

Energie: changeons d'ère !

*Paris, November 20, 2008, round table 3:
Integrating Renewable Electricity into the Grid*

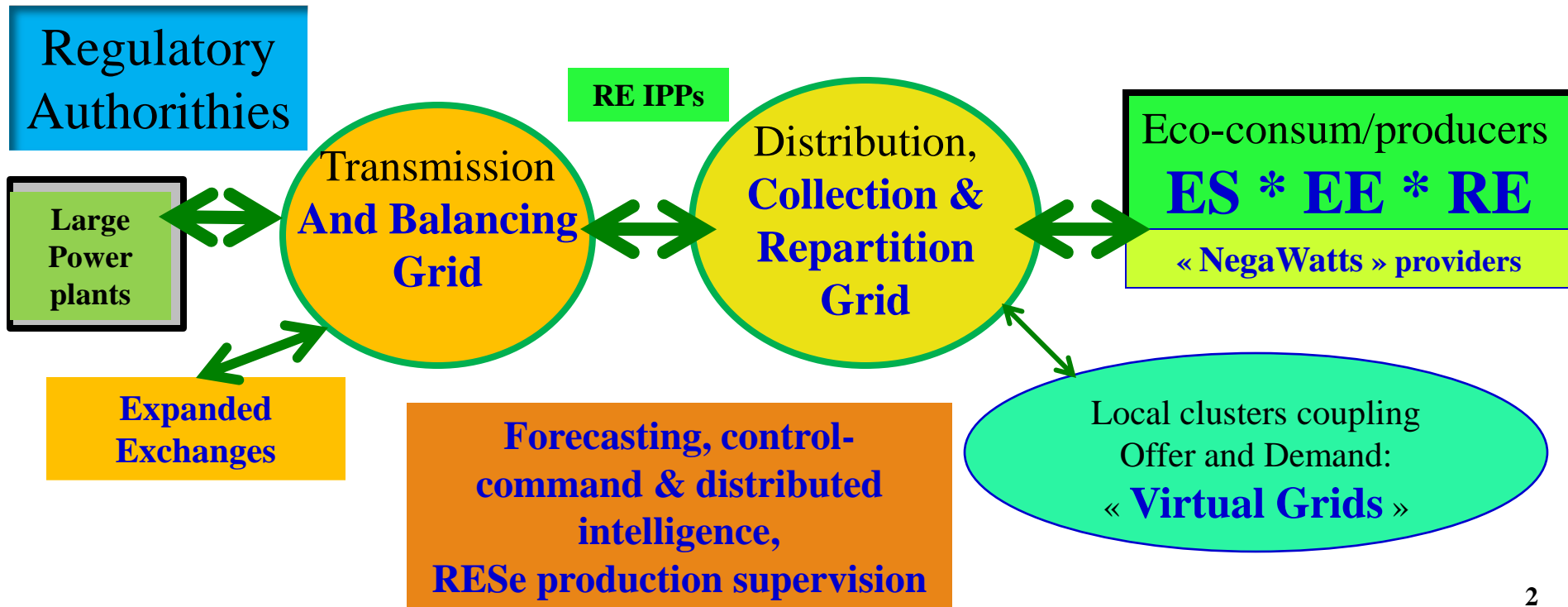
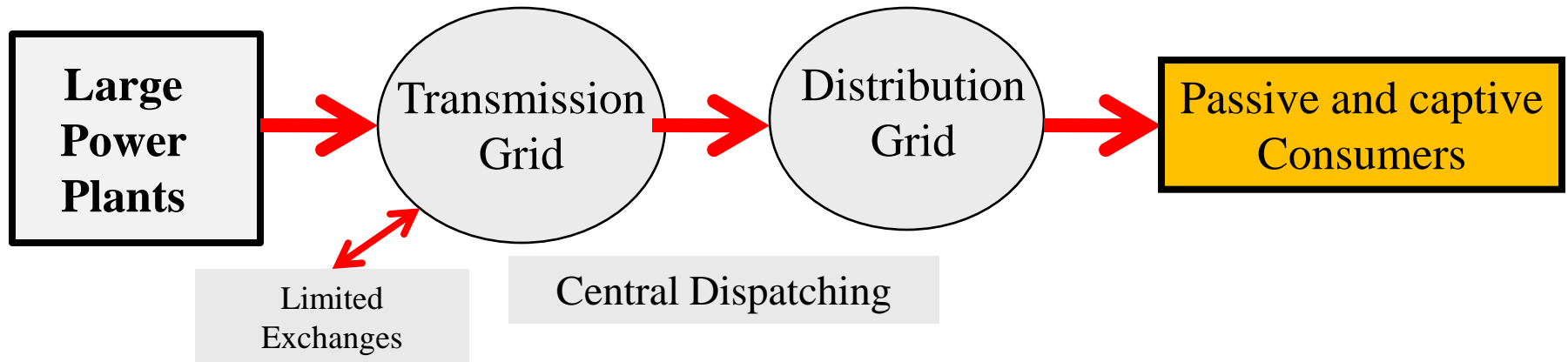
**Towards High Penetration Rates of
Renewable Electricity: Solutions,
Results of Experience**

