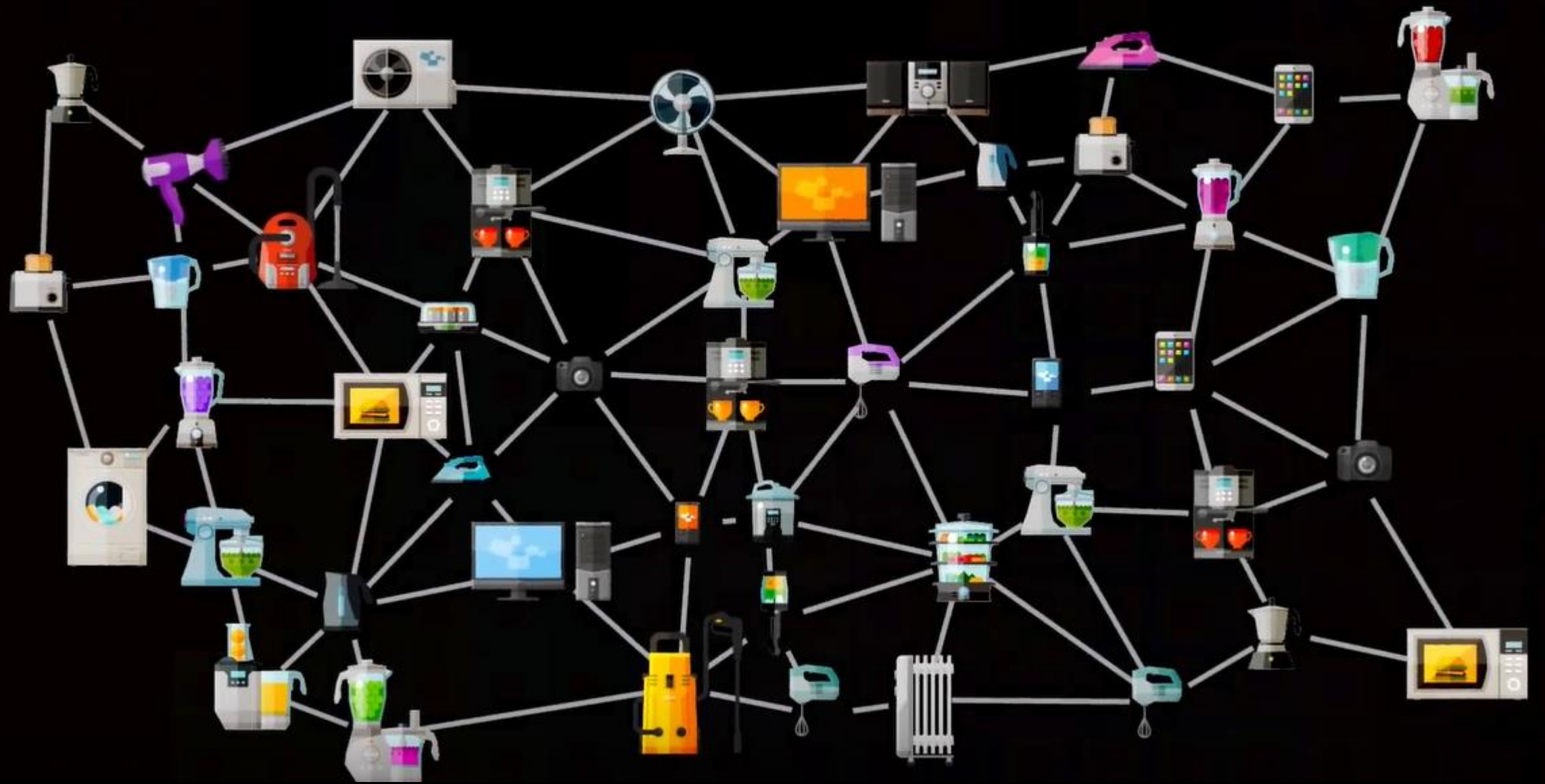
It will operate on an Hierarchy, with devices taking their own decision and being accountable for them and blockchain may be the solution



