

# Integrated ICT-platform for Distributed Control in Electricity Grids

Koen Kok, ECN

Luc Hamilton, EnS

Hans Akkermans, EnS



INTEGRAL

# The **INTEGRAL** project: Active Distribution Grids for DER Integration

How?



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# How to integrate DER?



Success of DER integration depends on:

1. *Aggregation*
  - Dynamic real-time context
  - Cells, micro-grids, virtual power plants
2. *Integration* of these DER aggregations into
  - Local distribution grid operations
  - Higher-level grid operations
  - Power trading
3. *Availability* of
  - Practical aggregation mechanisms
  - Low-cost and industry-quality, **standard** solutions

# Active Distribution Networks



## Operational Stages:

- Normal operation
  - Trading optimization (Supplier)
  - Grid operation optimization (DSO)
  - Prosumer local optimization (End-customer)
- Critical operation
  - Maintain local stability
  - Support stability higher-level grid
- Emergency
  - Self-healing reaction to local faults
  - Micro-grid Islanding mode

# ICT Systems for DER Clustering & Aggregation



## Requirements:

- Scalability:
  - Large number of DER components
  - Spread over a large area
  - Centralized control reaches complexity limits
- Openness:
  - DER units can connect and disconnect at will
  - All (future) DER types must be able to connect
- Multi-actor interaction:
  - Balancing of stakes: Locally and globally
  - Coordination exceeding ownership boundaries
  - Decide locally on local issues.
- Align with Liberalized Energy Markets

**Multi-Agent  
Systems  
(MAS)**

**Distributed  
Control &  
Intelligence**

**Electronic  
Markets**

# The **INTEGRAL** project: Scalable ICT platform for distributed control

Industry-Quality

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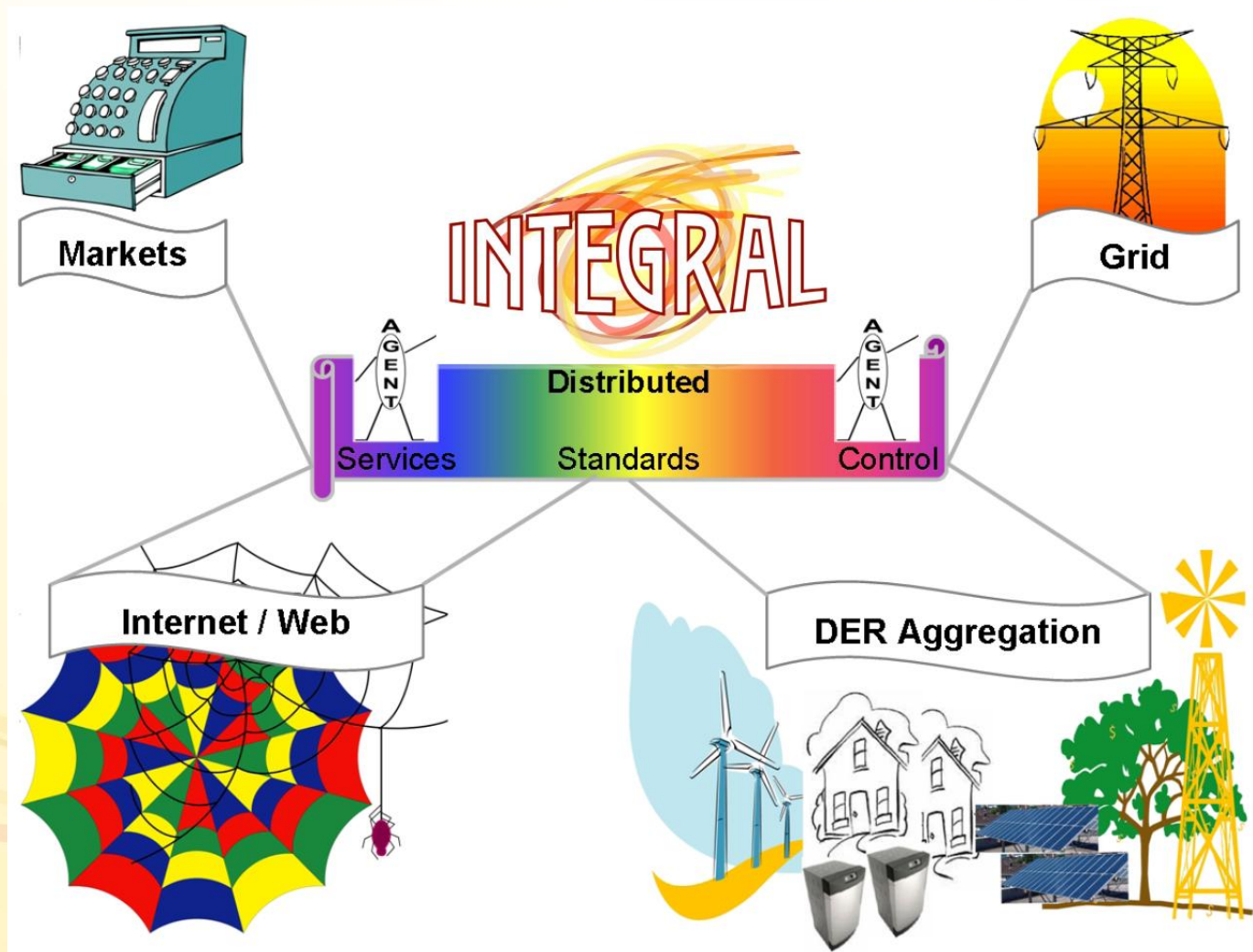


