Sviluppi e priorità europee nel settore delle smart grids

M. de Nigris

DRIVERS FOR AN ENERGY (R)EVOLUTION IN EUROPE

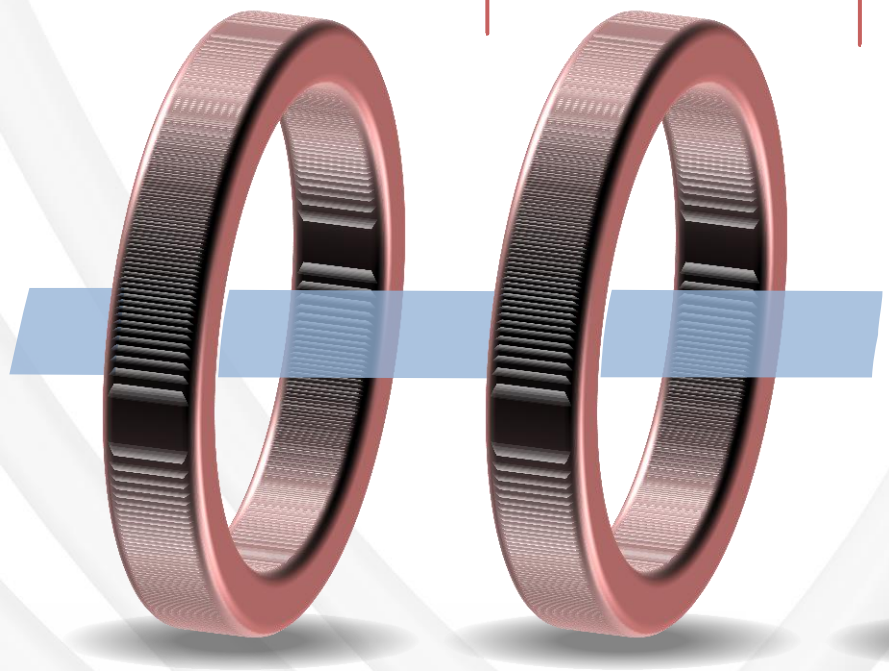
INCREASING ENERGY BILL

- EUROPEAN ENERGY BILL FOR IMPORT: 1 b€/DAY
- VOLATILITY OF ENERGY PRICES IN WORLD MARKET
- INCREASING SPENDINGS FOR ENERGY FOR EUROPEAN INDUSTRIES AND CUSTOMERS (4X THE PRICE OF GAS IN US)

DRIVERS FOR AN ENERGY (R)EVOLUTION IN EUROPE

INCREASING GHG EMISSIONS

INCREASING ENERGY BILL



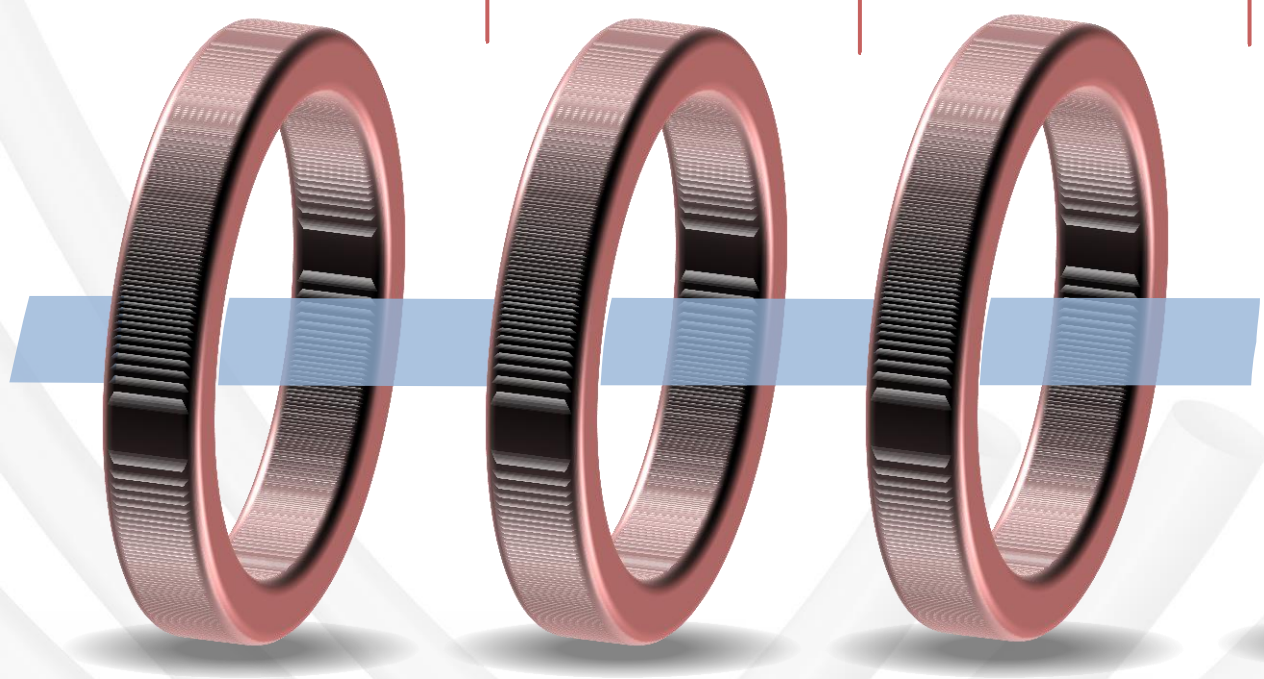
- GREENHOUSE GASES HAVE PROGRESSIVELY INCREASED TO UNPRECEDENTED LEVELS
- ACTION FOR MITIGATING EFFECTS IS NOW URGENT (> 2°C)
- DECARBONISATION OF ENERGY SYSTEM (RESPONSIBLE FOR 80% OF GHG EMISSIONS)

DRIVERS FOR AN ENERGY (R)EVOLUTION IN EUROPE

RECENT GEOPOLITICAL EVENTS

INCREASING GHG EMISSIONS

INCREASING ENERGY BILL



- 53% OF ENERGY IS IMPORTED
- DEPENDENCE FROM SINGLE SUPPLIER
- EXPLOITATION OF INDIGENOUS SOURCES IS INCREASING IN IMPORTANCE

TRANSFORMATION OF THE ENERGY SYSTEM IN EUROPE

RSE
Ricerca Sistema Energetico

GROWING SHARE OF RENEWABLES AND DISTRIBUTED GENERATION.

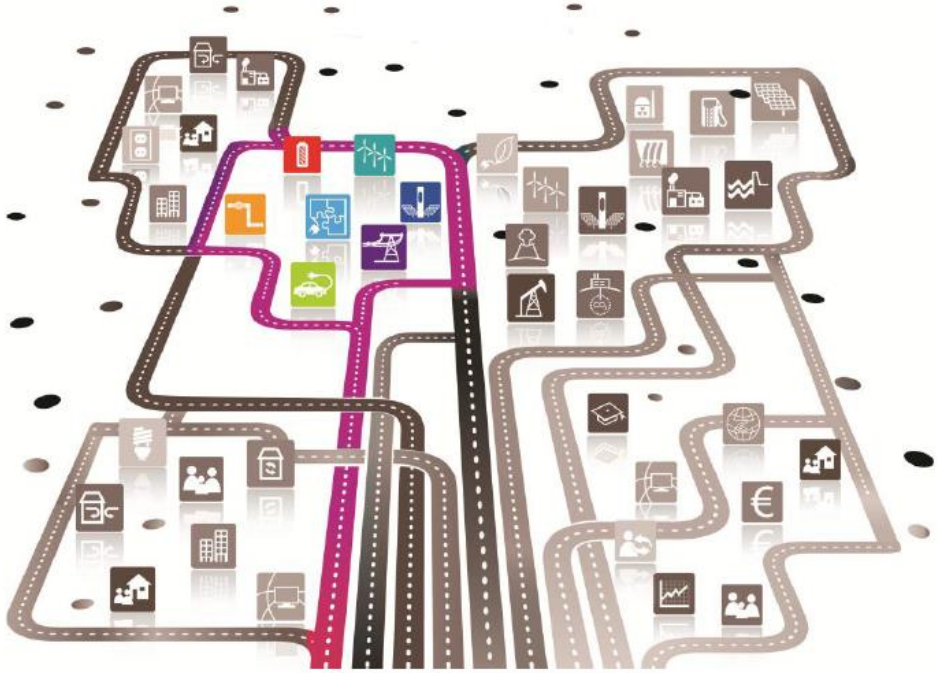
PROGRESSIVE INCREASE OF ENERGY EFFICIENCY ALONG THE WHOLE ENERGY VALUE CHAIN.

INCREASING NEED FOR FLEXIBILITY IN THE ENERGY SYSTEM.

EMERGENCE OF THE CONSUMER AS AN ACTIVE PLAYER IN THE ENERGY SYSTEM.

APPEARANCE OF NEW NETWORK USERS.

