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The FlexiBEL project
Introduction, October 30th 2008 Amsterdam

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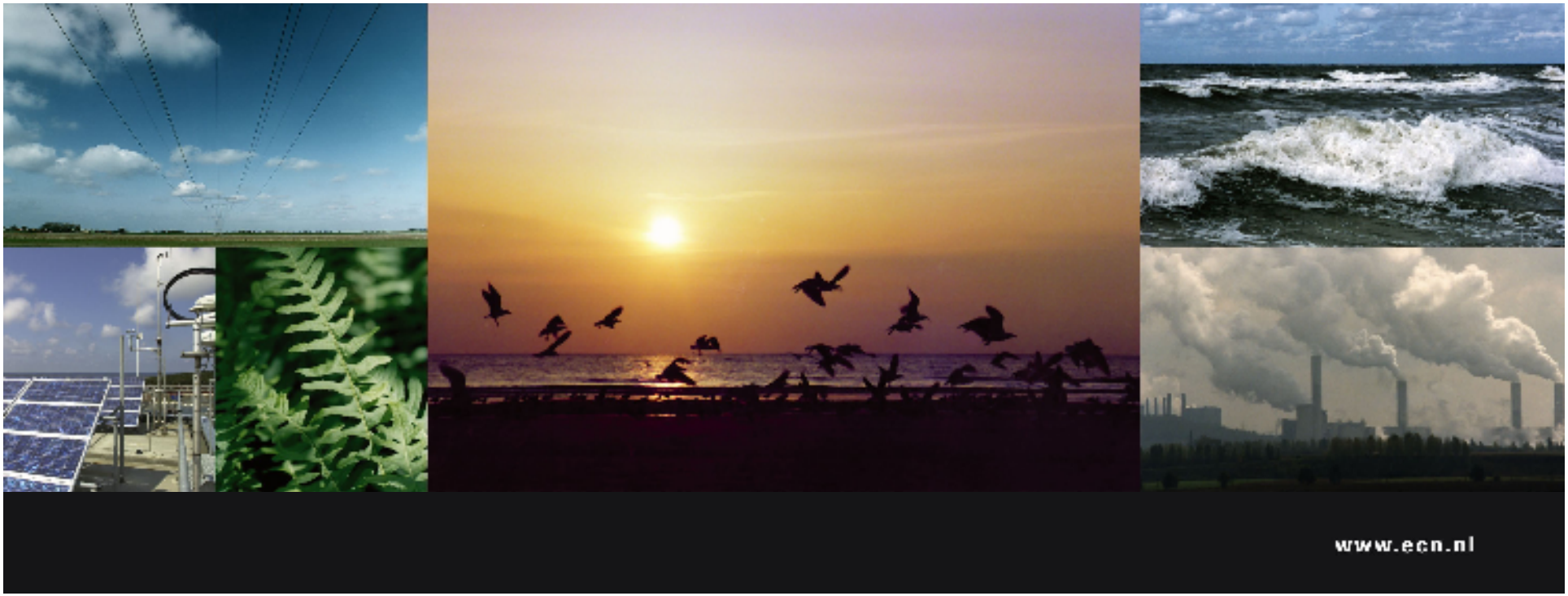


