The European Commission's science and knowledge service

Joint Research Centre

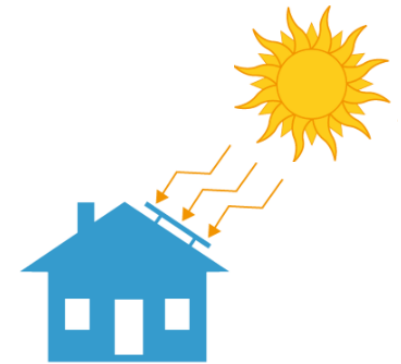# Energy distribution using a Blockchain

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Agenda

- Joint Research Centre

- Motivation

- Laboratory setup

- Ethereum Smart Contract

- Coloured Coins
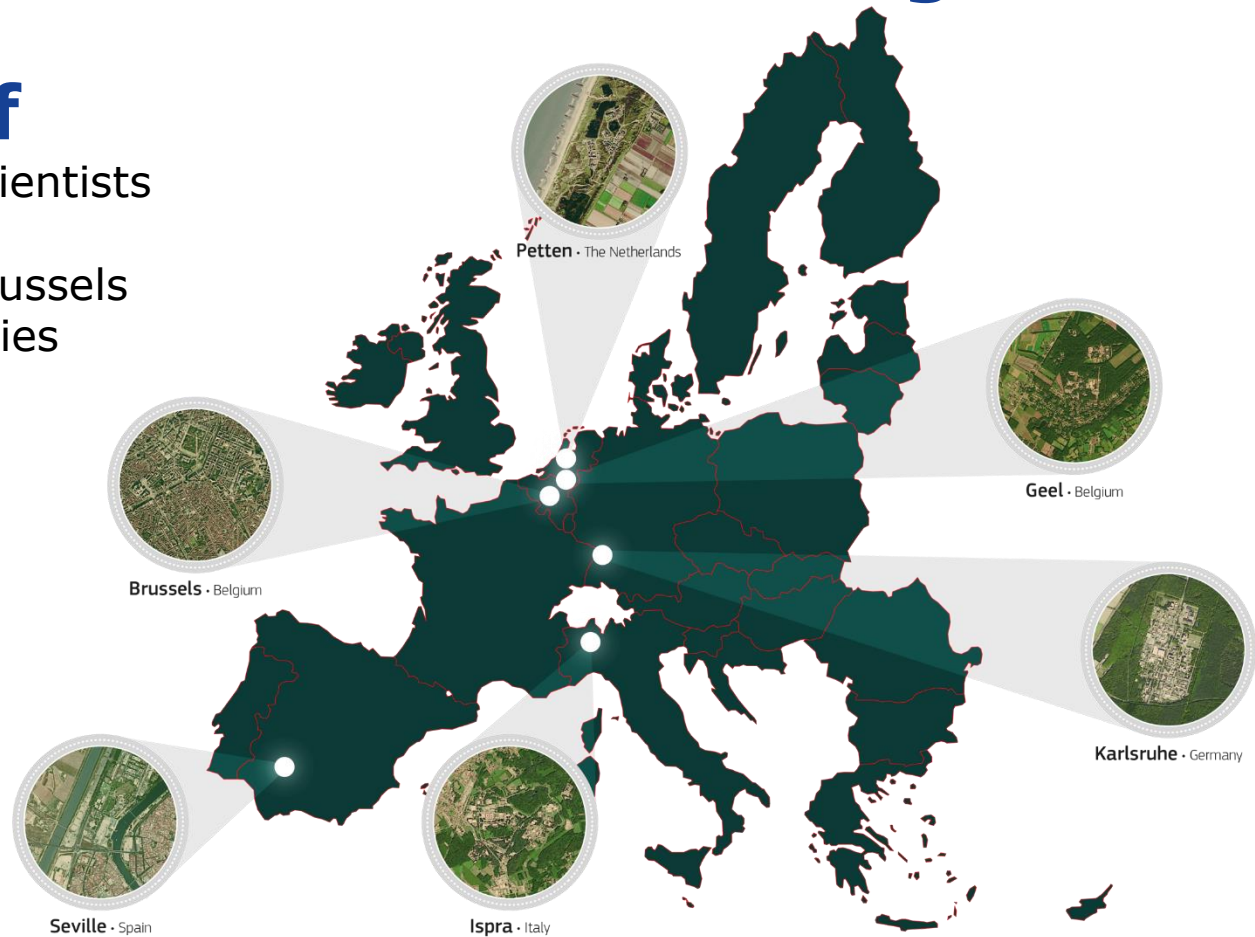
- Cryptocurrency

- Conclusions

The Joint Research Centre at a glance

3000 staff

Almost 75% are scientists and researchers.
Headquarters in Brussels and research facilities located in
5 Member States.