Source: GridWise







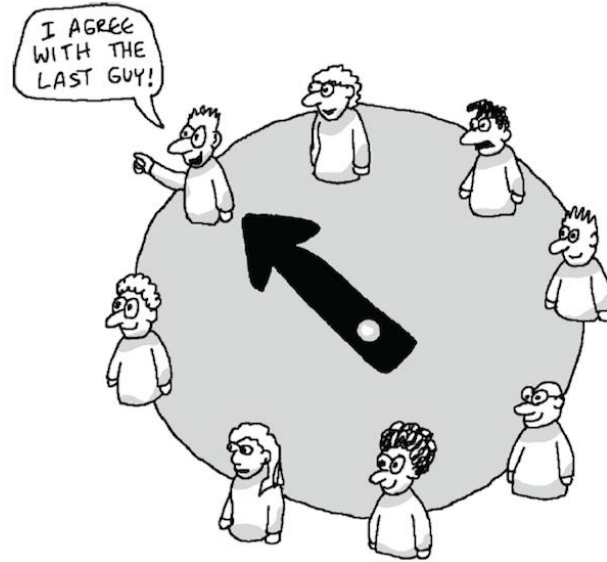
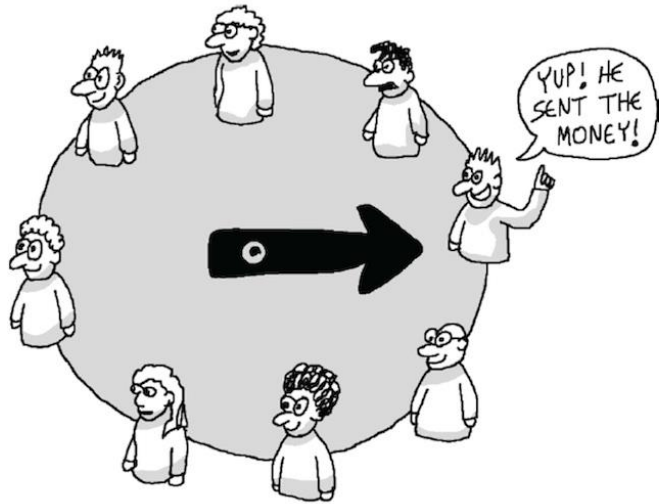
“A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another **without going through a financial institution.**”

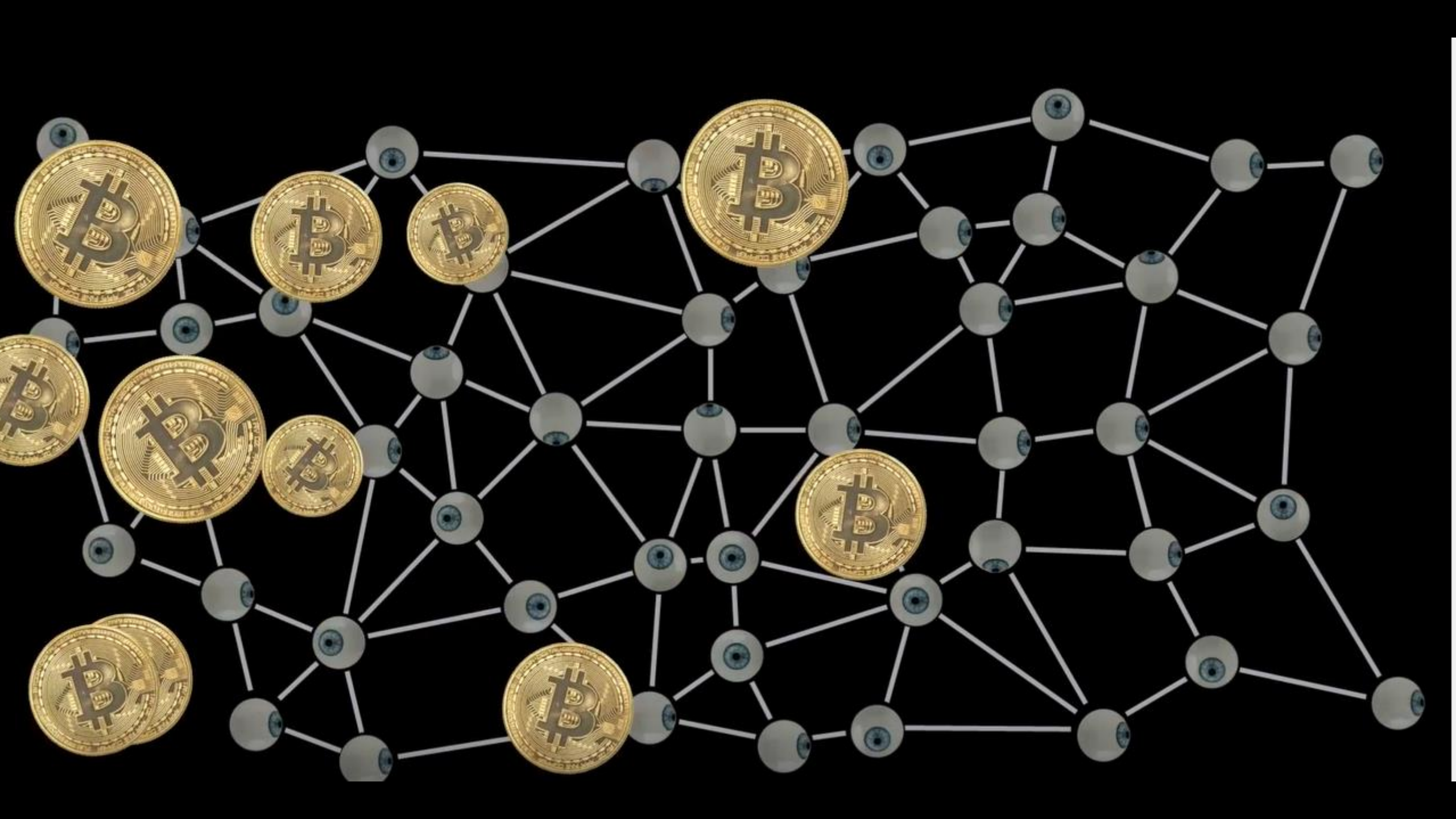
Paper published in the Fall of 2008 after Lehman Brothers demise, Satoshi Nakamoto published a paper

