



# **SEESGEN-ICT WP2 Recommendations for Concrete Actions**

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## Grouped recommendations for....

- design of open, robust and secure **ICT infrastructure** for smart grids
- design and validation of intelligent **intra-grid applications**
- **take-up of ICT** infrastructure and applications by shaping the context



# Overview of D2.4



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# Structure of each recommendation sheet

- ICT focal point
- special issue addressed
- description of the recommendation
- suggested action/initiative/existing solutions and limits in implementing the recommendation,
- priority of the action
- scope of the action
- target of the recommendation
- first impacted stakeholders
- expected impact
- impact term



# DESIGNING AND DEVELOPING OPEN, ROBUST AND SECURE ICT INFRASTRUCTURE FOR SMART GRIDS



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## SEES-WP2-001

### ■ Go for *interoperable* communication protocols and information models based on *open standards* and *open source*

- avoid proprietary standards
- future-proof standards
- open standards supported by open source software, to foster spread and robustness of standards
- e.g.
  - 4DIAC -> distributed control
  - Mango -> SCADA
  - openPOWERLINK & OpENer -> Industrial Ethernet
  - openPMU -> PMU
  - CIMTool -> CIM
  - mySmartGrid & OPENmeter -> Smart Meters



# Priority & scope of the action

## ■ Priority of the action

- Immediate
- To be prepared
- To think about

## ■ Scope of the action

- Standardization objectives
- Development of new technologies
- Sharing of Best Practices
- Improvement of existing technologies/practices
- Investment Protection
- Social consensus
- Environment protection
- Market opportunities



# Target of the recommendation

- Policy Makers
- Regulators
- Standardization Bodies
- Distribution System Operators
- Transmission System Operators
- ICT Industry
- Consumers
- Research and Academia





# First impacted stakeholders & impact term

## ■ First impacted stakeholders

- Industry

- Producers
- Distributors
- Manufacturers
- ICT

- Consumers

- Market operators (ESCo, Service Providers, Retailers, Aggregators, etc.)

- Public Institutions

- Research & Academia

## ■ Impact term

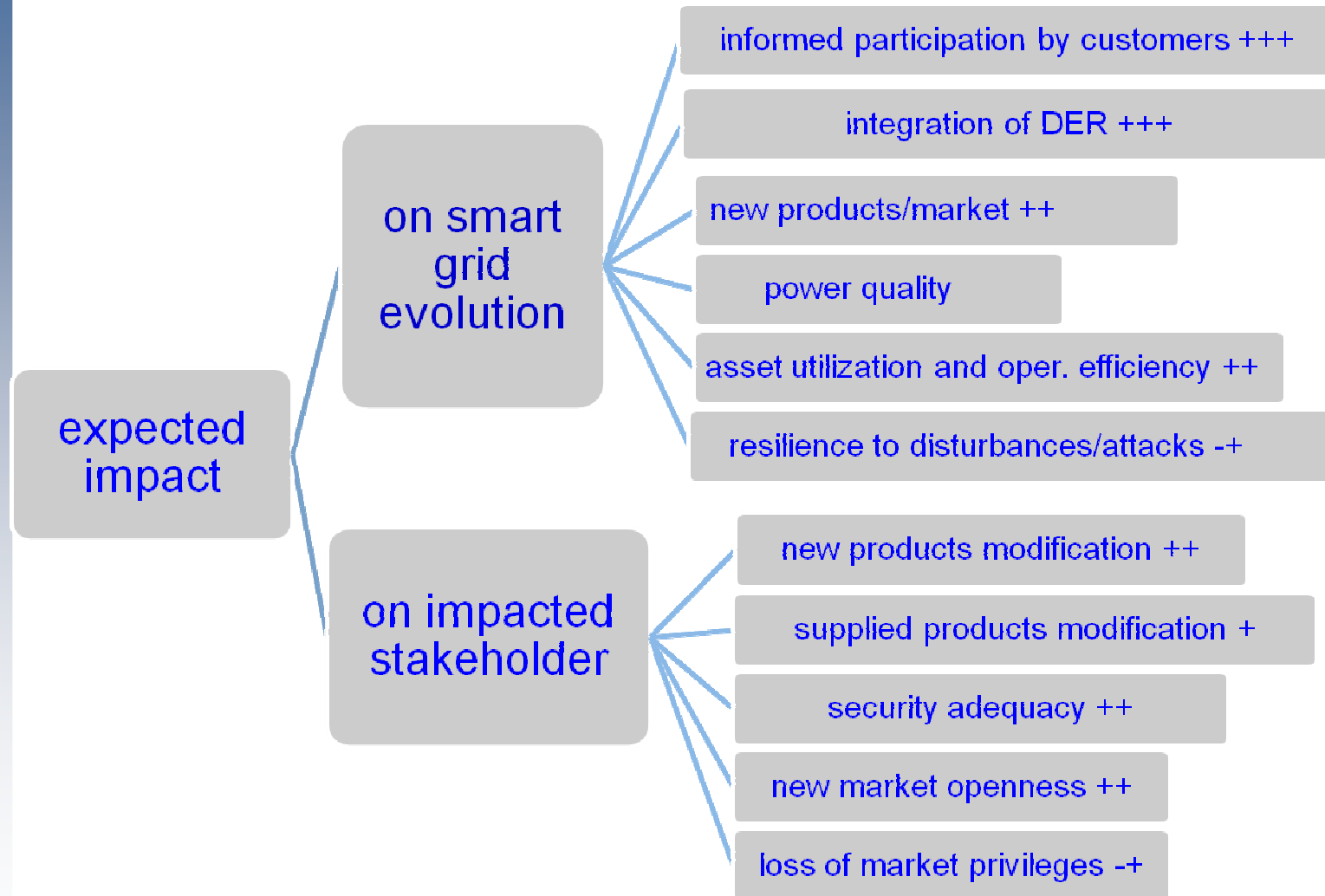
- Short term (2020)