SMART GRIDS INFRASTRUCTURES ARE THE BACKBONE OF THE INTEGRATED ENERGY SYSTEM OF THE FUTURE



SMART GRIDS ENABLE ALL PILLARS OF THE EUROPEAN ENERGY UNION:

- ***Security***, *solidarity, trust*
- ***Competitiveness*** *and the completion of the* ***internal energy market***
- ***Moderation of demand***
- ***Low emissions*** *in the EU energy-mix*
- ***Research and innovation***

EUROPE HAS A RECOGNISED AND CONSOLIDATED WORLD LEADERSHIP IN THE DEVELOPMENT AND USE OF SMART GRIDS SOLUTIONS

130 GW RENEWABLES ADDED IN LAST 5 YEARS

100 MILLION SMART METERS INSTALLED

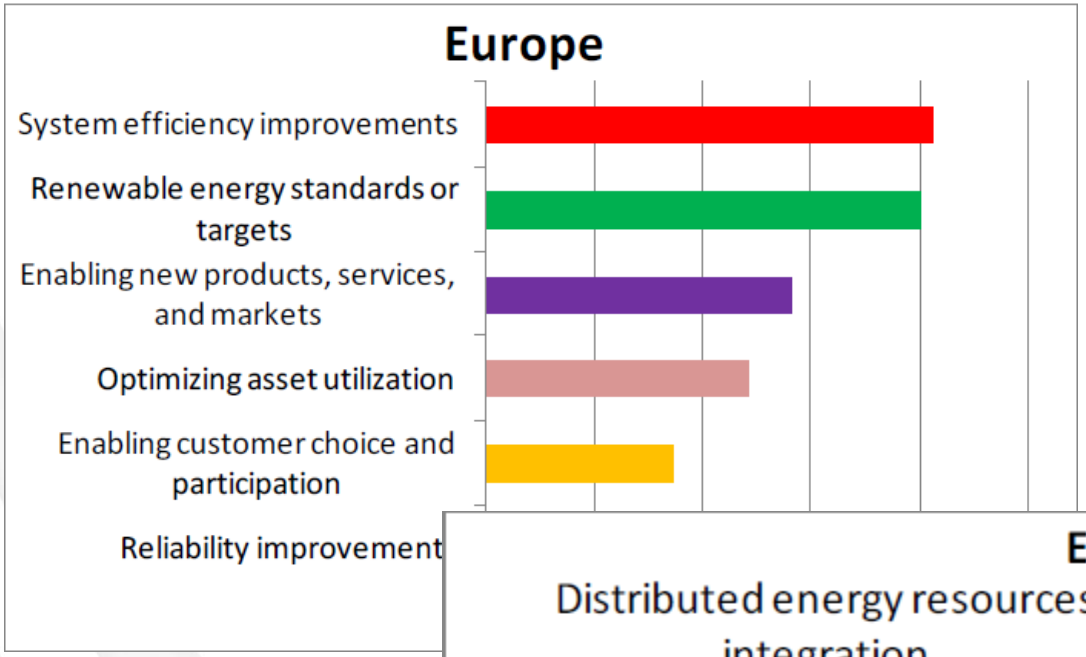
400 SMART GRIDS RESEARCH AND DEMONSTRATION PROJECTS

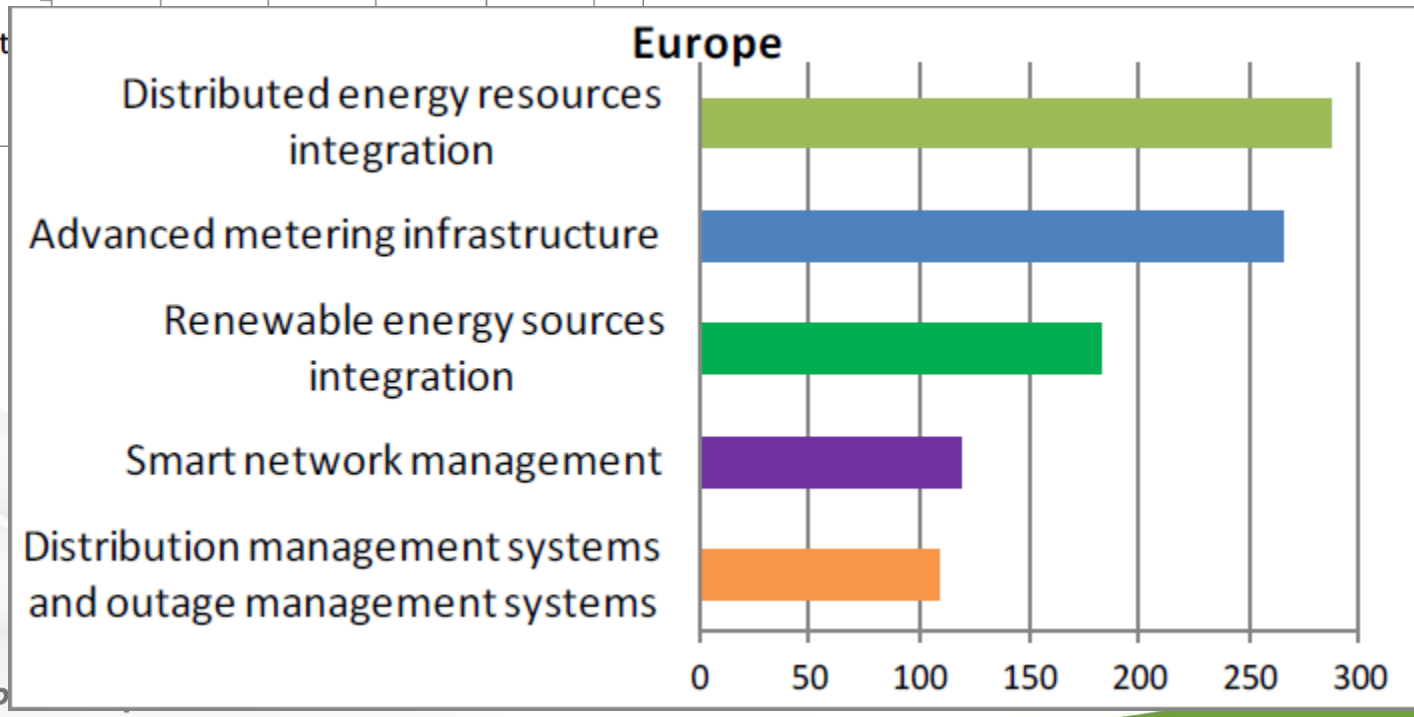
350 ENERGY STORAGE RESEARCH AND DEMONSTRATION PROJECTS

SMART GRIDS SECTORAL SPECIALISATION IN EUROPE

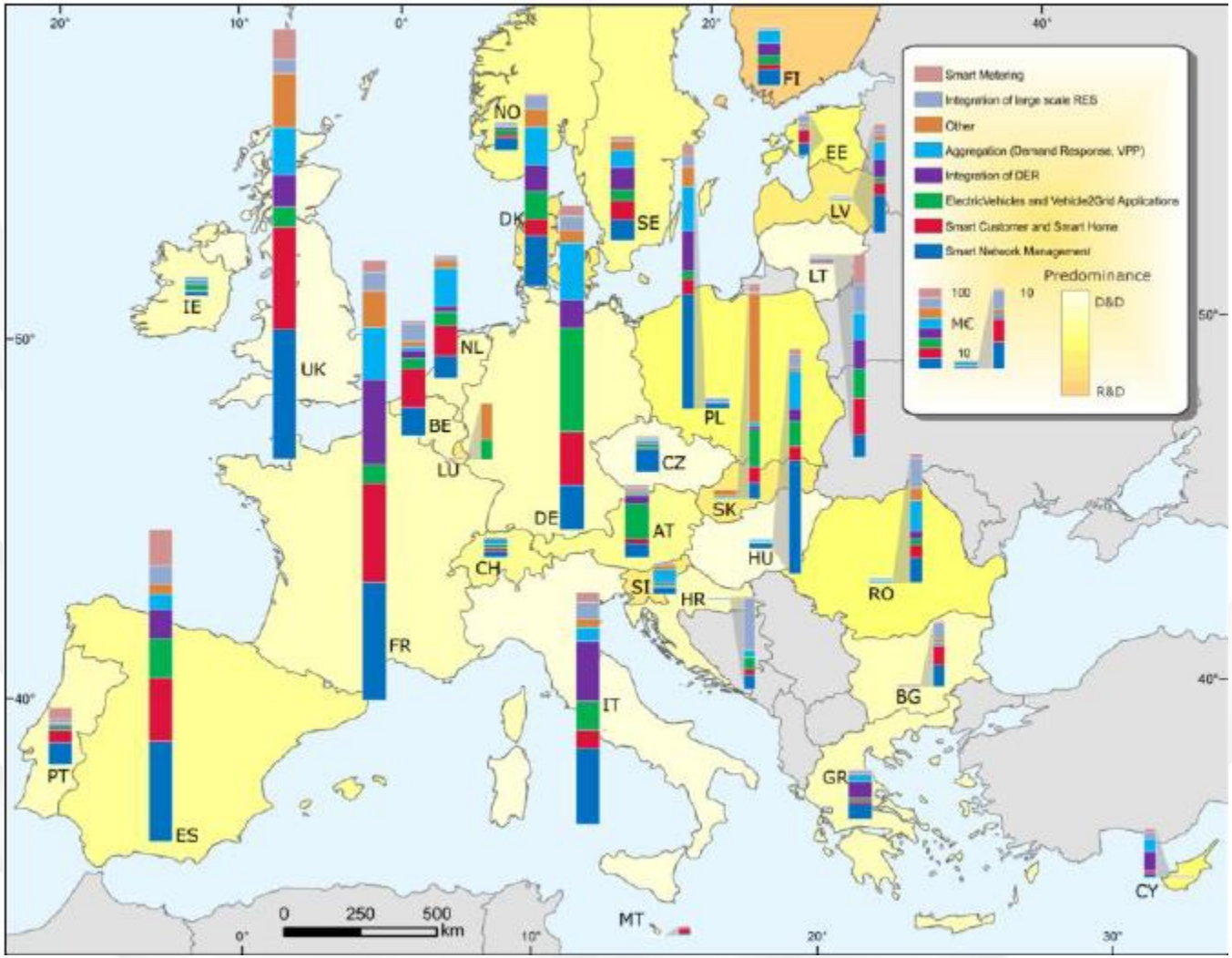
- **MOST OF THE MAJOR SMART GRIDS TECHNOLOGY PROVIDERS ARE OF EUROPEAN ORIGIN**
  - TECHNOLOGIES ARE TESTED AND DEPLOYED OUTSIDE EUROPE
  - RD&D PLANS AND INVESTMENTS ARE ATTRACTING PLANTS AND EXCELLENCE CENTRES OUTSIDE EUROPE
- **EUROPEAN NETWORK OPERATORS HAVE ADAPTED THEIR SYSTEMS WITH A PROACTIVE ATTITUDE TOWARDS INNOVATION**
  - ROADMAP FOR IMPLEMENTATION – 2022
  - ROLLING IMPLEMENTATION PLANS AVAILABLE 2016-2018
  - NEED MORE DATA ABOUT NATIONAL/REGIONAL PROJECTS
- **EUROPEAN REGULATORS ARE AMONG THE MOST ACTIVE IN PROMOTING SMART SOLUTIONS**
  - THIRD ENERGY PACKAGE PROMOTES R&D ACTIVITIES BY OPERATORS REMUNERATED ON THE ELECTRICITY BILLS