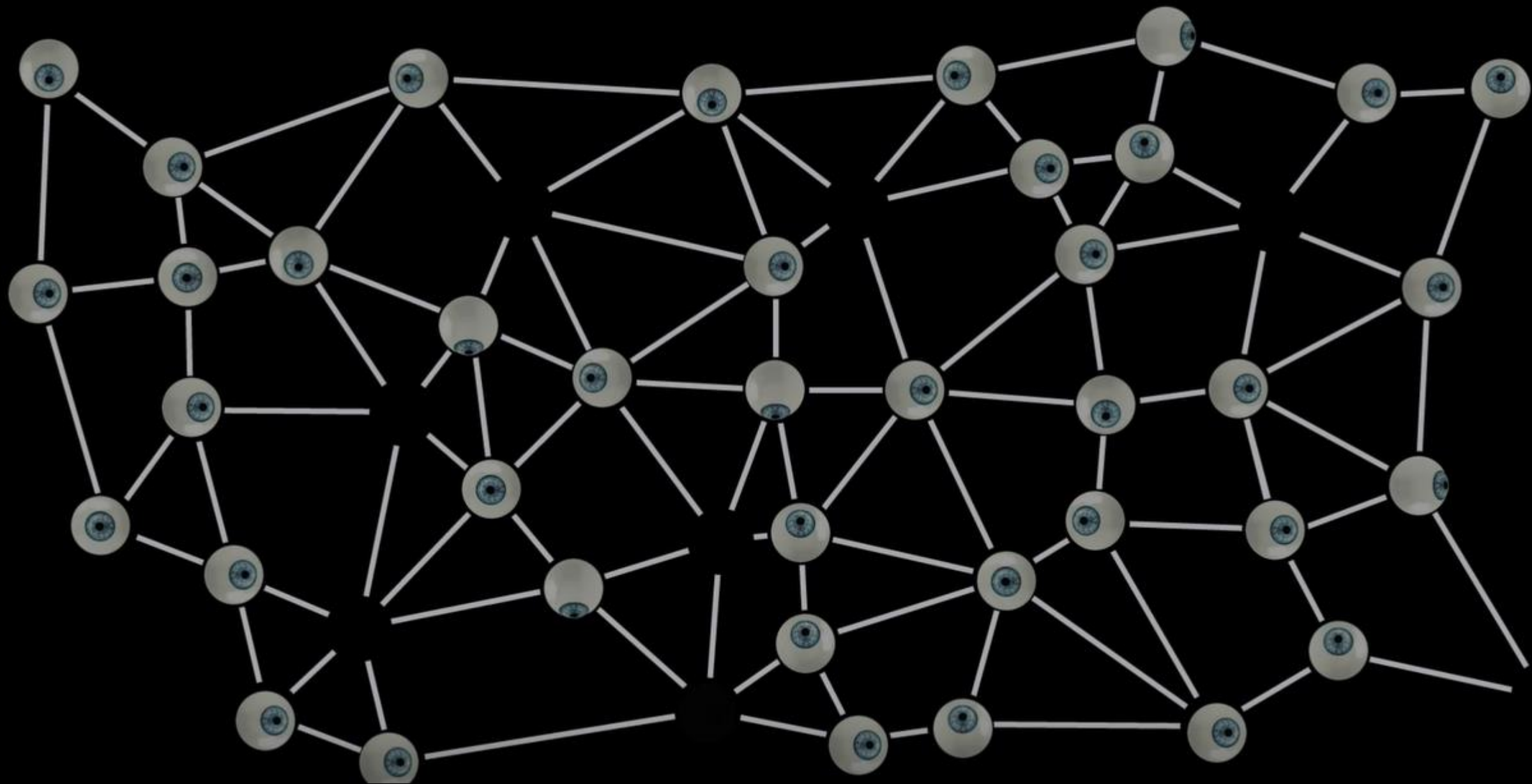
### **Bitcoin: A Peer-to-Peer Electronic Cash System**