# Integrating Cutting-edge EU R&D:



- **PowerMatcher** distributed control (Crisp, Fenix)
- Micro-Grid control (Microgrids, More Microgrids)
- Self-healing grids (Crisp)

# Integrated ICT-platform based Distributed Control (IIDC)

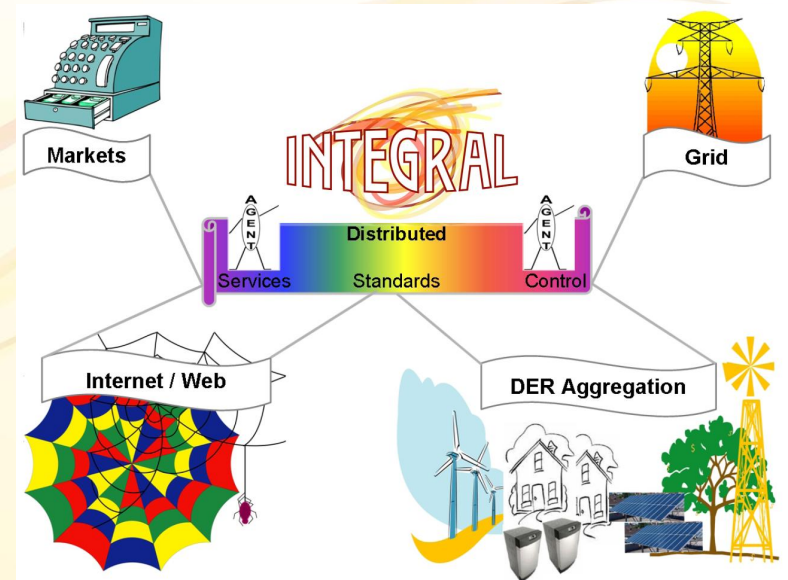




# Integrated ICT-platform based Distributed Control (IIDC)



- Industry-Quality
- Commonly-available ICT components and standards
- Service-centric Information Architecture