TOP DRIVERS FOR INVESTING IN SG TECHNOLOGIES





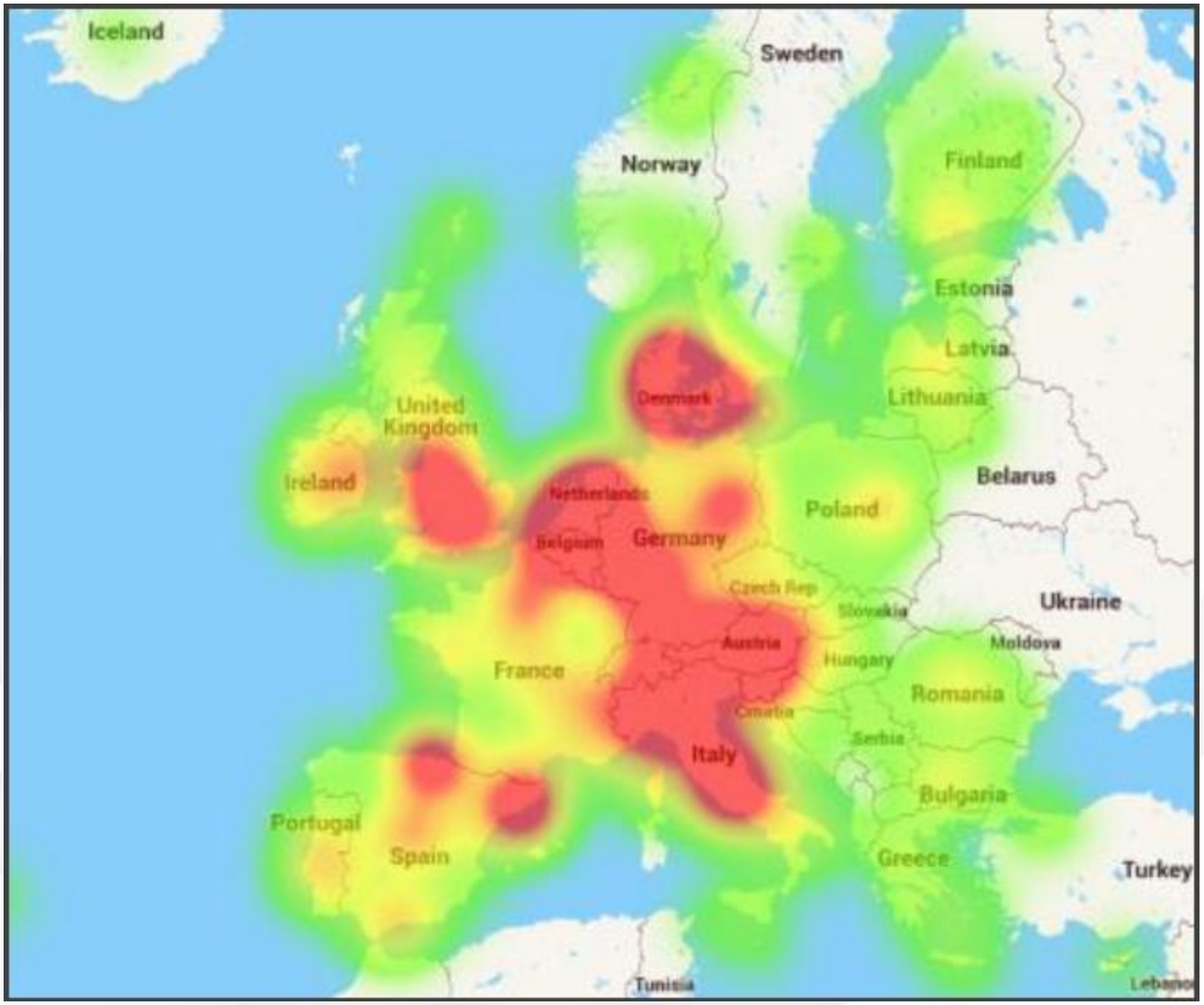
SMART GRIDS GEOGRAPHICAL SPECIALISATION IN EUROPE



- **DIVERSITY**
- 1° **NETWORK MANAGEMENT**
- 2° **SMART CONSUMERS**
- **DISTRIBUTED SERVICES** (ICT, FLEXIBILITY)
- AUTOMATION IS CONSOLIDATED

SOURCE – JRC

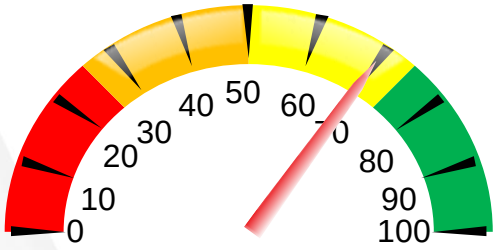
SMART GRIDS GEOGRAPHICAL SPECIALISATION IN EUROPE



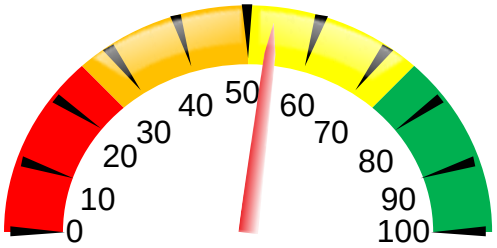
- **EU 15 MOST ACTIVE COUNTRIES**
- INITIAL ACTIVITIES IN EAST EUROPEAN COUNTRIES
- DATA CONFIRMED IF WEIGHED BY BUDGET
- LEVARAGE **REGIONAL INTEREST**

SOURCE – JRC

HOW FAR ARE WE IN THE DEVELOPMENT OF SMART GRIDS SOLUTIONS - TRANSMISSION



ARCHITECTURES

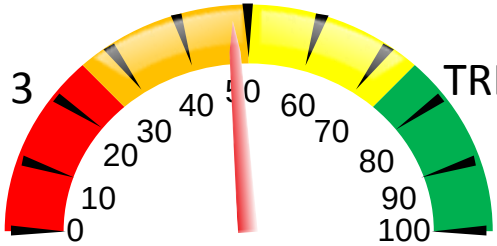


TECHNOLOGIES

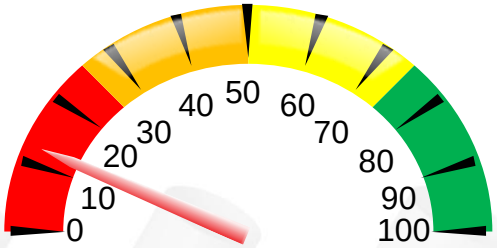
TRL 5

TRL 3

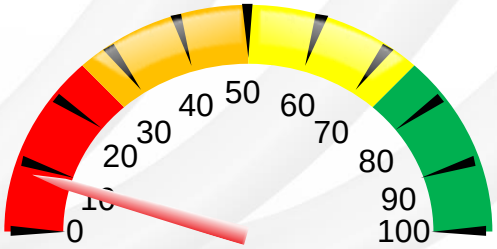
TRL 7



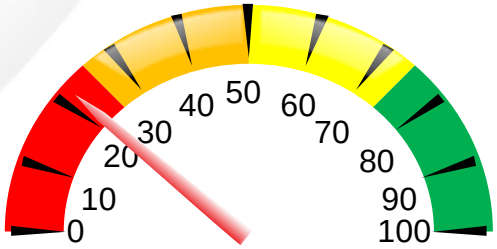
OPERATION



MARKET

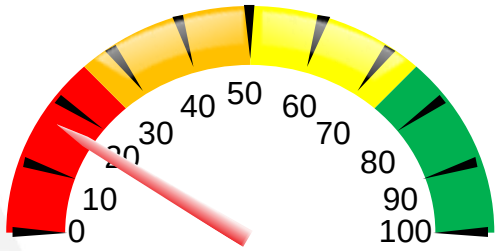


ASSET MGT.