Satoshi Nakamoto  
satoshin@gmx.com  
www.bitcoin.org

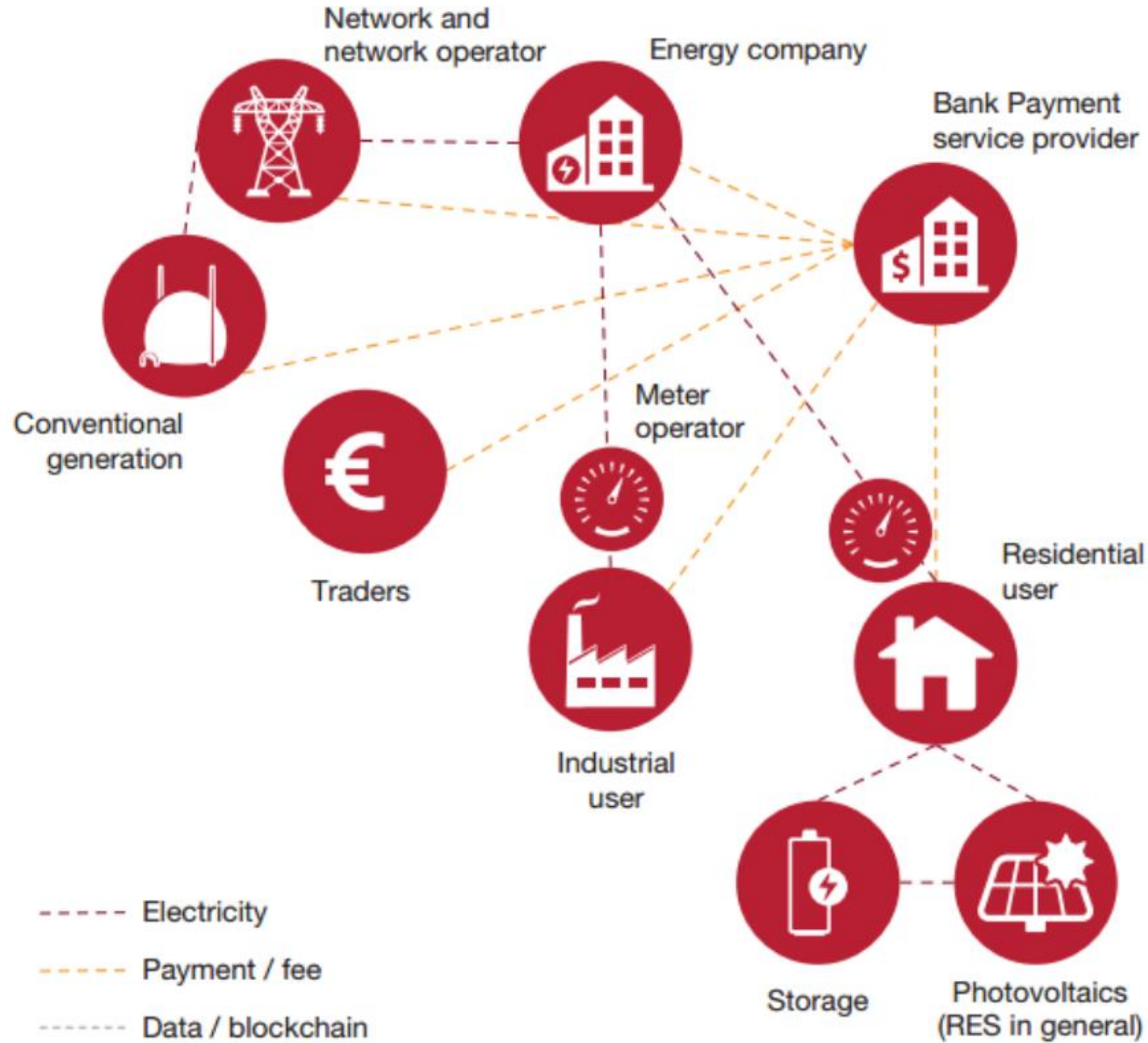
**Abstract.** A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone.