# The **INTEGRAL** project: Field demonstrations

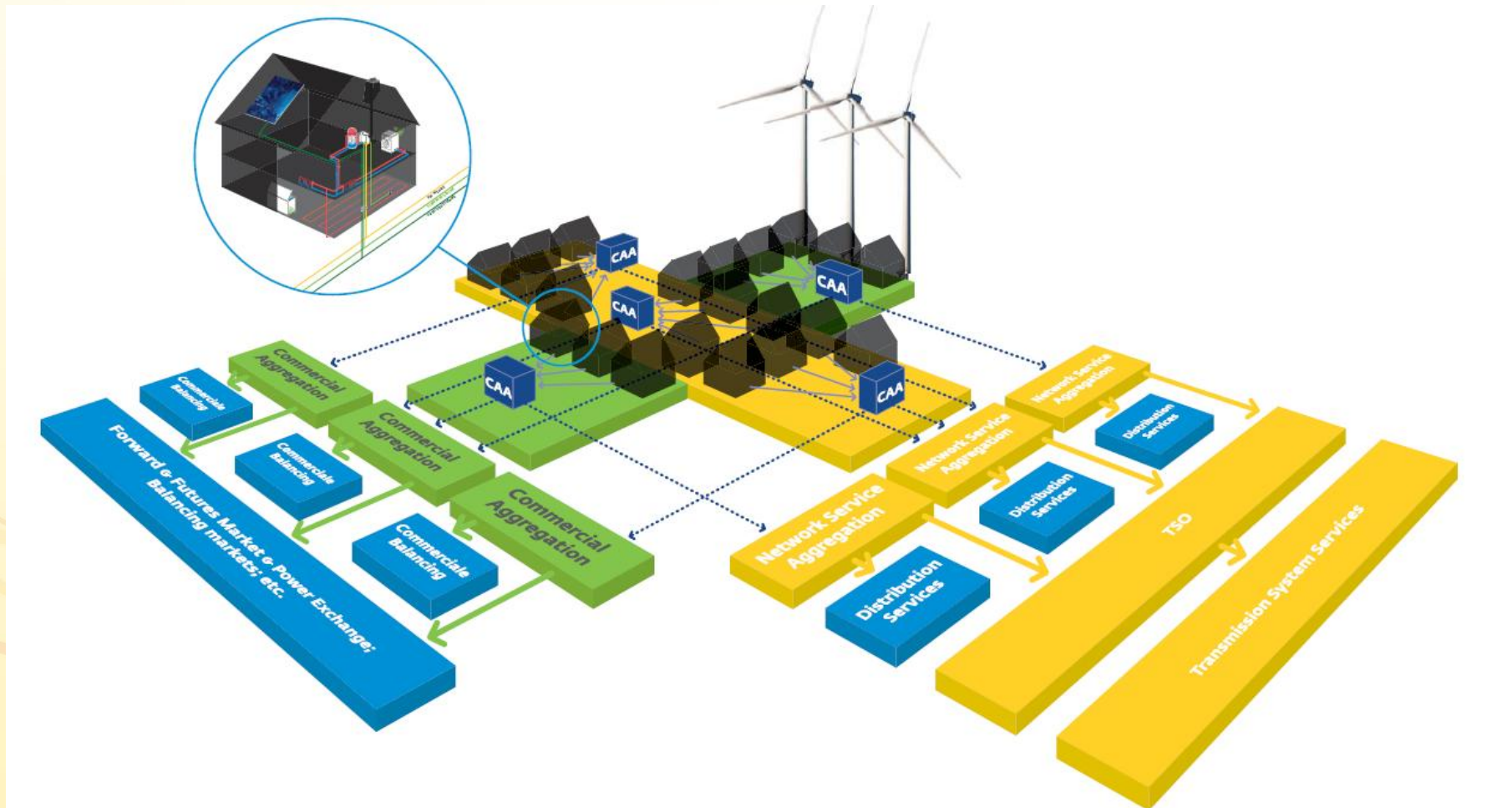
Practical Validity