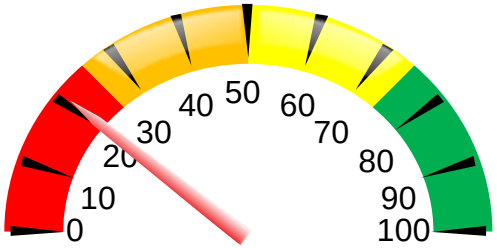


T&D ISSUES

HOW FAR ARE WE IN THE DEVELOPMENT OF SMART GRIDS SOLUTIONS - DISTRIBUTION



CUSTOMER

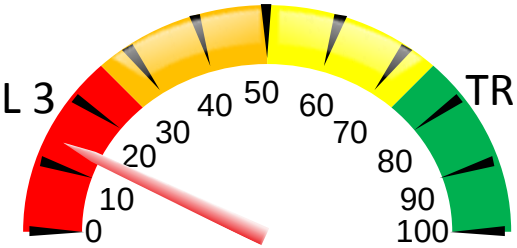


D.E.R

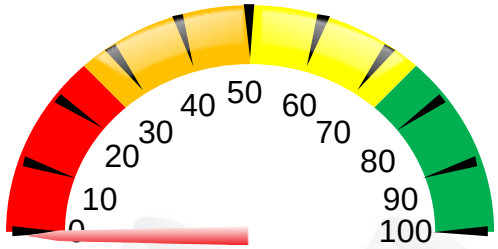
TRL 5

TRL 3

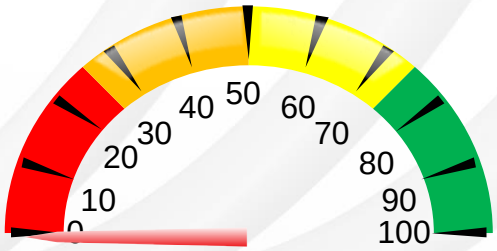
TRL 7



OPERATION

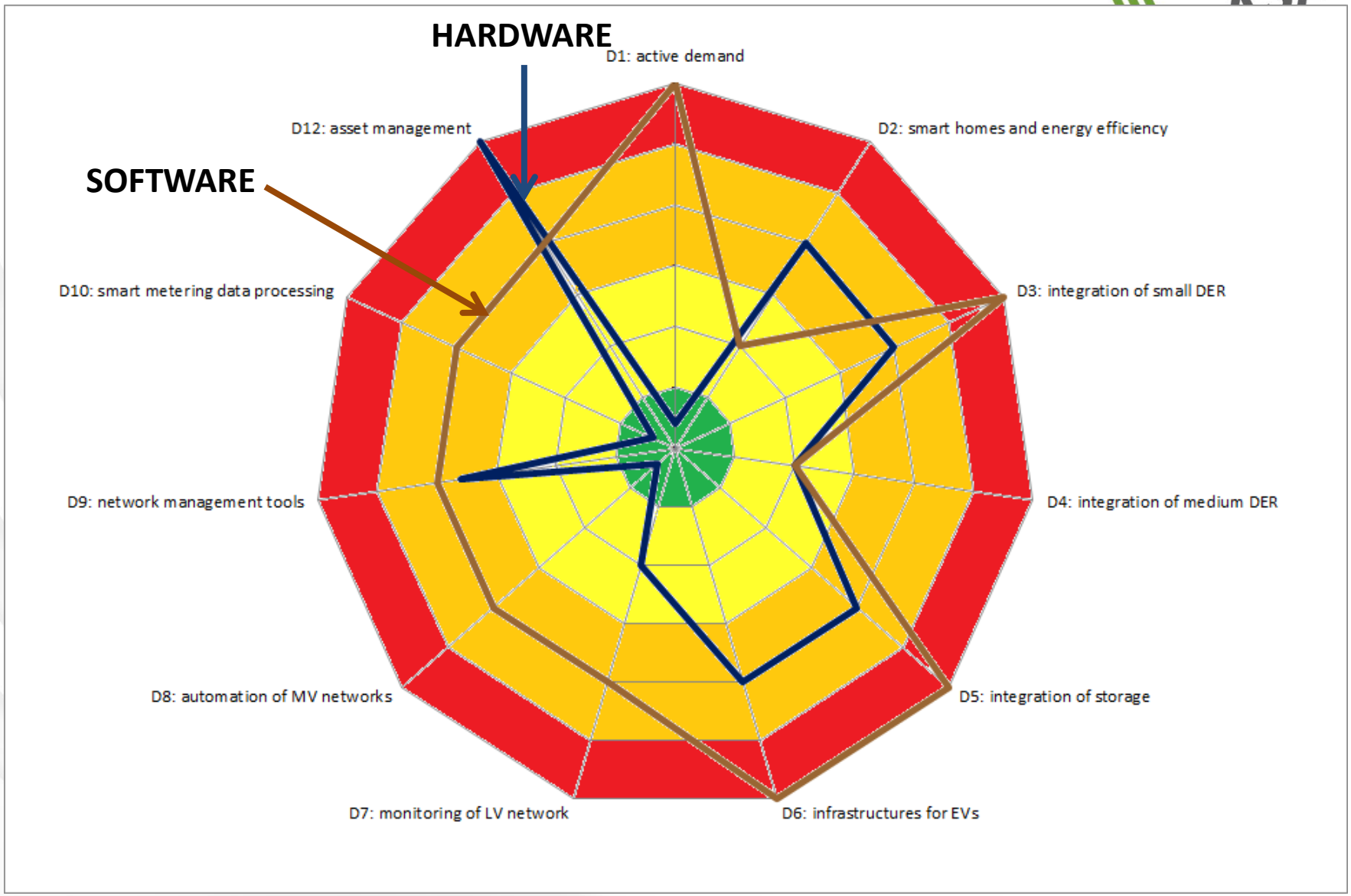


PLANNING – ASSET MGT.