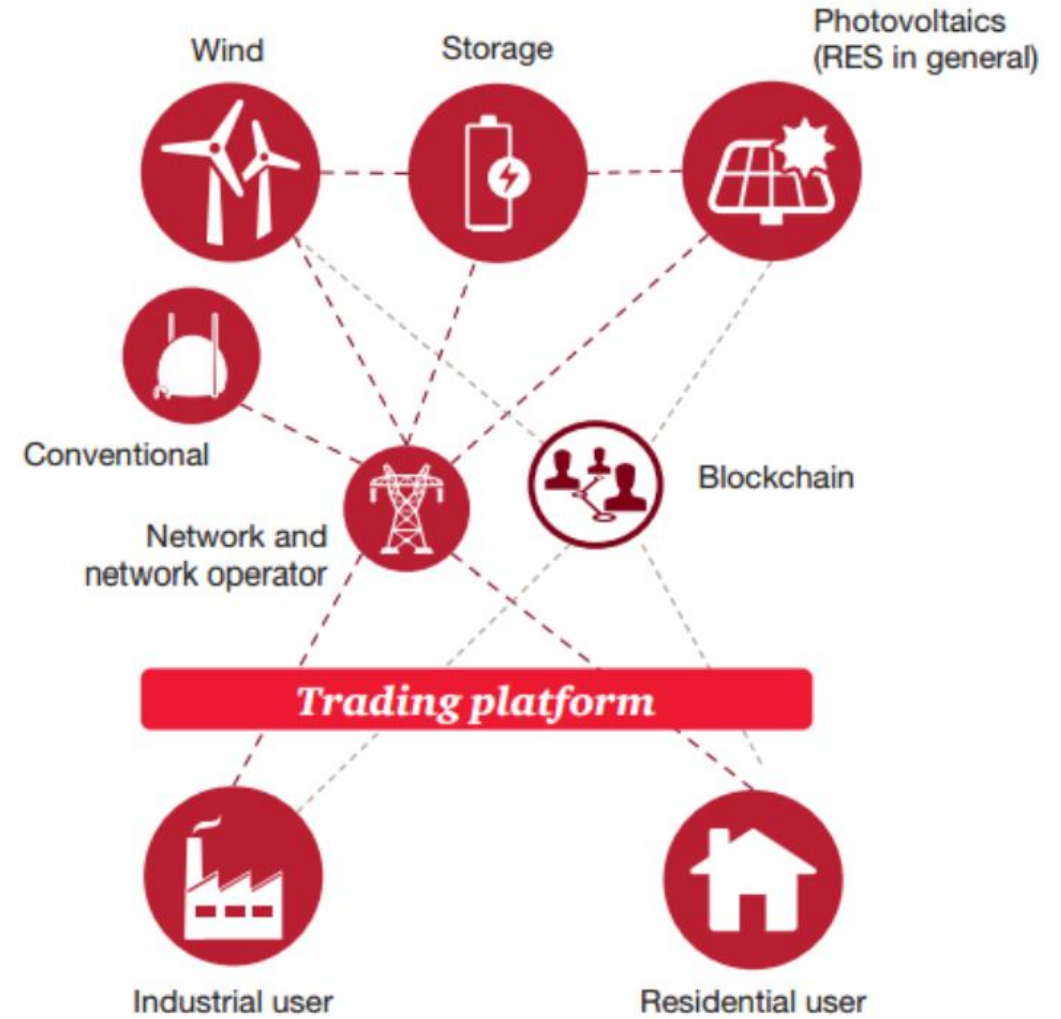




## Traditional processes



## Processes in a blockchain-based system



## Moore's Law still at work (since 1965)

ASCI Red – the World fastest computer from 1997 to 2000



Computing Power: 1.0 teraflops / Cost: 55 million US\$

ASCI Red was housed in 104 cabinets, taking up 2,500 square feet (230 square meters).