- Medium term (2030)

- Long term (2050)



# Expected impact





# SEES-WP2-002

## ■ Enhance communication redundancy

- Mission-critical applications
  - => automatic alternative communication routing QoS
- Communication protocol prioritizing mission-critical functions
- Existing standards TCP/IP, IEC 60870-5-104 support automatic alternative communication routing



# SEES-WP2-003

## ■ Ensure information security

- Well-established security objectives must be assured
  - privacy
  - integrity
  - availability
  - non-repudiation and confidentiality
- Review, adapt & enhance standards  
=> security across wireless and wired connections
- Developed standards should consider security aspects
- Awareness of new risks & threats



# SEES-WP2-004

## ■ Interconnect local and wide area systems

- WAMS adapted to properties of LV & MV networks
- Utilization of smart meter data & infrastructure for:
  - data concentration
  - meter data management systems
  - control applications
- WAMS already used by TSOs  
=> extended to DSOs with modifications



## SEES-WP2-005

### ■ Map interdependencies and decrease vulnerabilities

- Resilient communication system  
=> mapping communication & electricity infrastructure interdependencies
- Impact of the interdependency  
-> thoroughly investigated and analyzed
- Developing solutions to decrease vulnerabilities  
=> simulation & testing in real time  
=> knowing the impact and implications of communication failures, h/w / IEDs , data acquisition



# DESIGNING, DEVELOPING AND VALIDATING THE INTELLIGENT INTRA-GRID APPLICATIONS WITH THE HELP OF ICT



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## SEES-WP2-006

### ■ Incorporate additional actuators and sensors for improved controllability

- Additional sensors and control knobs  
=> increased controllability of distribution system
- Installed h/w components improve controllability
  - installed near load, DG and EV charging stations
  - e.g. fault indicator - a control knob - for adaptive protection
- Retrofitting existing components instead of replacing  
=> curbing the cost





# SEES-WP2-007

## ■ Research control and exchange information

- Research on control paradigms
  - central, distributed & coordinated control
- Active participation by all stakeholders
  - in innovative voltage control, power flow management etc