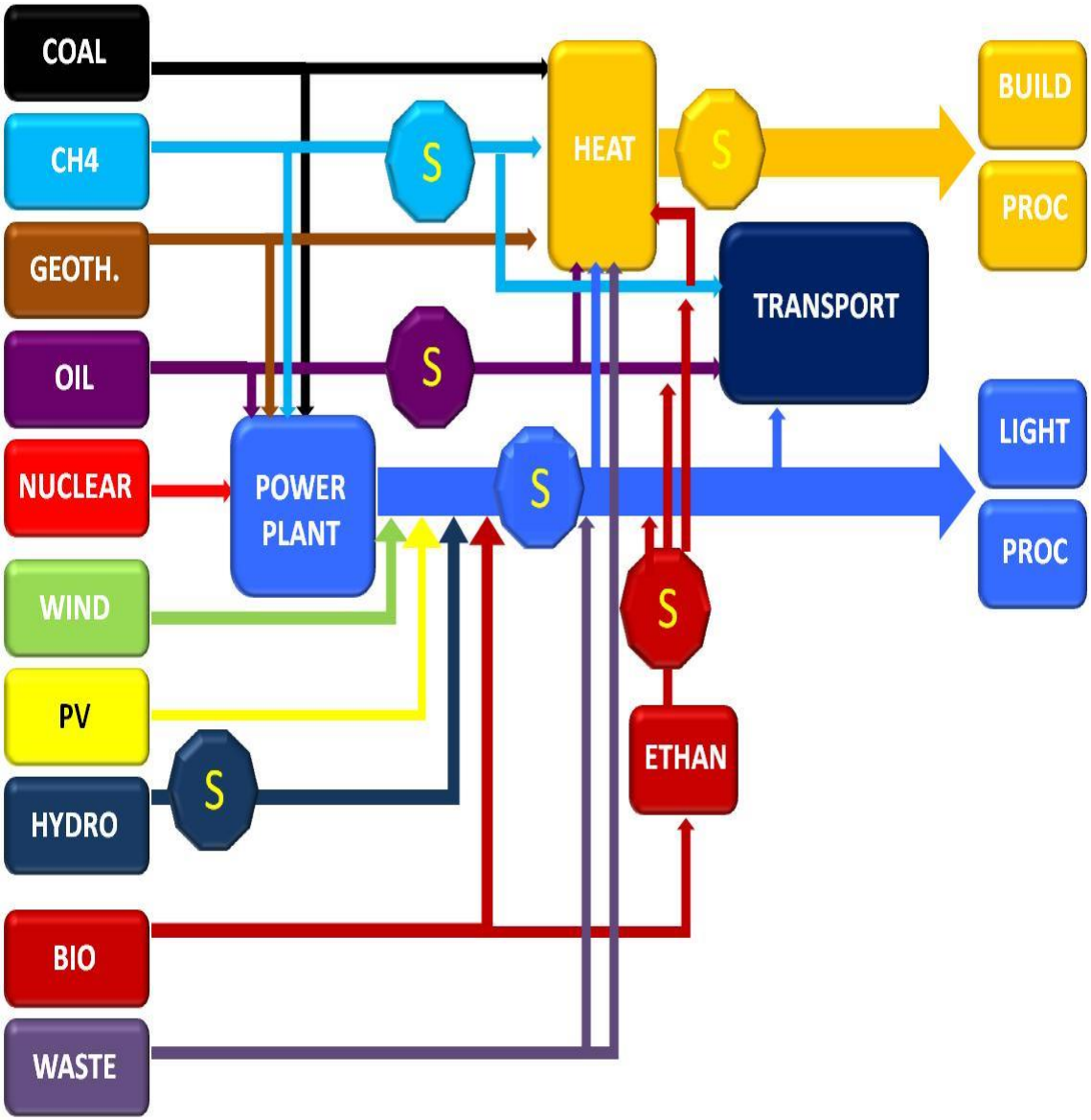


MARKET

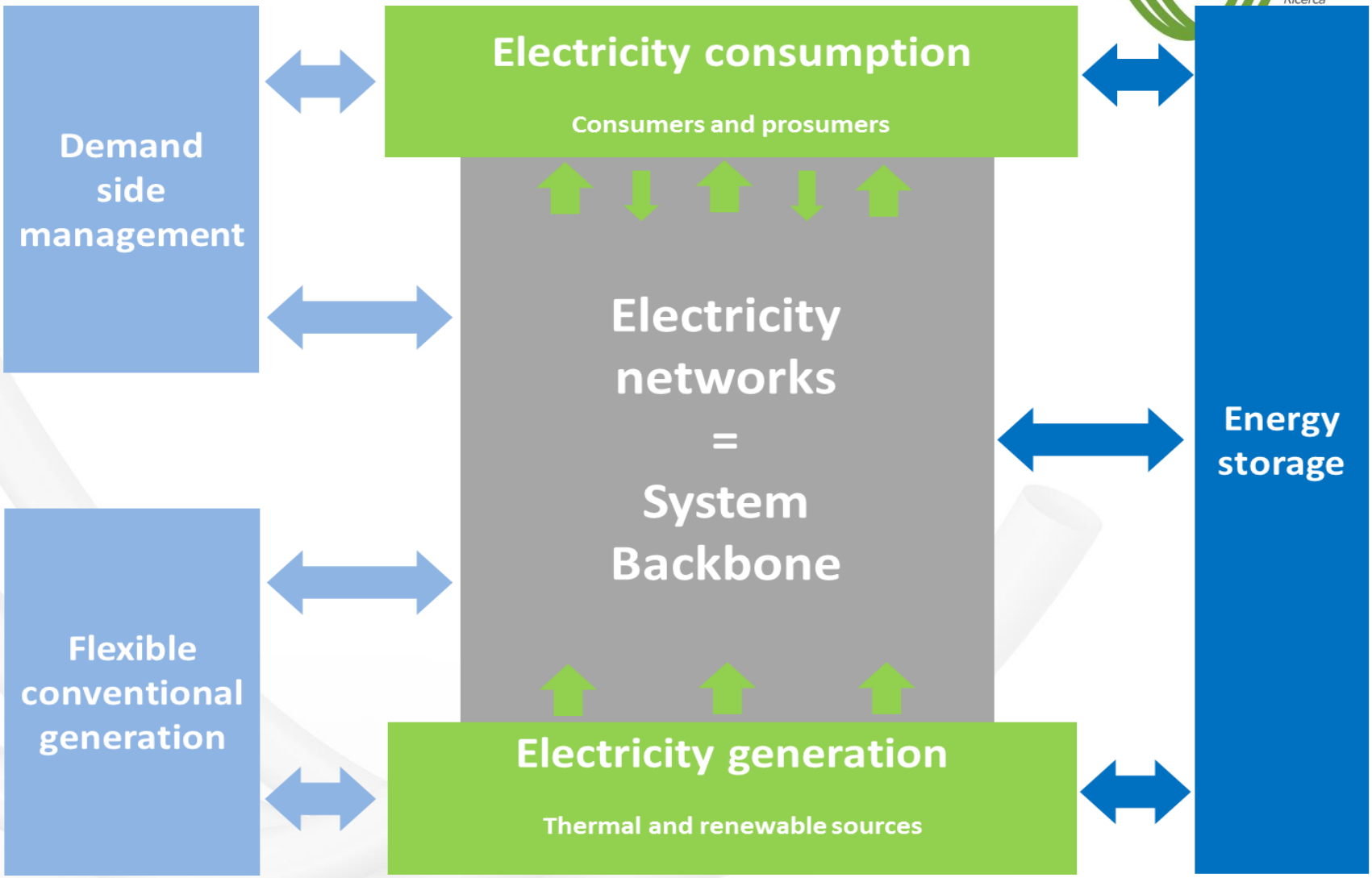
HOW FAR ARE WE IN THE DEVELOPMENT OF SMART GRIDS SOLUTIONS - DISTRIBUTION



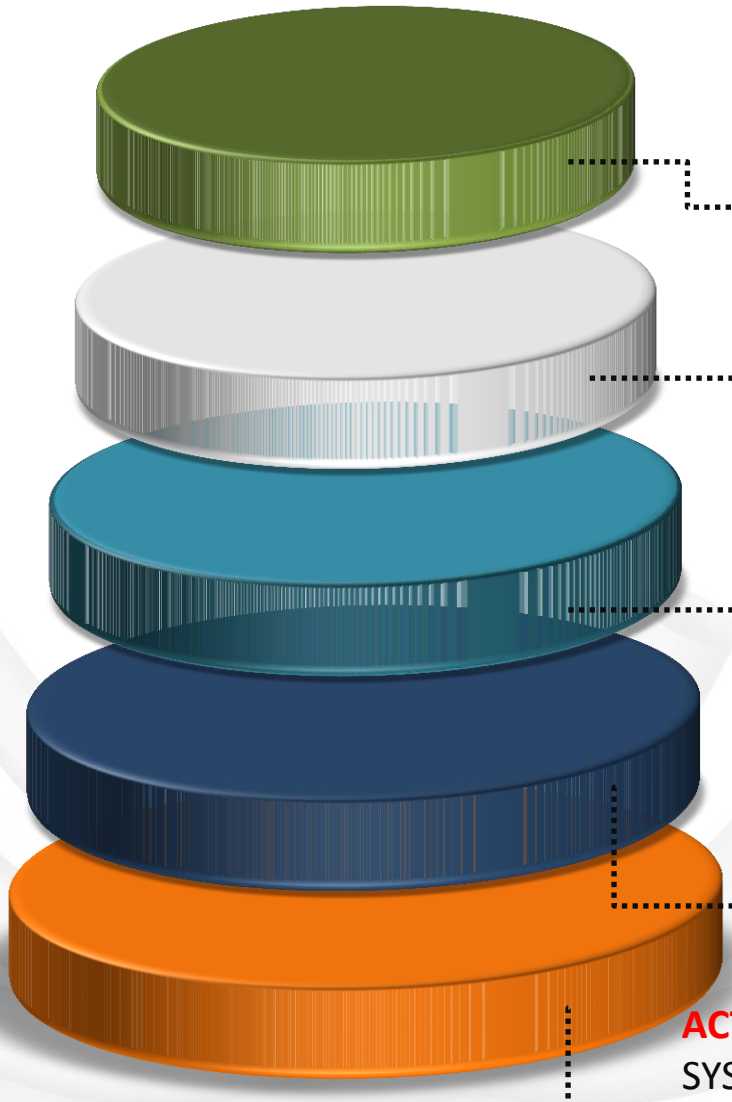
ENERGY SYSTEM IS CHANGING



ELECTRICITY NETWORKS ARE BACKBONE OF SYSTEM



THE MAIN CHALLENGES OF THE EU INTEGRATED ROADMAP



CROSS-CUTTING ISSUES: **FINANCING, EDUCATION, SOCIO-ECONOMICS**

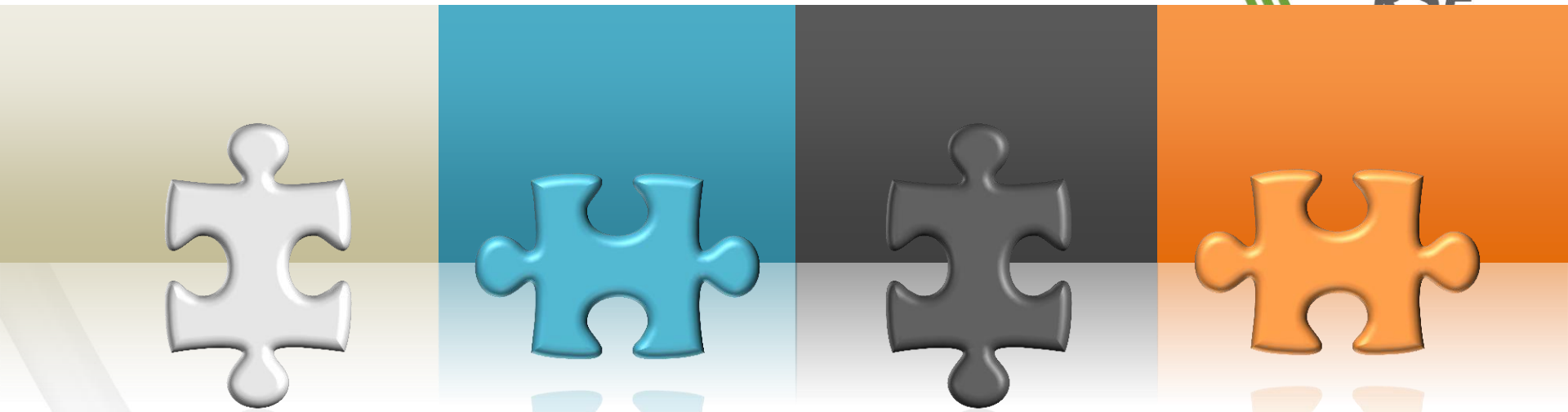
SECURE, COST-EFFECTIVE, CLEAN AND COMPETITIVE **ENERGY SUPPLY**

SYSTEM OPTIMISATION: MODERNISE GRID, SYNERGIES BETWEEN CARRIERS, STORAGE, FLEXIBILITY, SECURITY, COST-EFFECTIVENESS, HOLISTIC APPROACH

INCREASING **ENERGY EFFICIENCY** ACROSS THE ENERGY SYSTEM

ACTIVE CUSTOMERS AT THE CENTRE OF THE ENERGY SYSTEM

THE PRIORITIES OF THE INTEGRATED ROADMAP FOR SYSTEM OPTIMISATION



NEW GRID CONCEPT

- NEW GRID TOPOLOGIES AND INTERFACES
- INTEGRATE D.G. AND R.E.S WITH CENTRALISED GENERATION AND STORAGE
- DG MONITORING AND REMOTE CONTROL
- NEW SIMULATION TOOLS
- ASSET MANAGEMENT AND NETWORK MONITORING
- DEMONSTRATION
- BUSINESS CASES

STORAGE

- NEW MATERIALS, CONCEPTS, TECHNOLOGIES
- OPTIMISE EXISTING TECHNOLOGIES (COST-LIFE-SAFETY)
- CROSS SECTOR TECHNOLOGIES
- NETWORK INTERFACES AND STANDARDS
- NEW SYSTEM WIDE SIMULATIONS
- DEMONSTRATION
- BUSINESS CASES

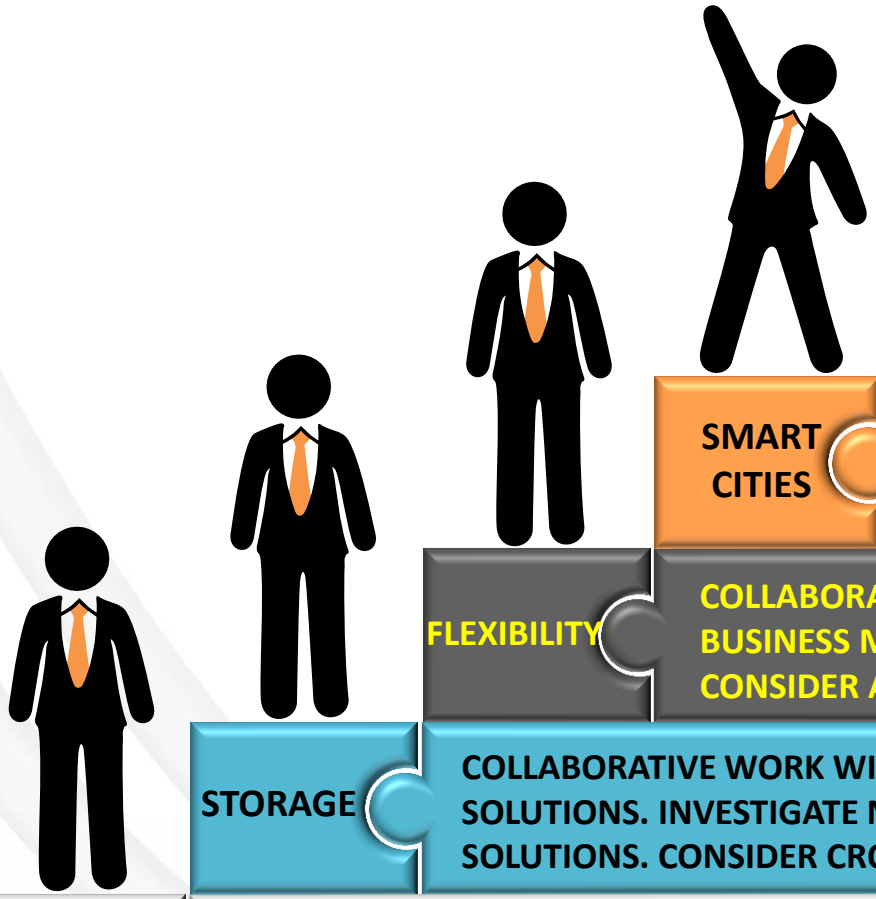
FLEXIBILITY

- SIMULATION FOR DEMAND-RESPONSE: RESIDENTIAL, COMMERCIAL, INDUSTRIAL
- BUSINESS MODELS FOR DEPLOYMENT, INCLUDING USER ACCEPTANCE
- FLEXIBLE GENERATION (CONVENTIONAL AND RES): NEW OPERATIONAL MODES
- CROSS-TECHNOLOGY OPTIONS (GAS, EL, HEAT)
- INTERDEPENDENCY AND SECURITY