Context: Transition to increasing percentage of renewables

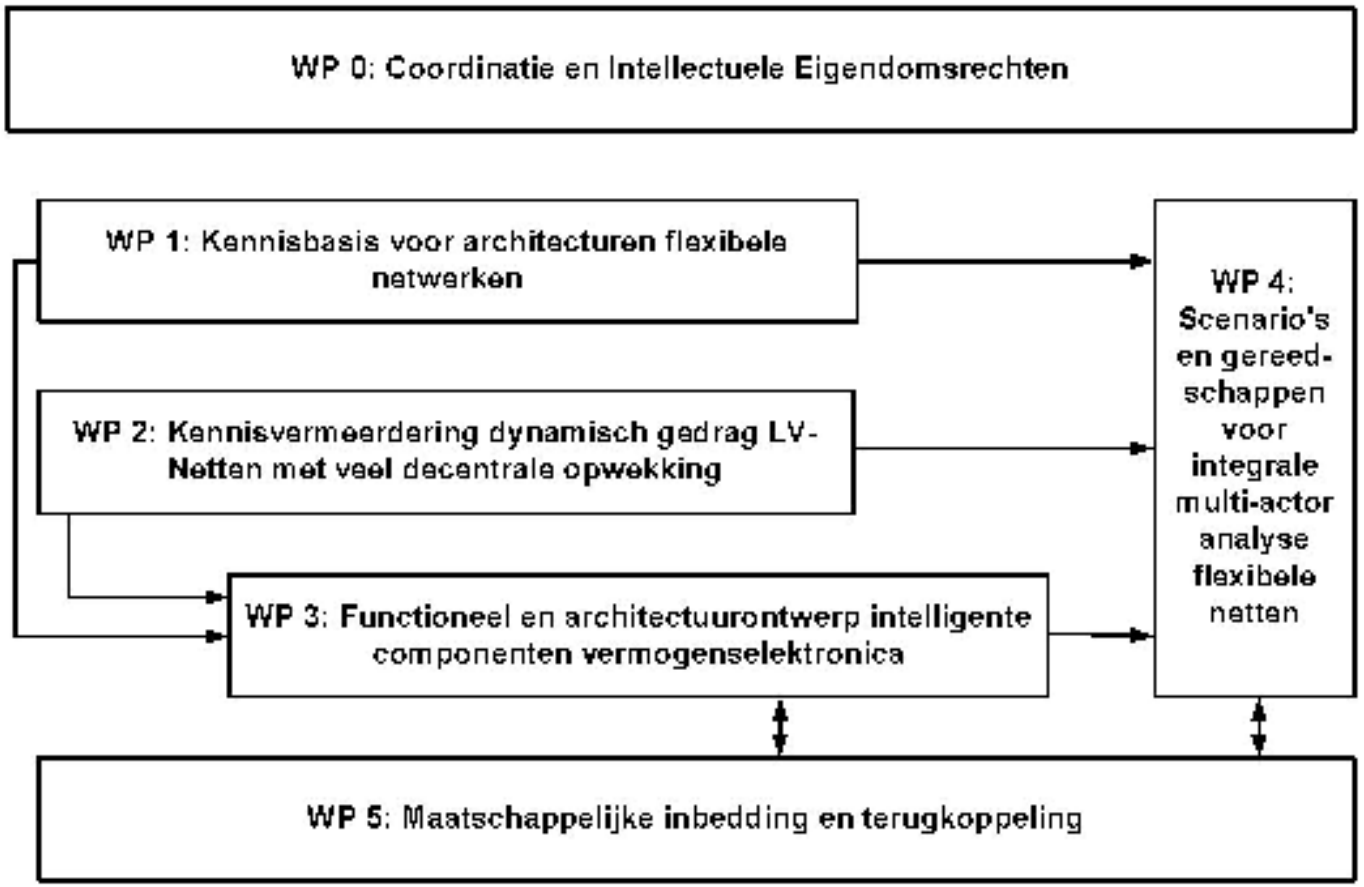
% of Generation	≤ 2%	≤ 10%	≤ 25%	100%
Grid Penetration Scenarios	I. Low-numbers and level of DER with relatively stiff grid connection	II. Moderate-level of DER with relatively soft grid connection	III. High-level of DER with capacity of grid less than the load demand	IV. DER operates part time as an island or micro-grid
DER Impact and its Role in the Grid	Very low, not significant to grid operation	Non critical, can affect distribution voltage near DG	Critical to power delivery and meeting demand	Primary power source for stand alone operation
Interconnection and Integration Objectives	Non interference, good citizen and compatible	Manage any local distribution impacts	Engage DER for system operations and control	Rely on DER for stability and regulation
Rules/Standard Operating Procedures	IEEE 1547-2003 current practice radial feeders	Modified 1547, add network and penetration limits	New rules include operation and grid support requirement	Standalone rules that are system dependent
Main Concerns with-respect-to system dynamic grid impacts	- Voltage and current trip limits, - Response to faults - Synchronization	- Interfere with regulation, - Recovery times, - Islanding - Coordination.	- Availability - Regulation provided - Ramping response - Interactions of machine controls	- Availability - Load following - Voltage control - Normal and reserve capacity

……Transitions On- and Off-Grid……

Context: Automated/ Smart / Intelligent grids

- Intelligent meter discussion (Europe wide)
- Expected rollout of co-generation (Stirling, Fuel Cell), heat pumps and storage
- Home networks, domotics and residential gateways
- SCADA-standard discussions
- ICT facilitates
  - .NET/Java architectures; embedding of software
  - WWW- Distributed computing models e.g. SOA (service oriented architecture), semantic WEB and SAAS-(software as a service) deployment
- Mobile device technology (Zigbee, ZWave); communication is becoming cheaper and more energy efficient

Structure of the project:
FLEXibele elektriciteitsnetten voor de Integratie van duurzame Bronnen van ElektriciteitsLevering



Work packages

- WP 0: Coördinatie en IP Rechten
- WP 1: Kennisbasis voor architecturen flexibele stroomnetwerken
- WP 2: Kennisvermeerdering dynamisch gedrag E-netten met hoog percentage DG
- WP3: Functioneel en architectuurontwerp intelligente vermogenscomponenten
- WP4: Scenario's en gereedschappen voor integrale multi-actor impact analyse van flexibele netten
- WP5: Maatschappelijke inbedding en terugkoppeling

Partners

FlexiBEL www.flexible-electricity-networks.nl

- Looptijd: medio 2005 - 28 feb. 2009
- Deliverables:
  - R 0.1: Eindrapport Flexibel
  - R1: Inventarisatie architecturen flexibel elektriciteitsnetwerken
  - R2.1 Netstabiliteit in DG-netten.
  - R2.2 Harmonische vervorming: metingen, modellen en simulatie
  - R2.3 Analyse en aanbevelingen
  - R3.1 Eisen vermogenselektronica
  - R3.2 Algemeen architectuurontwerp
  - R3.3 Detail ontwerpen interfaces
  - R3.4 Aanbevelingen architectuur
  - R4.1 Tussenrapportage Flexnet-studies
  - R4.2 Eindrapportage Flexnet-studies
  - R5.1: Maatschappelijke inbeddingsanalyse van 4 scenario's
- Conference presentations
  - CIRED-2007, Vienna, 4 papers
  - ISup-2008, Brugge
  - IEEE-PES-2008, July, Pittsburg General Meeting, two papers
  - IEEE-ICIS-2008, 10-12 November, Rotterdam