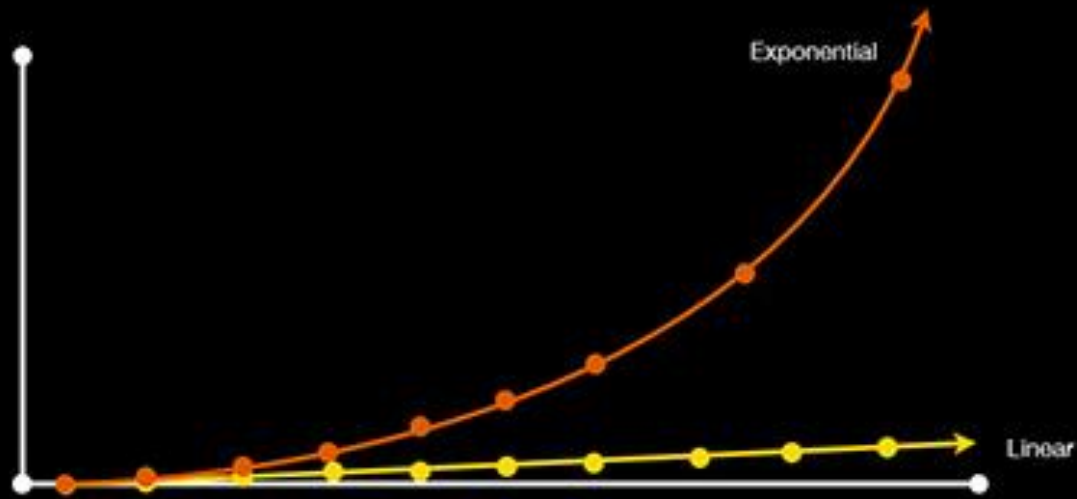


Computing Power: 1.8 teraflops /  
Cost: 327 US\$

Fits bellow the TV set

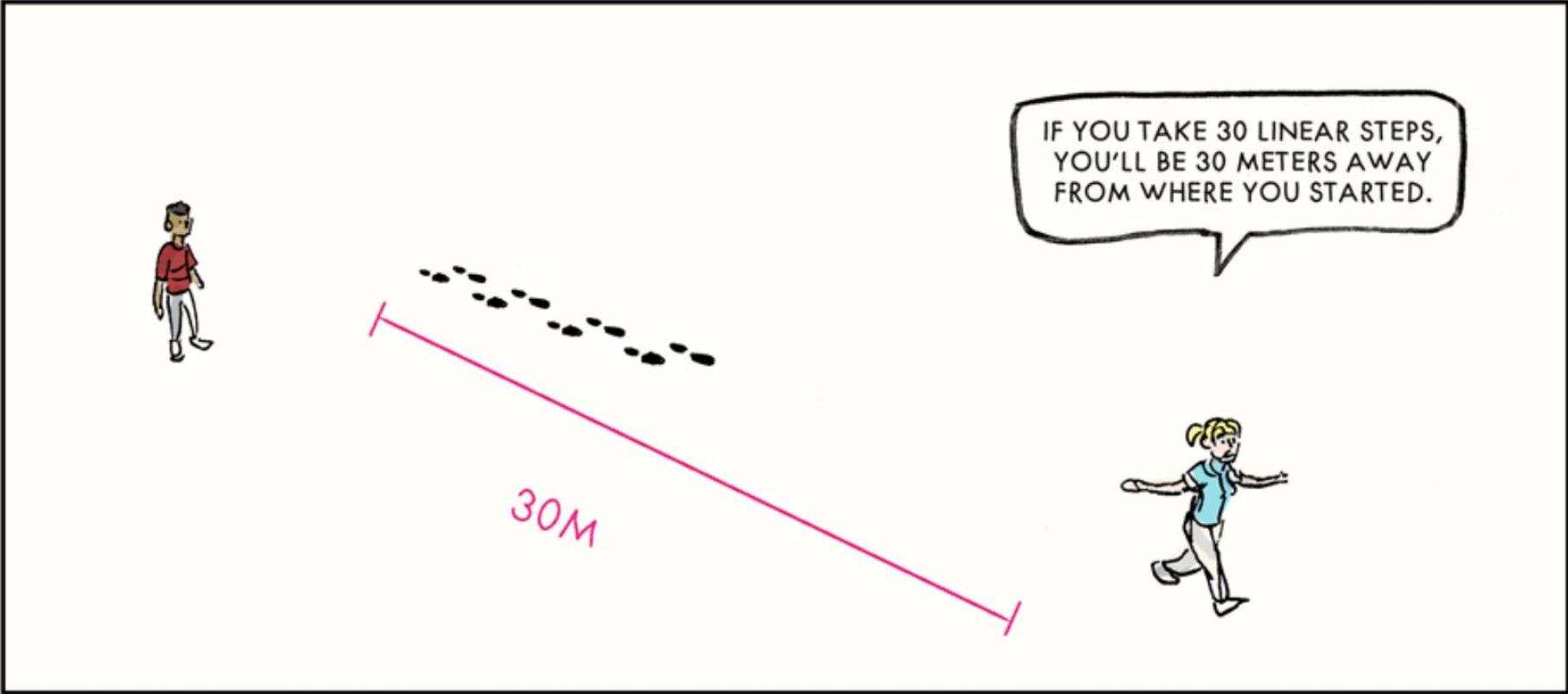
**Our blind spot comes from the fact  
that we have lived in a linear world.**

**But today's changes are exponential.**

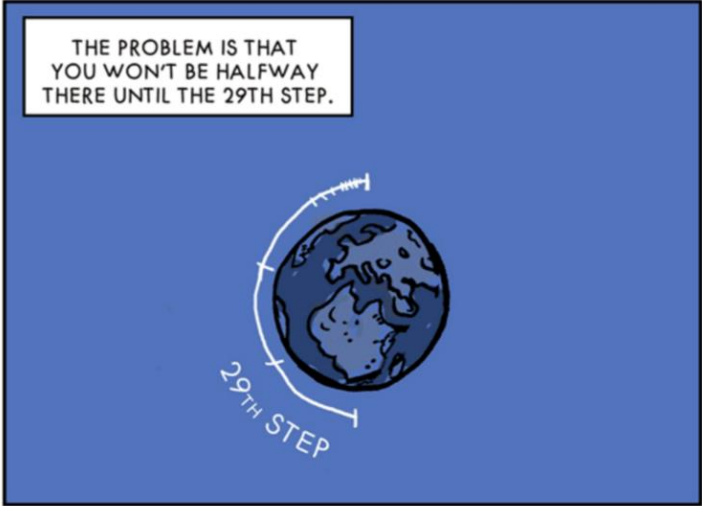
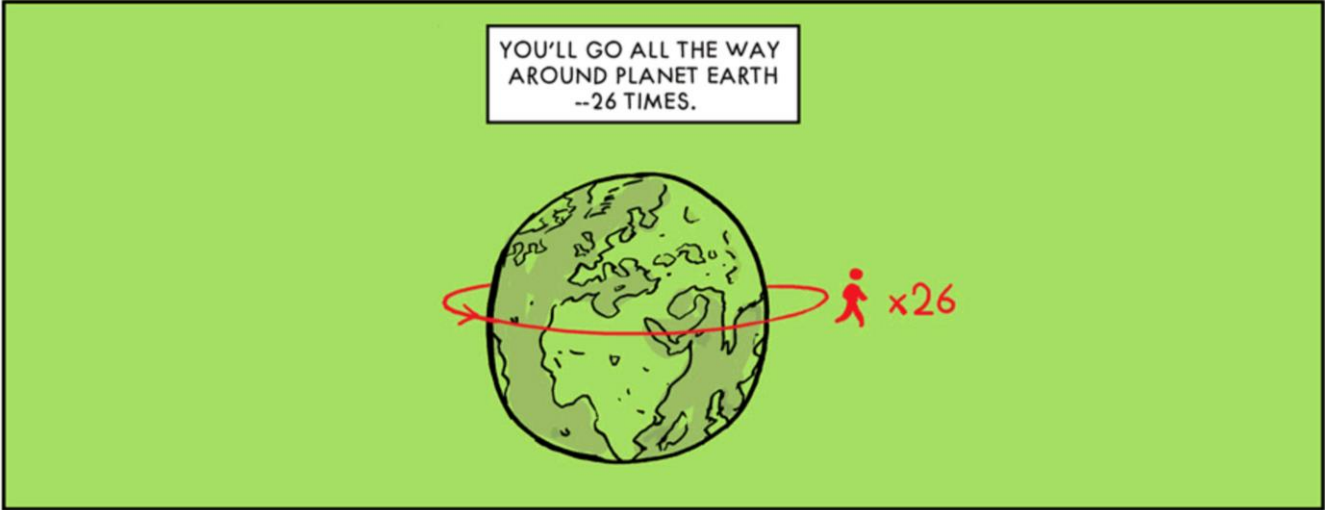