SMART CITIES

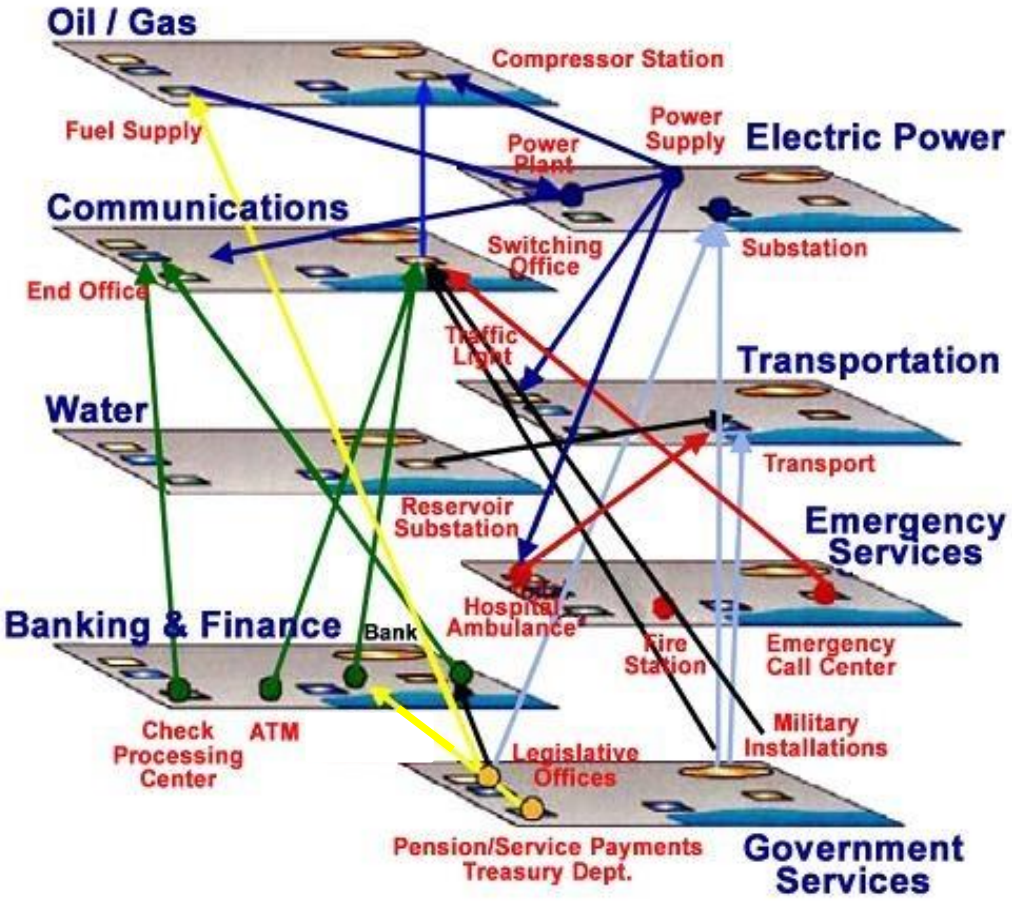
- FOSTER INNOVATION IN URBAN CONTEXT
- PLANNING RENOVATION STRATEGIES
- LINK BETWEEN URBAN INFRASTRUCTURES
- URBAN COMMUNICATION SOLUTIONS: DATA HUBS
- CUSTOMER INFORMATION AND SERVICES
- SUSTAINABLE TRANSPORT AND LOGISTICS
- GOVERNANCE AND INTRA CITY COLLABORATION

REFERENCE STAKEHOLDERS FOR RESEARCH INSTITUTIONS IN ADDRESSING I.R. PRIORITIES



SMART CITIES	COLLABORATIVE WORK WITH PUBLIC AUTHORITIES , GOVERNMENT, AND GENERAL PUBLIC. INTERDISCIPLINARITY IS KEY TO SUCCESS.
FLEXIBILITY	COLLABORATIVE WORK WITH REGULATORS TO EVALUATE NEW BUSINESS MODELS, DETERMINING BENEFITS AND BENEFICIARIES. CONSIDER ALL OPTIONS: DR, EV, FLEXGEN, HEAT PUMPS, GAS ETC.
STORAGE	COLLABORATIVE WORK WITH TECHNOLOGY PROVIDERS TO VALIDATE PROPOSED SOLUTIONS. INVESTIGATE NEW WORKING PATHS IN SEARCH OF BREAKTHROUGH SOLUTIONS. CONSIDER CROSS-TECHNOLOGY IN A GLOBAL ENERGY CONTEXT .
GRID CONCEPT	COLLABORATIVE WORK WITH NETWORK OPERATORS, GOING BEYOND THE STATE OF THE ART, PROPOSE NEW METHODS (PLANNING, OPERATION, MAINTENANCE ETC.), DEVELOP SENSORS AND LOCAL INTELLIGENCE AND STIMULATE CROSS-VECTORS APPROACHES

THE BIG CHALLENGE

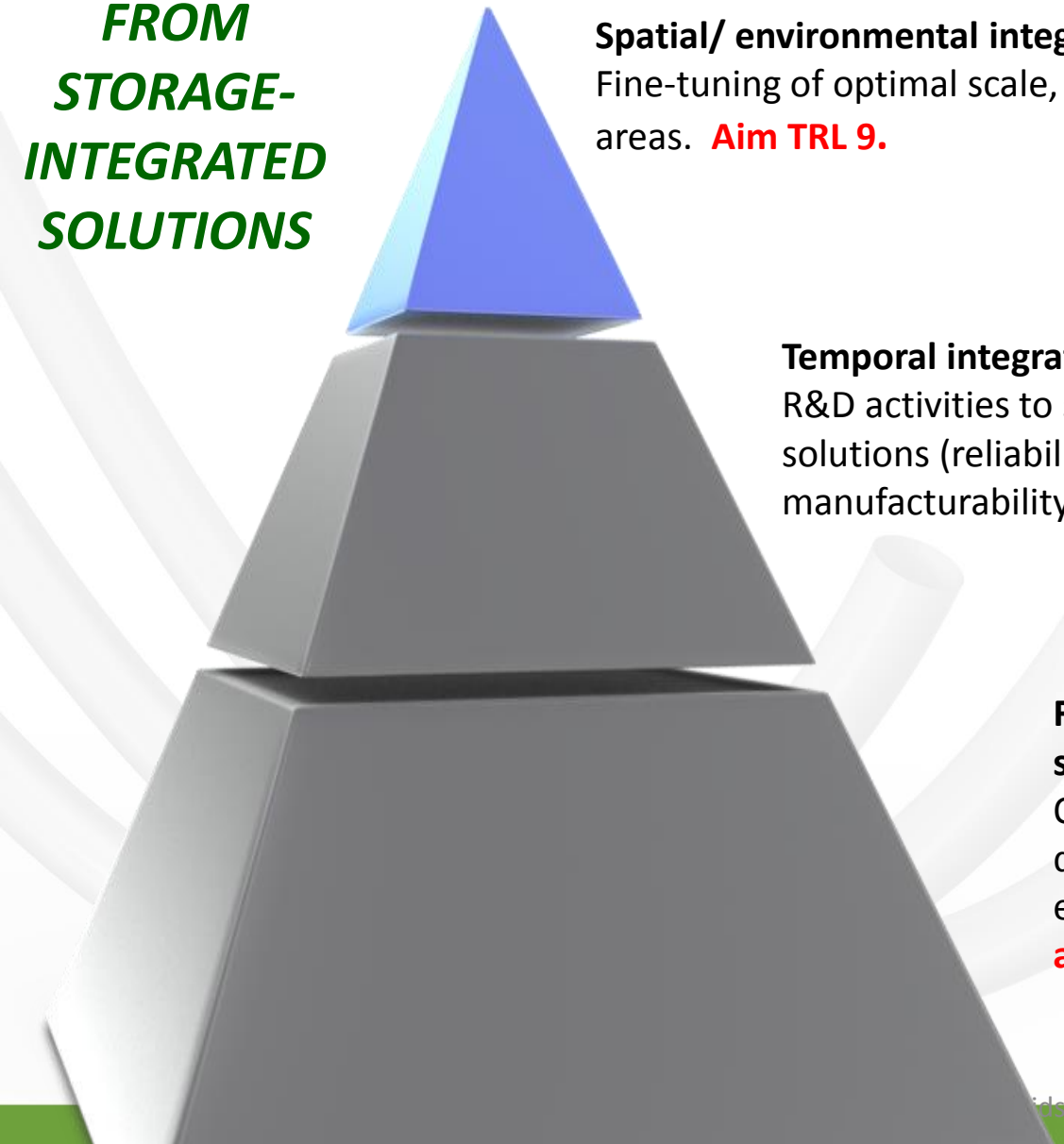


- DEVELOPMENT AND MANAGEMENT OF DIFFERENT SECTORS IS MOSTLY **INTERNAL**
- ACTORS OF EACH SECTOR FOCUSED ON **INTERNAL OPTIMISATION**
- OVERALL APPROACH MAY **NOT** BE FELT AS OWN **RESPONSIBILITY** BY ANY OF THE ACTORS
- HOLISTIC APPROACH MUST INITIALLY BE MOTIVATED BY **POLICY**
- SECTORS FIND BUSINESS INTEREST AT A **LATER STAGE**
- RESEARCH COMMUNITY IS BEST PLACED TO **TRIGGER THE HOLISTIC APPROACH**