- TSOs & DSOs must exchange information

=> improve coordination in mutually affecting activities

=> maintain a safe, reliable and stable system

- power flow management, voltage control, alarm surveillance & fault management
- Interoperability extended beyond distributed generation
  - transmission & bulk generation



# SEES-WP2-008

## ■ Research models for data exchange

- common descriptive and validated exchange of distribution network and DER models & their control information is necessary
  - similar to CIM
- exchange, validate and interface models  
=> reuse and evolving intra-grid applications
- e.g.
  - CIM for Dynamics (models at transmission level)
  - CDPSM (Common Distribution Power System Model)



## SEES-WP2-009

### ■ Shift from passive to active systems by incentivizing DGs

- Appropriate framework & incentives for DG to provide a range of ancillary services
  - e.g. voltage-reactive power control
- Analysis on impact of DG and high-power charging of EV on reliability & stability
- Incentivizing ancillary services provided by DGs



# **FACILITATING THE TAKE-UP OF ICT INFRASTRUCTURE AND APPLICATIONS FOR INTRA-GRID CONTROL APPLICATIONS IN SMART GRID BY SHAPING THE CONTEXT**





# SEES-WP2-010

## ■ Go for unified open standards

- Harmonization of standards
  - speeding up standardization process
  - be compatible with smart grid concepts
- E.g.
  - M441, M468 standardization mandate -> open architecture for utility meters
  - M490 standardization mandate -> deployment of smart grid
- Inform stakeholders
  - about capabilities, benefits and limits of standards
- Collaboration between standardization organizations
  - > necessary for having unified open standards



# SEES-WP2-011

## ■ Take a security mindset

- Specify set of security controls in all ICT to protect smart grid needs
  - e.g. perimeter security, access control, security standards, security of physical HW
- Provide common definitions within the smart grid community including the terms “security” & “critical asset”
- Provide common control system security policies or procedures
- Groups such as ISA, NIST and IEC TC57 are working on generic policies & procedures



## SEES-WP2-012

### ■ Enhance cooperation and increase funding for research

- Common standard format for exchange of network data models & simulation model data (e.g. based on CIM) -> enhance collaboration between research institutes
  - e.g. co-simulation of electrical and communication network
- Cooperation of TSOs and DSOs - focus on bi-directional electricity flows
- Co-operation among EU regions and various stakeholders to provide sufficient funding for fundamental research



# SEES-WP2-013

## ■ Benchmarking

- Benchmark existing best practices with considerable DG  
-> benchmark for new approaches
- ICT energy efficient itself -> energy efficiency in computing & networking
- Regional and national demonstrations -> creating interest & provide political & economic stimuli
- Reference models and validated systems
- Developed algorithms should be based on standards, implementations or benchmark models





## SEES-WP2-014

### ■ Ensure adequate market context and regulatory framework

- Regulatory framework
  - > create sufficient motivation for fostering market
- Cooperation between various stakeholders
  - > Adequate market context
    - e.g. exchange information between TSOs and DSOs
- Achievable by incentivizing certain aspects of electricity
  - e.g. quality of electricity sold to consumer



# SEES-WP2-015

## ■ Educate

- Consumer education to create sufficient interest & motivation -> actively participate in energy market
- Educate various stakeholders to actively participate in energy market
  - updated progress and innovations, especially use of standards for interoperability
- Educating stakeholders via all possible communication media
  - consumers, TSOs, DSOs, ESCOs, energy providers etc
  - education and training of technical staff
- Two level dissemination of project results:
  - basic for electricity consumers and higher level for grid operators



# SEES-WP2-016

## ■ Strengthen research infrastructure

- Research infrastructures => to develop new methods and control strategies
- Research infrastructures - investigated and validated reality set-ups
  - hardware-in-the-loop, real-time, multi-agent simulation environments
- Realize bigger virtual test facilities and enable multiple co-simulation environments => apply open standards based on open source technologies
- Realize set-ups and virtual test facilities -> strengthening research infrastructure



**Thank you**

**Questions?**



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