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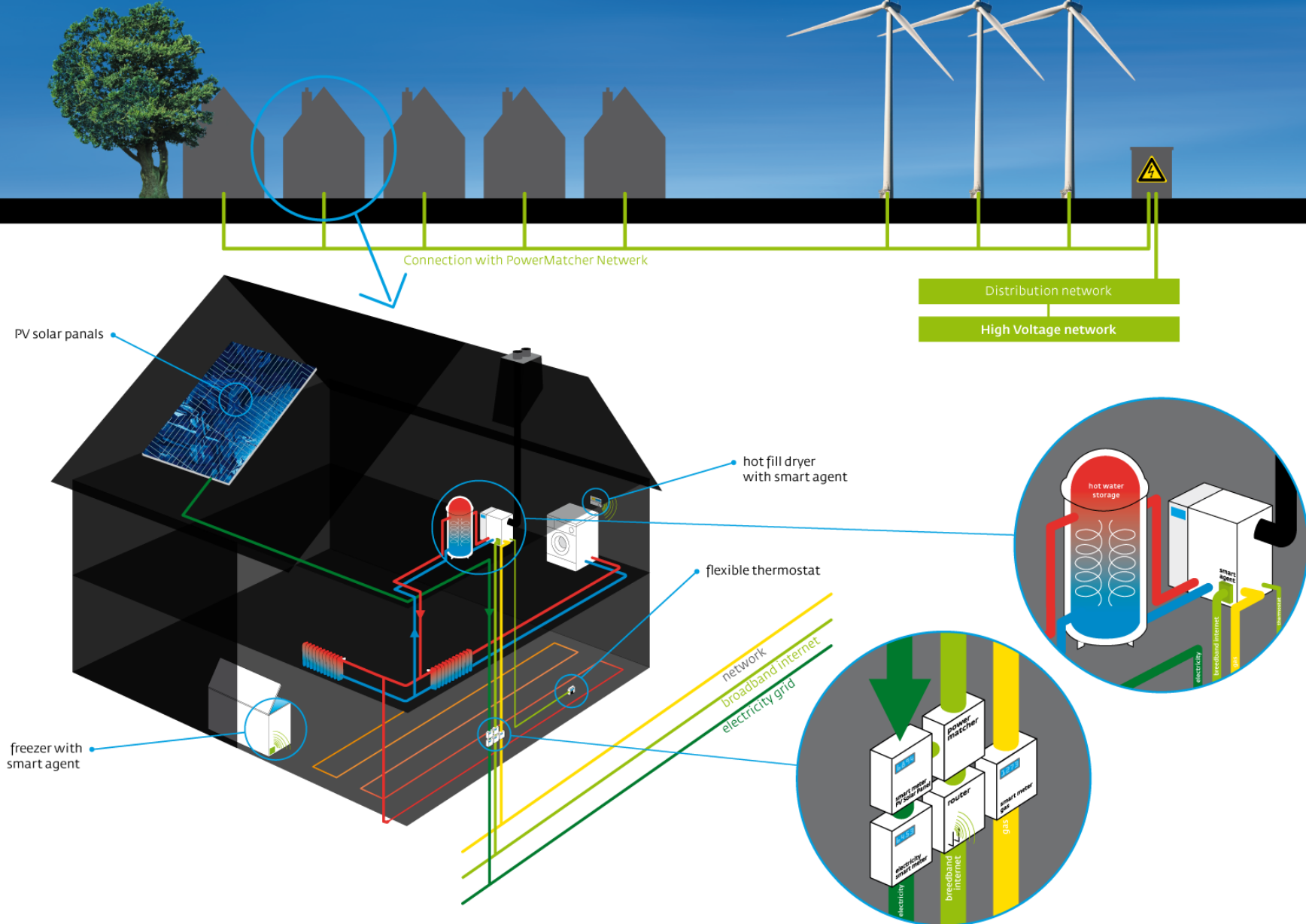
# Field test A: Normal operation & Commercial balancing