COMMUNICATION ARCHITECTURES – STANDARDS - REQUIREMENTS
DATA MINING – BIG DATA – SMART METERING – LOAD FORECAST
INTERDEPENDENCY – DEPENDABILITY - SECURITY
CYBER SECURITY – PRIVACY – CONSUMER BEHAVIOUR

FOCUS ON STORAGE

FLEXIBILITY FROM STORAGE-INTEGRATED SOLUTIONS

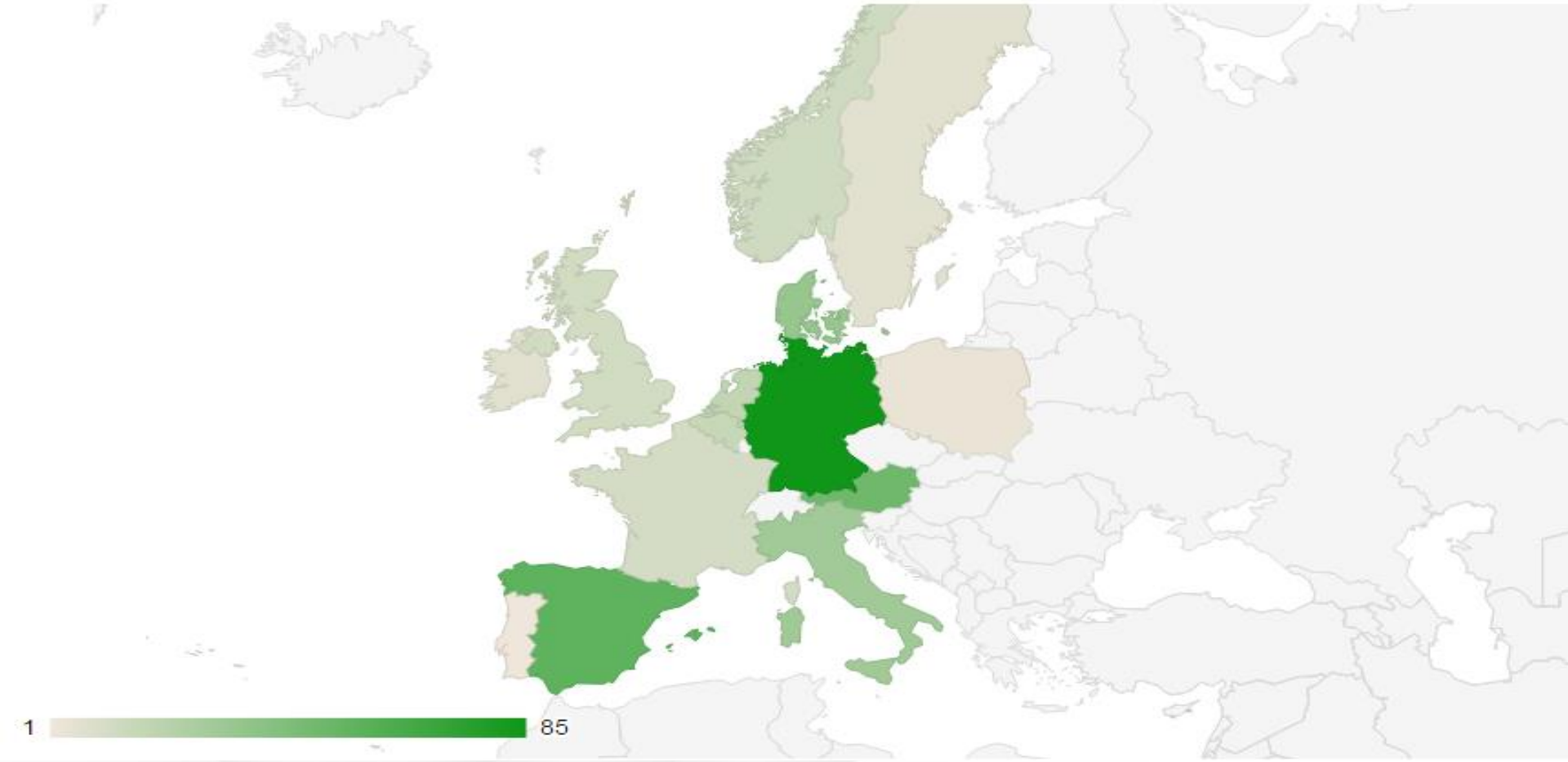


Spatial/ environmental integration of storage-based solutions
Fine-tuning of optimal scale, adjustment to local climates and to specific areas. **Aim TRL 9.**

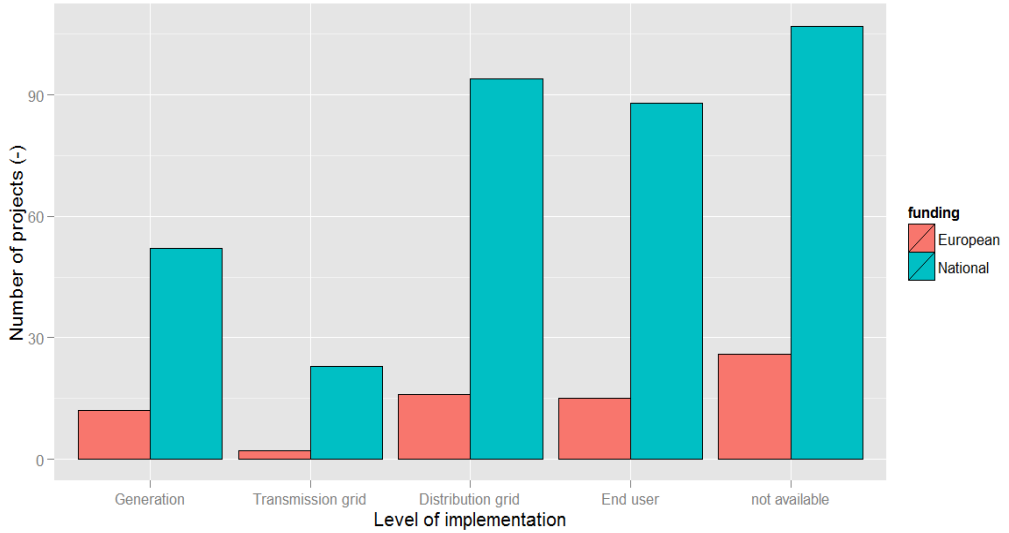
Temporal integration of storage-based solutions
R&D activities to shape the life cycle cost of integrated solutions (reliability, techno-economic performances, manufacturability).**Aim TRL: 6-8**

Functional integration of storage-based solutions into the system
Optimal mix, interfaces, experimental data and simulations to validate end-to-end functionalities.
aim TRL (op): 5-7