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From the XXth to the XXIst century for Electricity



100 % Renewable electricity has already been demonstrated

❑ **At the beginning of rural electrification: sometimes 100 % from renewables !**

⇒ France: many times **100 % by hydropower**

⇒ Denmark: wind power already used for rural electrification

❑ **Today examples: (without being comprehensive):**

⇒ DRE in China from village SHP: **200 Million inhabitants**

⇒ 98 % RESe (hydropower) in Europe: **Norway**

⇒ 98 % RESe in developing countries: (hydropower): **Ethiopia**

⇒ **Islands:**

¶ Samsø (Denmark): **> 100 % RESe**

¶ Cabo Verde: one island soon **being 100 % RESe: by wind power and a dedicated pumped-storage power plant**

❑ **Yes, of course, BUT, BUT, BUT, BUT, BUT...**

Towards 100 % RESe everywhere ? A mix of solutions

- ❑ **Back to basics: act as much on demand than on offer**
 - ⇒ Incentives to use synergies **Sufficiency * Efficiency * RE**
- ❑ **Coupling and adapting offer and demand**
 - ⇒ At consumer / producer level: PV roofs, CHP...
 - ⇒ At local level clusters : « Virtual local grids »
 - ⇒ Coupling models and monitoring of offer & demand to the meteorological and RE resources models: solar, wind, hydro, bioenergy
- ❑ **Benefiting from mixing RES, neighboring grids, countries**
- ❑ **Storage:**
 - ⇒ **Pumped-storage** → electrical vehicles → ...
 - ⇒ German BWE August 2008: target 150 TWh wind in 2020:
 - ¶ « Vehicles to grid »: 10 Millions EV = 30 TWh/year = 6 % elec. demand
 - ¶ 10 KW plug: charging 2 h, 22 available → **100 GW of balancing power**

A qualitative change: the «Kombikraftwerk» experiment

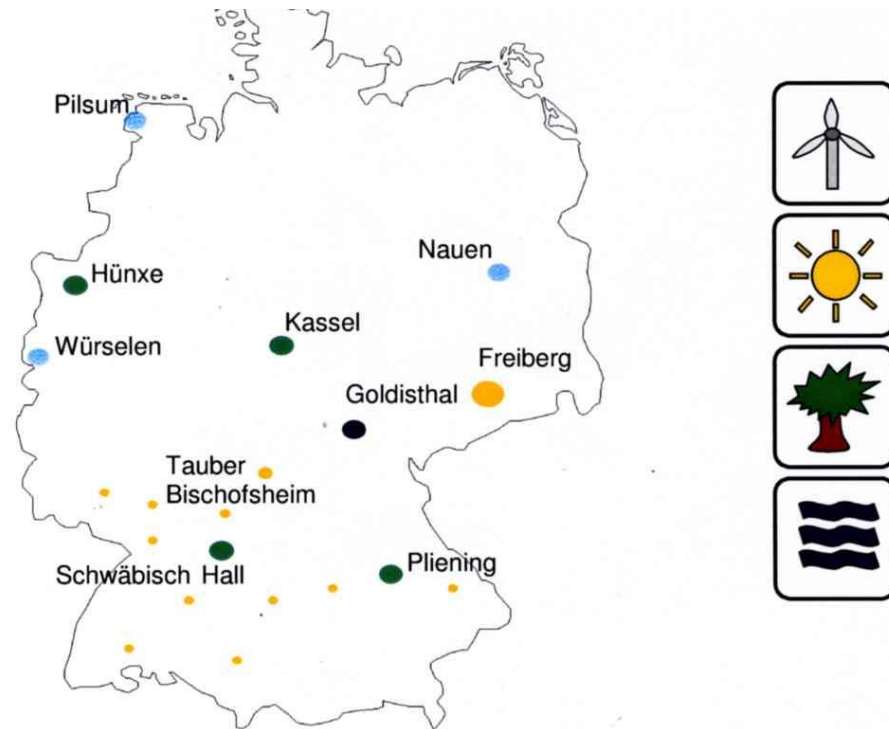
□ **Origin:**

- ⇒ Preparation of the German Energy and Climate plan in 2006-07
- ⇒ Initiative from ENERCON, Q-CELLS, SCHMACK-BIOGAS:
- ⇒ Fast implementation of a demonstration program :
 - ¶ Putting together existing RE power plants: wind power, PV, CHP biogas
 - ¶ Production = « 1/10 000 of German demand»
 - ¶ Taking into account 1 MW of virtual hydro pumped-storage
 - ¶ ISET Kassel : in charge of central control & command of those RE plants
 - ¶ **Simulation on an complete year and verification of 100 % RESe**

□ **Results presented in October 2007: the challenge has been met successfully!**

100 % RESe simulated : « Kombikraftwerk » experiment (1)

- ❑ Wind: 12.6 MW; PV: 5.5 MW; Biogas: 4 MW; 1MW Pump-Stor.
- ❑ Total : 43.5 GWh/year, 61 % wind, 15 % PV, 24 % biogas