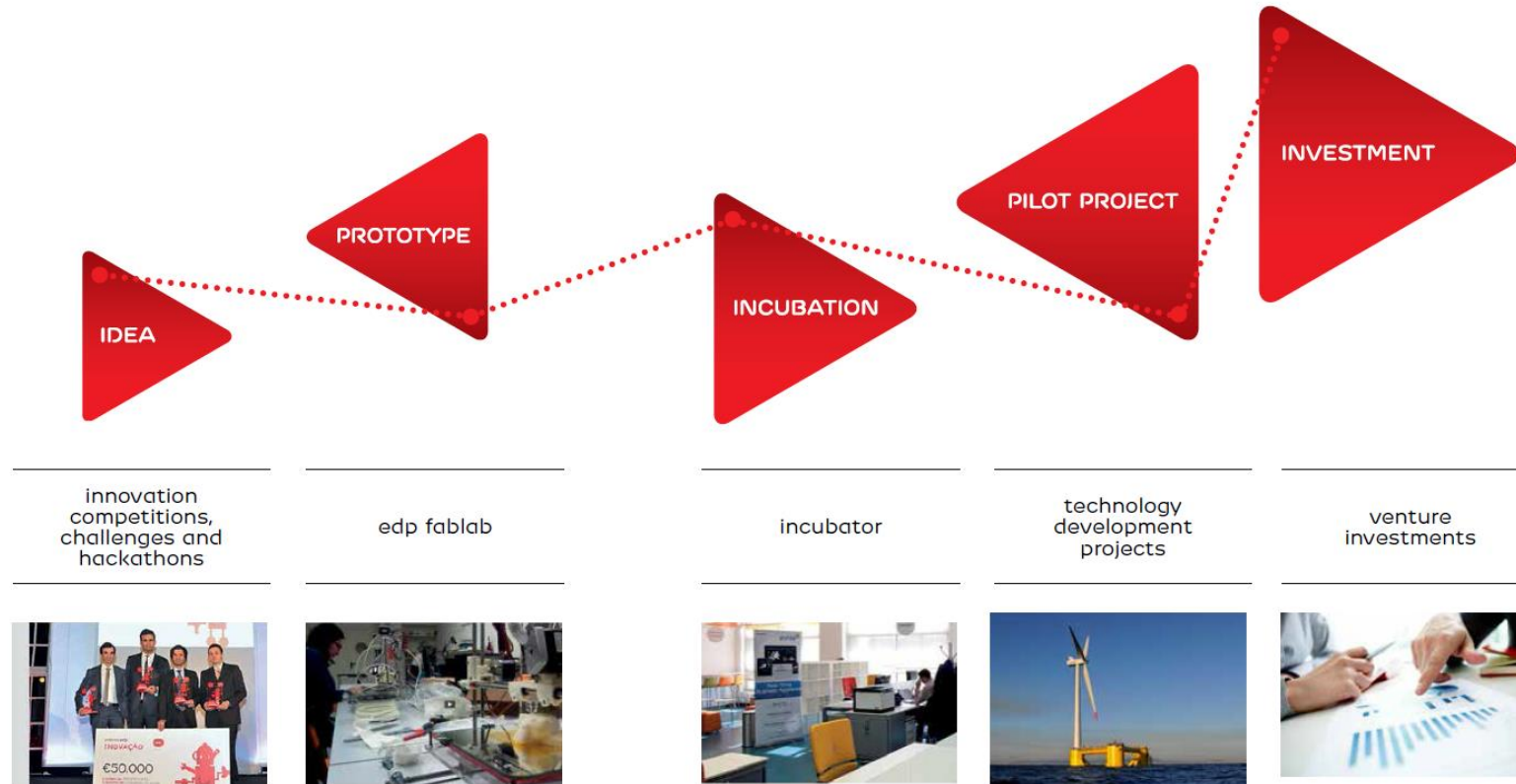
To grasp where things are going we will have to learn to think exponentially and it has never been easy



To grasp where things are going we will have to learn to think exponentially and it has never been easy