STORAGE PROJECTS ON-GOING ACTIVITIES MAPPING

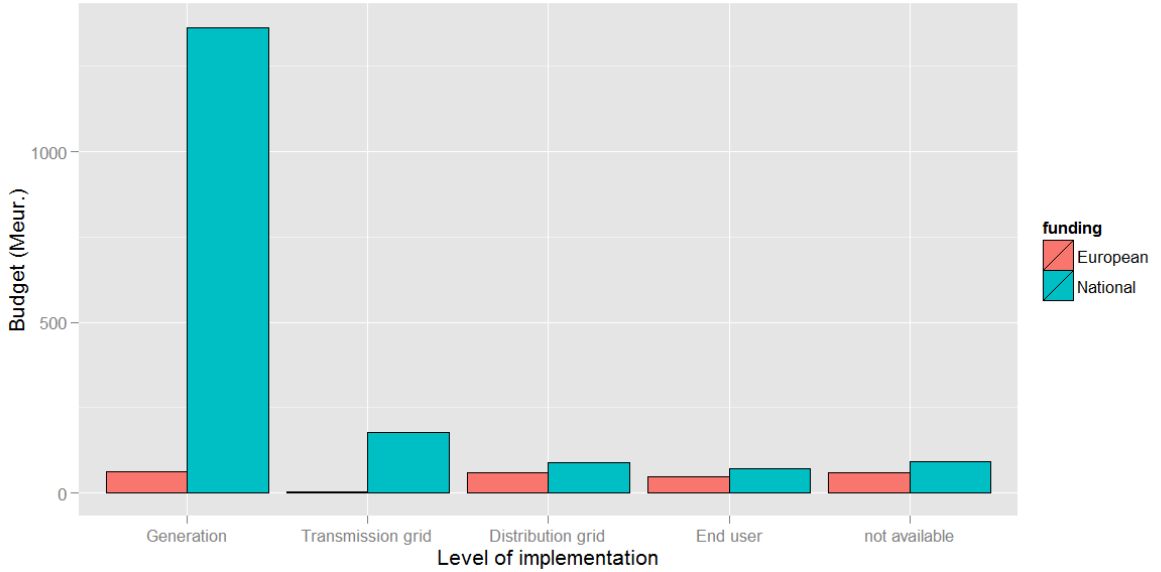


STORAGE PROJECTS: NUMBER AND BUDGET

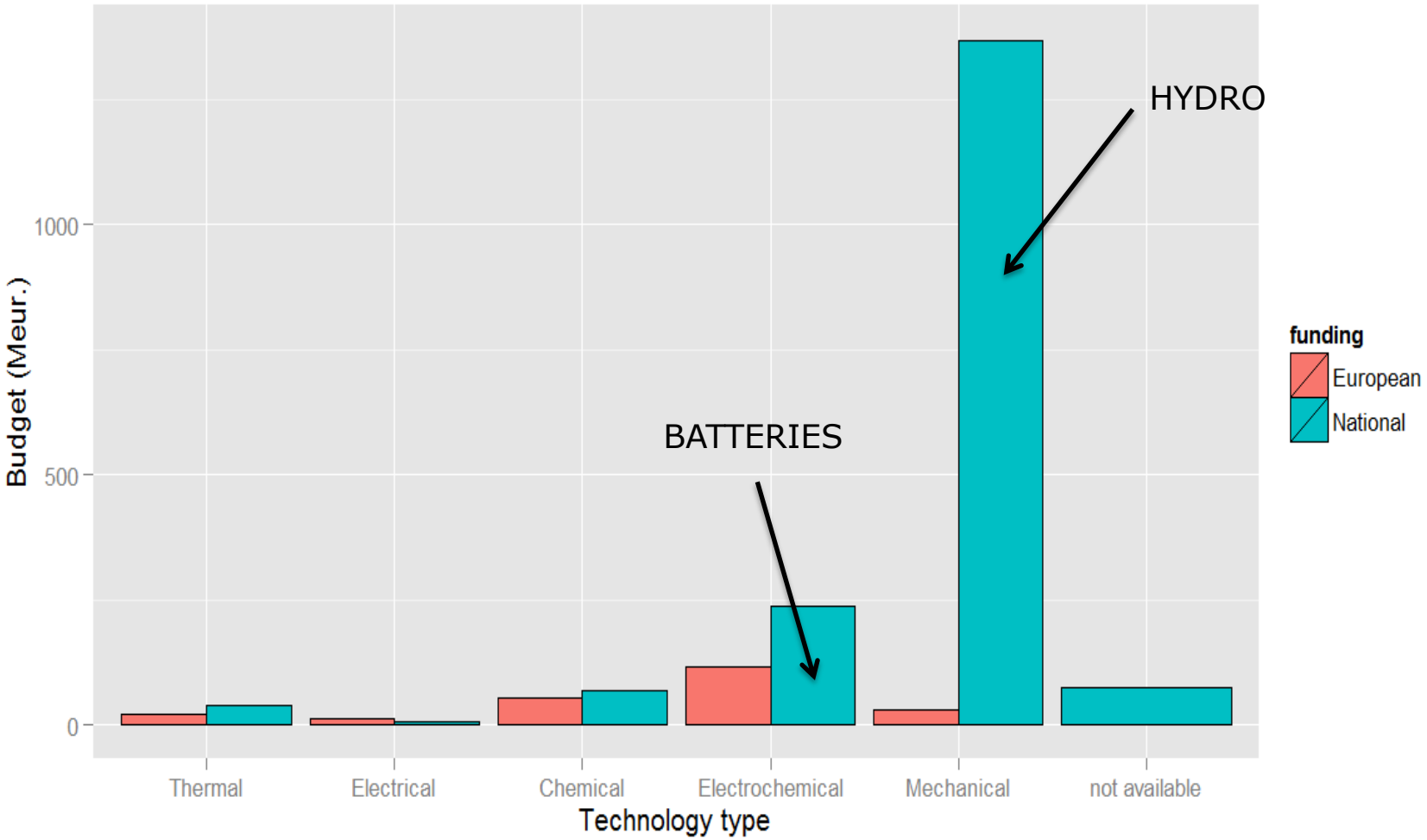


- Importance of National fundings
- Number of projects in DISTRIBUTION and END USE
- European attention on end use

- In terms of BUDGET, most investments are NATIONAL and address the GENERATION SIDE (hydro) – bias in the analysis



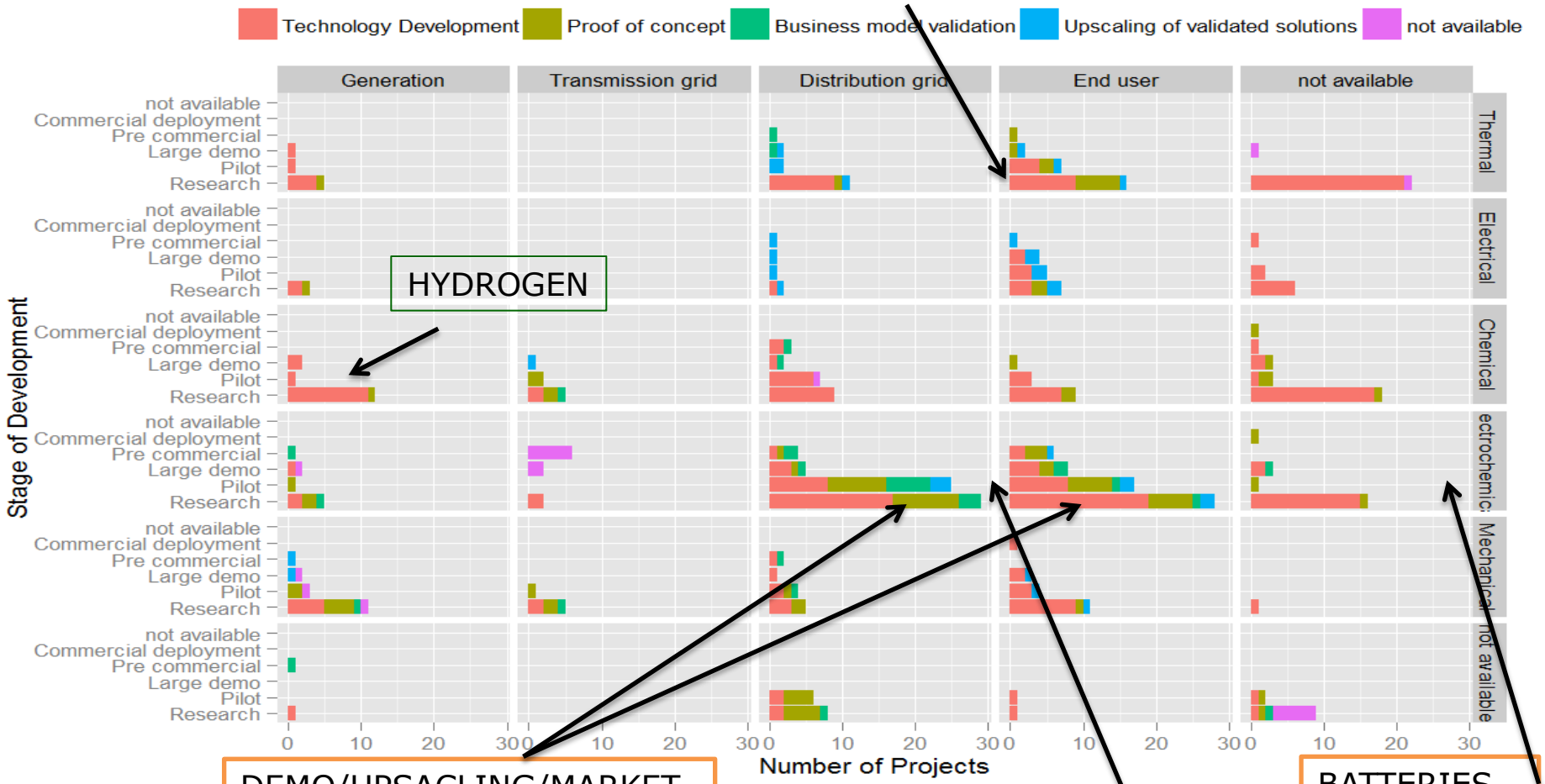
STORAGE PROJECTS: BUDGET BY TECHNOLOGY



NUMBER BY STAGE OF DEVELOPMENT

EXCLUDING HYDRO STORAGE PLANTS

HEAT AND DISTRICT HEATING



HYDROGEN

DEMO/UPSACLING/MARKET

DISTRIBUTION – END USE

BATTERIES

EUROPE: LESSONS LEARNED

SMART GRIDS LANDSCAPE

- Projects not evenly distributed (EU15 doing most of the job)
- Many projects focus on integration of technologies and applications
- Fundamental role of the DSOs / TSOs
- Deployment cover most of investments (7% of projects – 60% of investments)

LARGE SCALE MULTIDISCIPLINARY DEMONSTRATORS

- Large scale demonstrators, involving high number of sites and communities needed to prove up-scaling and reliability of solutions
- Incresaed complexity of electricity system requires multidisciplinary consortia to integrate competences and share risks

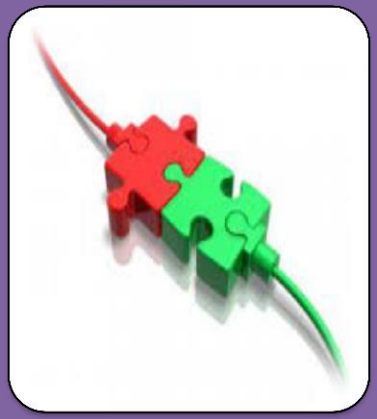
SET UP OF MARKET PLATFORMS FOR THE PROVISION OF SERVICES

- Revise incentives model to accelerate innovation uptake and encourage to move towards a service-based business model
- Most of smart grids benefits are systemic in nature – service-based market platforms are essential to attract operators

EUROPE: LESSONS LEARNED

CONSUMERS

- Need to have trust to harvest benefits from smart grids technologies and applications;
- Consumer engagement is crutial to development of electricity services platforms;
- Consumer segmentation is very important to taylor energy services, target early adopters, guarantee different levels of engagement.



INTEROPERABILITY, DATA PROTECTION AND DATA SECURITY

- Open and secure ICT infrastruture is core for smart grids implementations;
- Convergence towards IP communications and other standard-based solutions;
- Energy and ICT communities need to work together to coordinate security measures, avoiding blind spots;
- Data protection and security not yet sufficiently addressed by the projects. Experience from other sectors is needed. Privacy-by-design approach

Grazie

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