ENERCON
ENERGIE FÜR DIE WELT

Schmack
Biogas AG

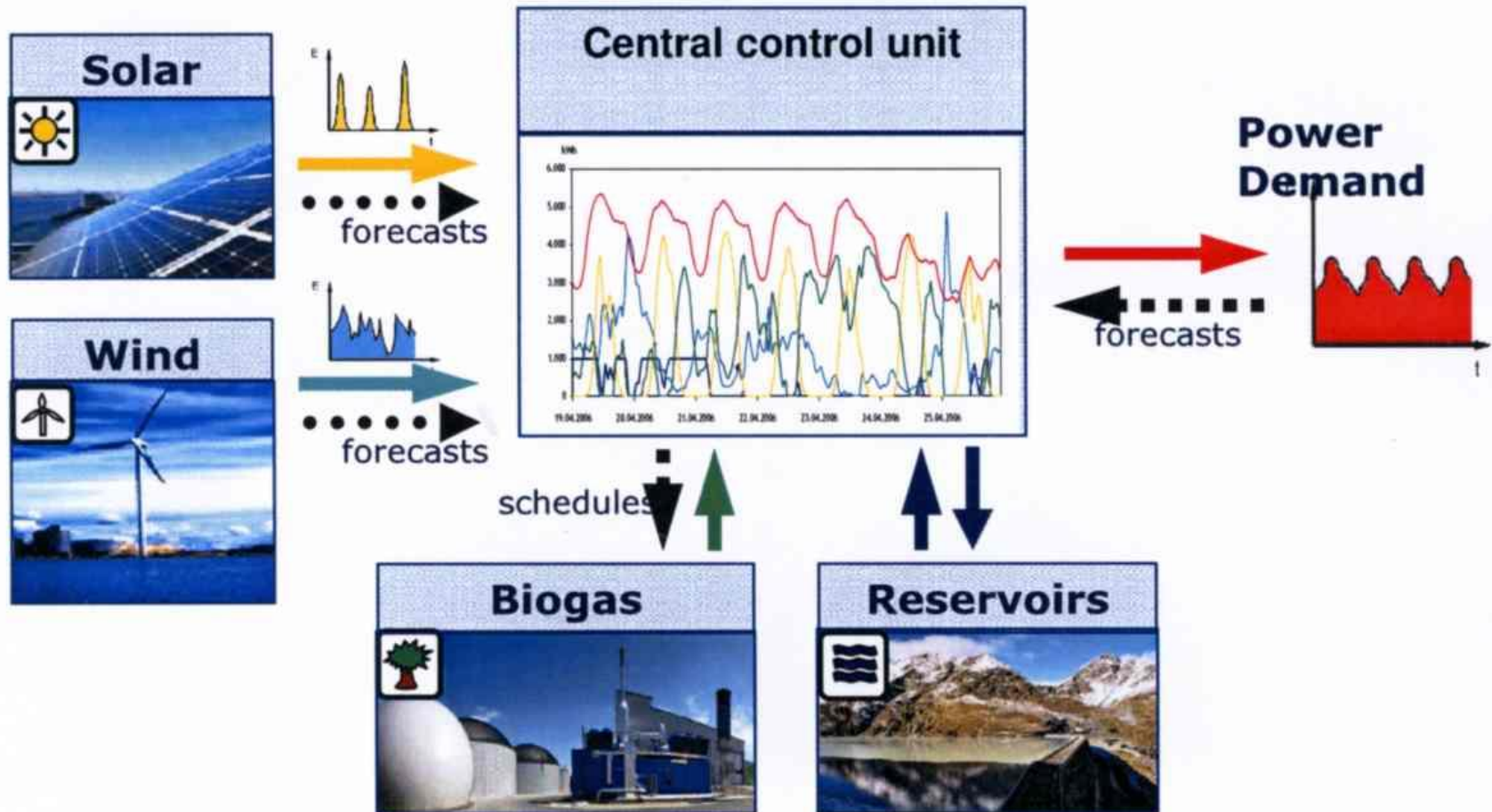
SOLARWORLD

ISET

**ERNEUERBARE
ENERGIEN**

Kombikraftwerk: almost 100 % verified in real time on one year

Combined Power Plant



- ❑ Possible potential to add: DSM (kW and kWh), Hydro, offshore wind, solid biomass, geothermal power, ocean energy

Provisional Conclusions

- ❑ **A reasonable optimism to achieve high rates of RESe**
 - ⇒ Potential and preliminary strong impact of combining ES * EE
 - ⇒ A mix of already available solutions
 - ⇒ Already proven solutions in the past and nowadays
 - ⇒ «Possible surplus of RESe» → **Think large and far** for new application of electricity: electrical vehicles, heat pumps...
- ❑ **Strategic impact of the « Kombikraftwerk » experiment**
 - ⇒ A simulation based on actual German demand, without impact of DSM and peak power management
 - ⇒ A simulation based on limited existing RE power plants
 - ⇒ **Already very near 100 % adequate to the demand !**
- ❑ **Necessity to think « large and far » also in France**
- ❑ **→ Accelerate thoughts and et evolution already engaged**