- NL: 100 DER/RES devices in 60 family houses, run as VPP



# Smart Homes: Maximize Rol

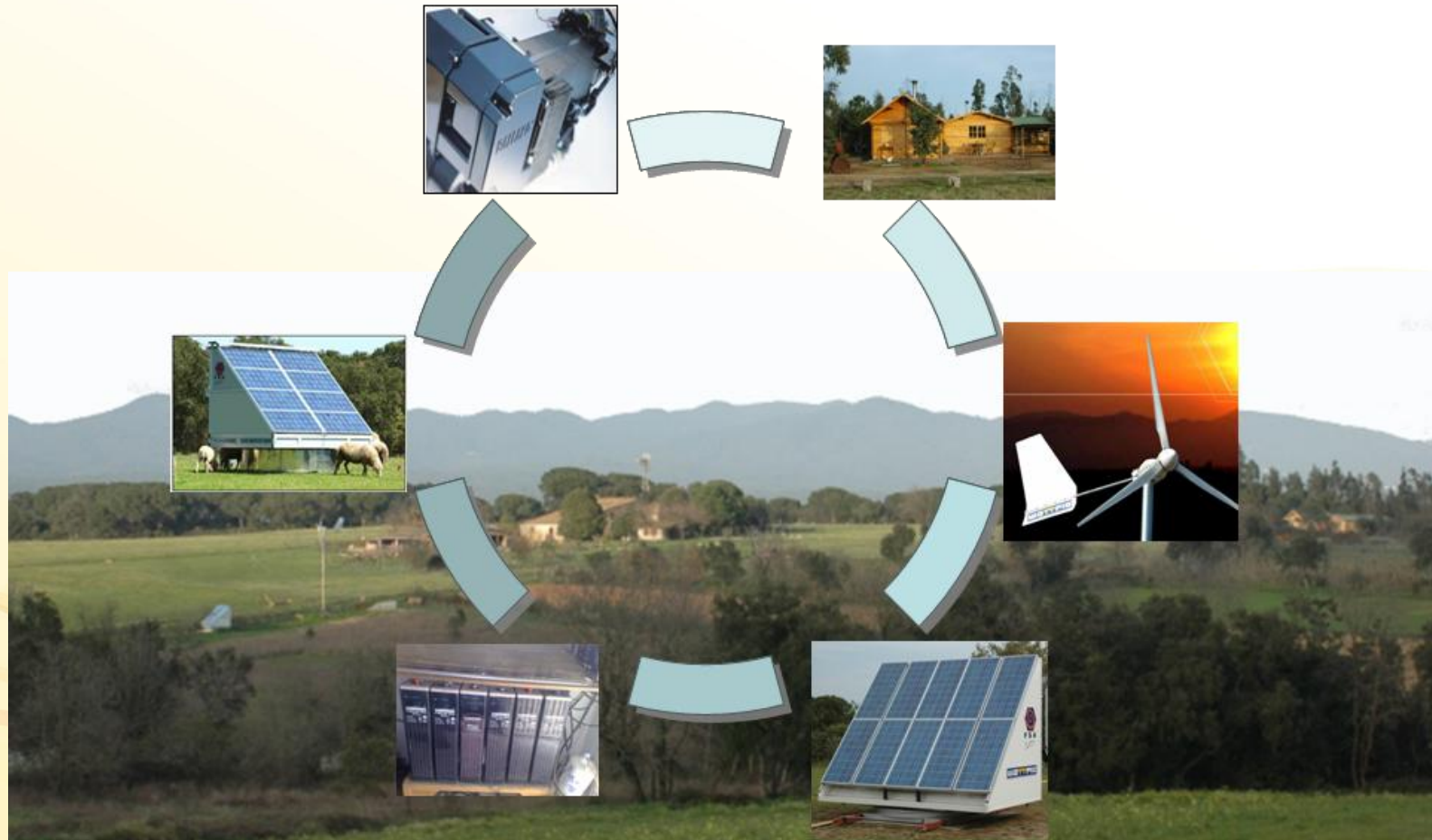




# Field test B: Grid stability under critical conditions



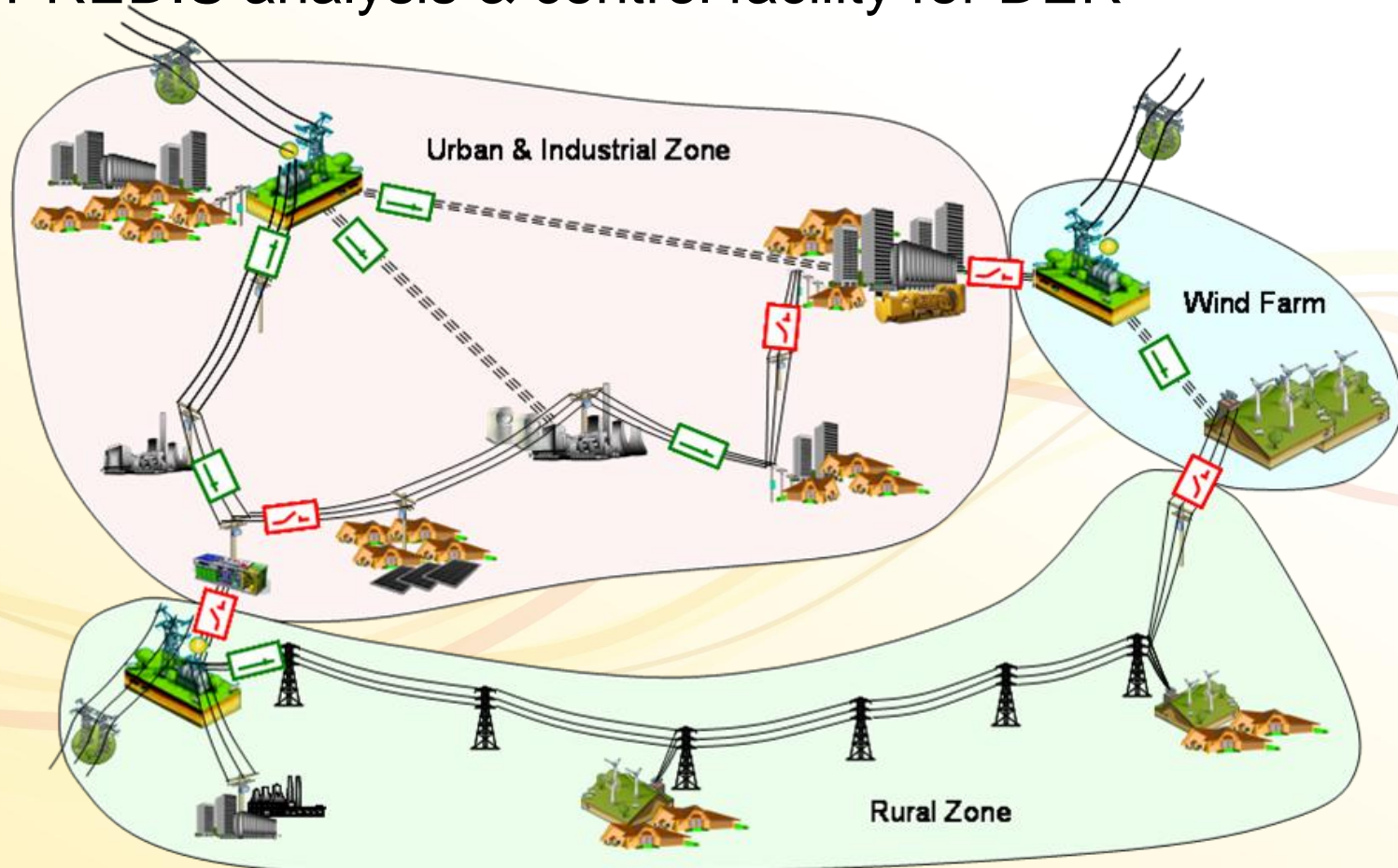
- ES/GR: extended microgrid with variety of DER devices



# Field test C: Emergency conditions & Self-healing capabilities



- F: Grenoble DER, Urban/industrial, Rural grid cells, + PREDIS analysis & control facility for DER





# The **INTEGRAL** project: Lessons learned and practical guidelines

Under Construction!

Watch: [www.integral-eu.com](http://www.integral-eu.com)

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# The INTEGRAL Project



- Who?



# The INTEGRAL Project



When?

- Soon available:
  - High Level Specification
- First half 2009
  - Field test roll-out start
- Early 2010:
  - Evaluation of the Results & Lessons learned
- End 2010: Practical Guidelines:
  - Reference ICT architecture
  - Reference Information Model

# Conclusions



- A common ICT Framework for active distribution is needed
- INTEGRAL is going to fulfill this need