Petten · The Netherlands

Geel · Belgium

Brussels · Belgium

Karlsruhe · Germany

Seville · Spain

Ispra · Italy

Joint
Research
Centre

Open up the Micro-Generation Market

Scenario & Motivation

- Europe is investing a lot of efforts in encouraging micro-generation

- The present business schemes however, put the end-users in a passive role making to them the investment for micro-generation not appealing

- Need for new paradigms allowing to incentive the engagement of end-users in the energy generation market

JRC started recently a study on the exploitation of distributed ledgers for micro-generation to:

- Create a genuine neighborhood energy market

- Diminish the energy-generation fees making the in-house generation economically appealing

- Enable new digital services

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Test Bed

3 Solar Panels (130W)

3 Batteries (12V, 300AH)
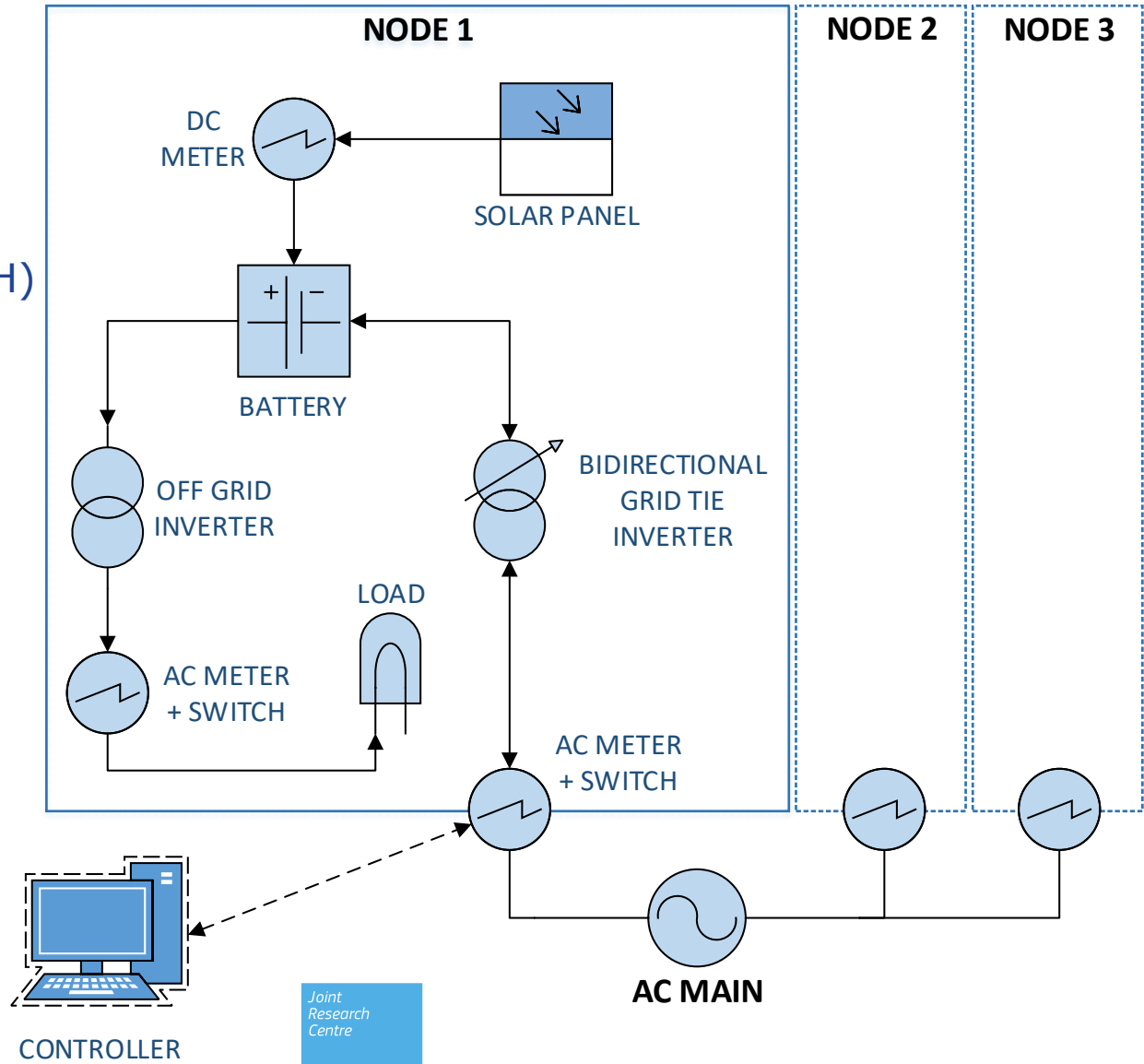
Inverters

AC/DC Switches
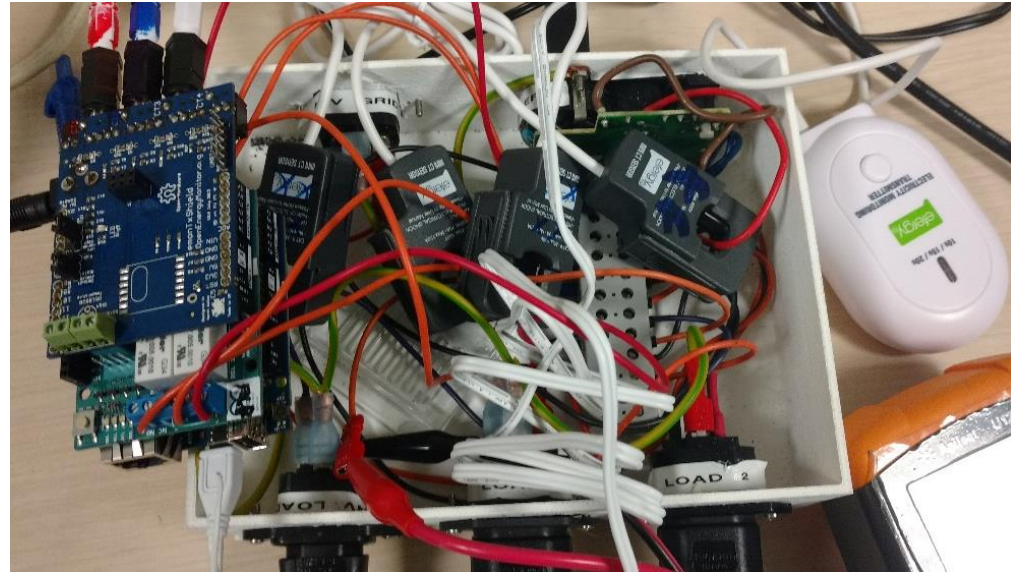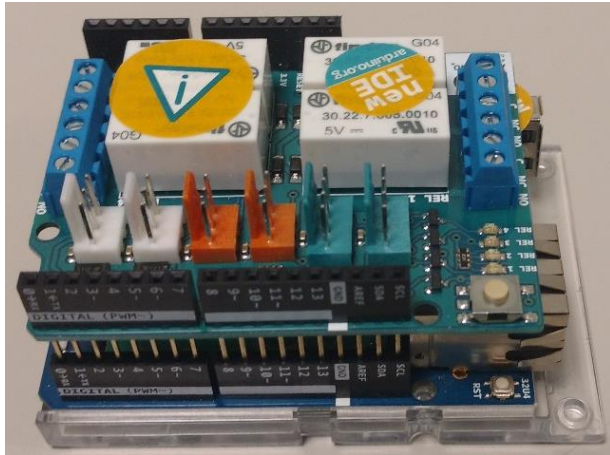
AC/DC Meters