# EDP Innovation is now a one-stop shop for innovation, being able to cater disruptive ideas all the way to the stage of investment



**40 M€**

2016 Revenues from incubated and invested startups

**+550**

Projects Evaluated\*

**30**

Startups incubated

**12**

Investments

**+300**

Jobs created by incubated and invested startups



**HOW ABOUT SOME FACTS ABOUT US?**

\*Between awards, incubation, investment sourcing and including a deeper evaluation from technical areas



# Calling all energy startups!

Join the world's first global energy startup accelerator backed by major utility companies

Apply at [www.freeelectrons.co](http://www.freeelectrons.co)

Silicon Valley • Lisbon and Dublin • Singapore



هيئة كهرباء ومياه دبي  
Dubai Electricity & Water Authority

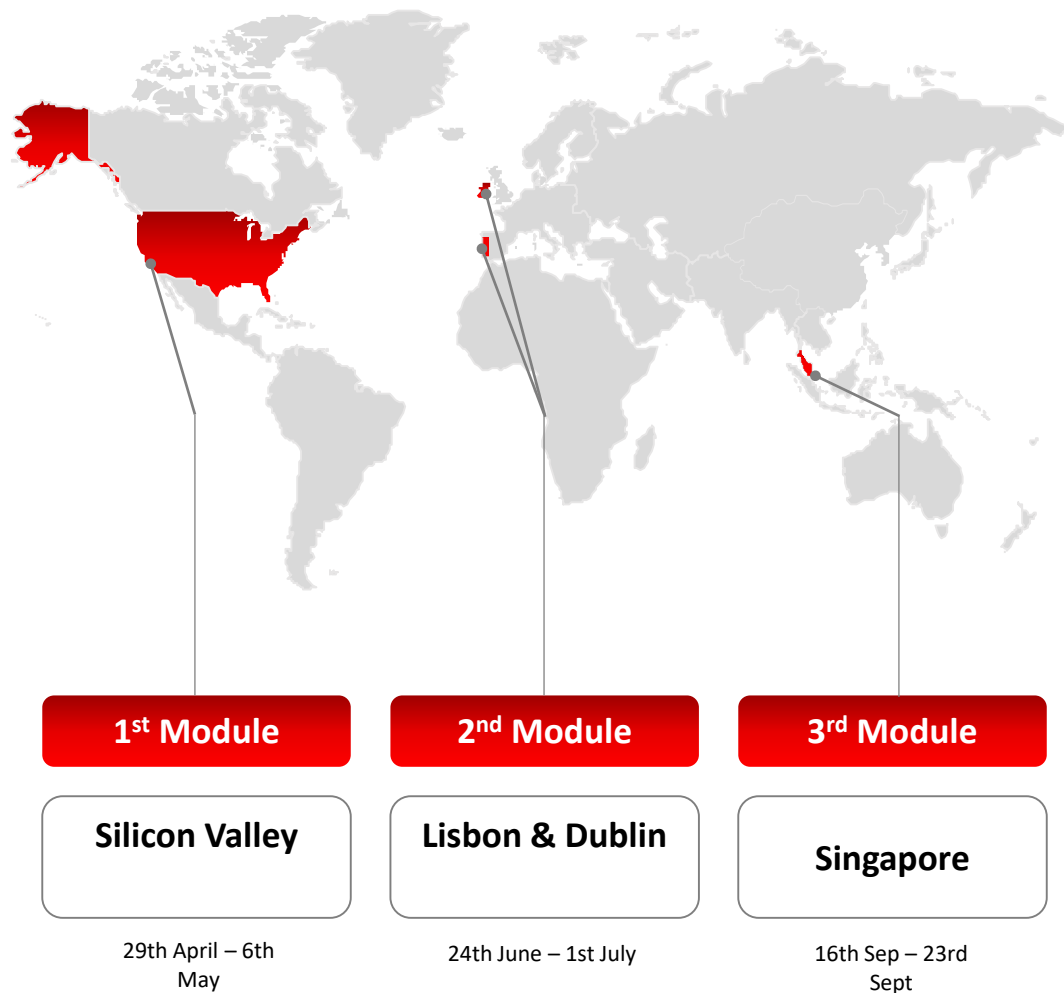


NEW ENERGY  
NEXUS

SWISSNEX  
san francisco



# Free Electrons aims is to become the reference in utility business accelerator programs



## Goals

- Access top quality tech/startups in the energy sector
- Accelerate innovation adoption in EDP and other utilities by promoting the search for innovative technologies within all business units
- Establish long term cooperation with the program utilities
- Follow-up on business opportunities and investment

## Description

- Applications closed on 28<sup>th</sup> Feb (304 applications in with two weeks remaining)
- Involves the 12 best startups that apply
- Each utility contributes with 200K\$ (8 utilities, 3 accelerators) with balanced roles in the governance of the accelerator
- 3 acceleration modules – Silicon Valley, Lisbon/Dublin and Singapore over the course of 6 months
- Focus on the interaction between startups and utilities to generate tech pilots and investments
- Best startup gets a substantial prize money (max. 250k\$)



**Thank You!**