Emon Shield Board

Arduino Yun Board
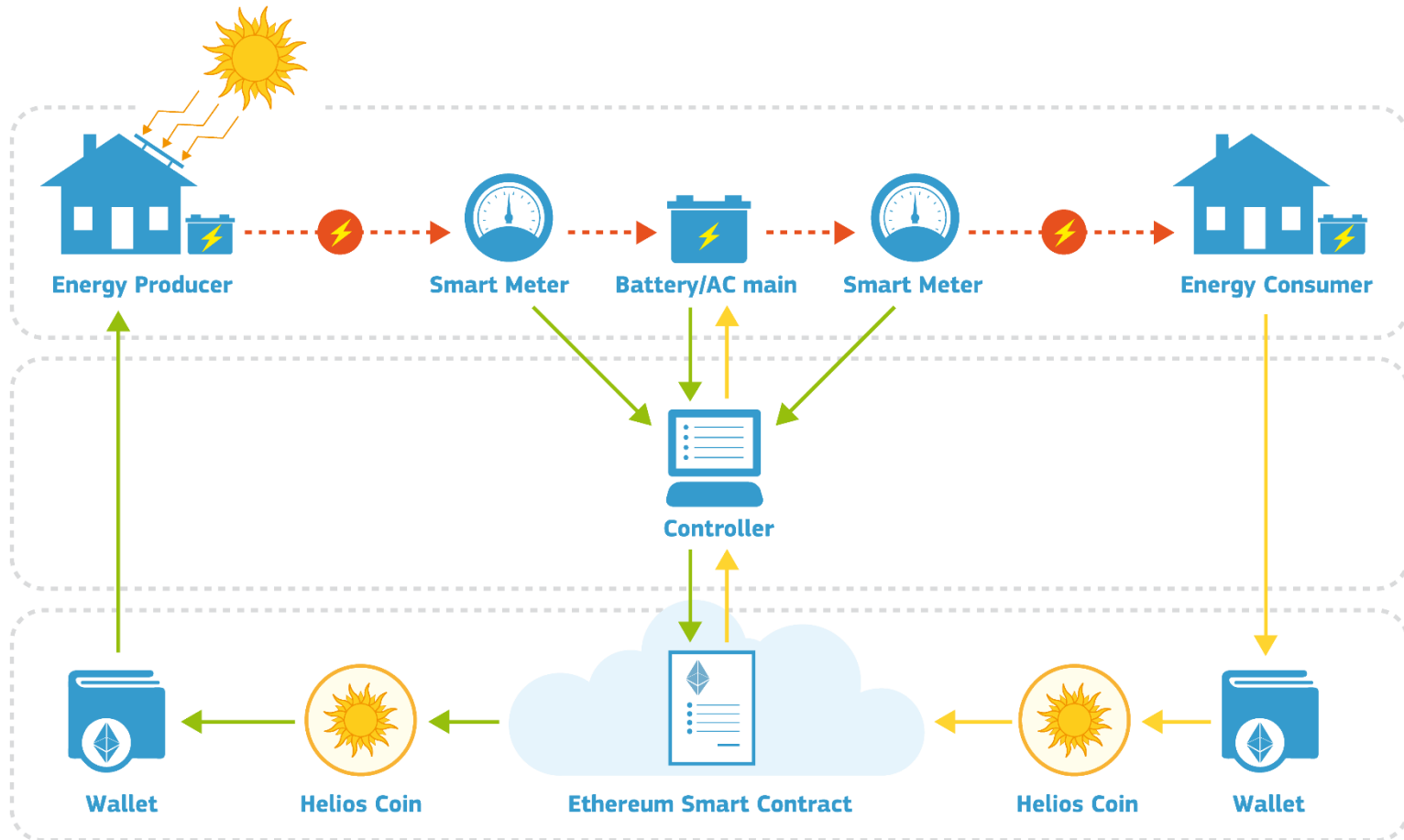
Test Bed

Ethereum Smart Contract

Ethereum Smart Contract

Smart Contract Functions (Solidity)
- Mint function
- Transfer function
  - Total Supply, Account balance
  - Symbol, Name, Decimals

Controller Functions (Web3 JavaScript Đapp API)
- Read smart meter (Arduino)
- Send signal to release power (Arduino)
- Call mint function (Smart contract)
- Watch events for incoming transactions (Smart contract)

Coloured Coins

Two well-known implementations
- Open Assets Protocol
- Colored-Coins

Metadata protocol on top of Bitcoin

Enables the creation of digital assets on top of the bitcoin Blockchain

Energy use case - same logical concept with Ethereum's smart contract

Cryptocurrency

Energy Creation acts as Proof of Work
- Coins generated and given to the energy producers
- Coins are circulated as any other crypto coin

Challenges
- Motivate users to maintain the blockchain, being active nodes
- Ensure trust on the Proof of Work mechanism

- Involvement of energy distribution players (paradigm proposed is against their actual business model)
- Real-world infrastructure (deployable as "isolated islands" easily possible only when building from scratch new neighborhoods)

Conclusions

Developed and tested whole infrastructure, both on the **physical** and **logical** layer

Can be configured to work in both an **autonomous island** and connected to a **main grid**

Future steps
- Enrich smart contract with more functionalities
- Implement coloured coins and cryptocurrency scenario
- Study the feasibility for large scale deployment and use
- Use blockchains for other use cases, such as digital identity and IoT management

Thanks for your attention !

Joint Research Centre (JRC)

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