Renewable Energy Network

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RLS-Sciences at the 8th RLS Conference
München, Residenz, July 15th, 2016
1. **Challenges for the World’s Energy economy**
   - Climate change
   - Aging of the global Generation system

2. **Vision: The “Globalisation” of Renewable Energies**
   - Renewables in the partner regions
   - Three key challenges: storage, logistics and integration!

3. **The RLS Renewable Energy Network**
   - The energy networks achievements
   - Further challenges and opportunities

4. **Planned activities**
   - Results of the iSEneC conference
   - The Regional Renewables Alliance
1. Challenges for the World’s Energy economy

- Climate change
- Aging of the global Generation system
1st Challenge: Impact of Global Warming

- Fossile Energy Consumption urgently needs to be substituted with **Renewable Energies**

Quelle: Nasa/Goddard Space Flight Center
2nd Challenge: Age structure of the conventional power plant structure

Deficits due to shutdowns within the next 10 years:
- Germany: 257 TWh (42%)
- France: 360 TWh (66%)

Under construction (gas + coal):
- Germany: approx. + 9 TWh
- France: approx. + 16 TWh

Planned Renewables in Germany („Ausbaukorridor“): + 113 TWh (18%)

Estimated deficit: 500 TWh within the next 10 years?
2nd Challenge: Age structure of the conventional power plant structure

Deficiencies due to shutdowns within the next 10 years:

- Germany: 257 TWh (42%)
- France: 360 TWh (66%)

Under construction (gas + coal):

- Germany: + 9 TWh
- France: + 2 TWh

- Planned Renewables in Germany ("Ausbaukorridor") + 113 TWh (18%, "Ausbaukorridor")
2nd Challenge: Age structure of the conventional power plant structure

Impacts of the liberalization of the energy markets

- Installation of conventional power plants will further decrease due to rising economic risks for investors (fuel costs, public acceptance, low flexibility...)

Renewables currently replace missing capacities

90 GW

Installed capacity in GW

- 4-5 x per year

- Expected shutdowns ca. 5 GW/a
Impact of the Renewable Energy Law in Germany

- German Renewable Energy Law ("EEG") initiated a booming industry…

Challenges

The Vision

The Alliance

Next steps

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Impact of the Renewable Energy Law in Germany

- German Renewable Energy Law ("EEG") initiated a booming industry...
- Wind and PV meanwhile cover (theoretically) more than **90% of Germany's maximum power demand**

**Installed capacity (kW)**

- 4 x
- 30 x
- 29 x

**EEG surpassed all expectations**...

**Installed capacity**

- Wind power: 34.7 GW
- Photovoltaics: 35.9 GW
Impact of the Renewable Energy Law in Germany

- German Renewable Energy Law („EEG“) initiated a booming industry…
- Wind and PV meanwhile cover (theoretically) more than **90% of Germany’s maximum power demand**
- Renewables meanwhile cover up **90% of Germany’s actual power demand**

**EEG surpassed all expectations …**
2. Vision: The “Globalisation” of Renewable Energies

- Renewables in the partner regions
- Three key challenges: storage, logistics and integration!
Power from Wind, PV and Biomass in the partner regions (2004 to 2014)

- Renewables are rapidly rising in particular in Bavaria’s partner regions…

Challenges

The Vision

The Alliance

Next steps

Conclusion

Renewables are rapidly rising in particular in Bavaria’s partner regions…

- Installed capacity in nuclear plant equivalents
Conclusions

1. renewables are meanwhile often competitive and emerge world-wide
The Global renewable energy markets vision

- Renewables are rapidly rising also in Bavarian partner regions…

Challenges

The Vision

The Alliance

Next steps

Conclusion
• Prof. Gilberto Jannuzzi,
• iSEneC, RLS Session, Nürnberg 12.7.2017
• Prof. Gilberto Jannuzzi, São Paolo
• iSEneC, RLS Session, Nürnberg 12.7.2017
The Global renewable energy markets vision

- Renewables are rapidly rising also in Bavaria's partner regions...
- Global renewable energy markets are needed to transfer renewable energy from regions with an excess of natural resources to regions with limited own sources.

Our challenge:
- Storage, transportation and integration of renewable energy
- Biofuels, Substitute Natural Gas, Hydrogen and other Chemicals are particularly important as storage options for other renewable sources
Examples for Second Generation Fuels: Substitute Natural Gas (SNG)

1. Step: Thermal gasification

\[ CH_xO_y + H_2O \xrightarrow{gasification} CO + 3H_2 + CO_2, H_2O, \text{etc.} \]

2. Step: Methanation

\[ CO + 3 \xrightarrow{hydrogenation} CH_4 \]

- Production of synthetic „natural gas“ from biomass ("Methanation")

- Hydrogenation of CO to CH4
Examples for Second Generation Fuels:

- **CO₂** + **4 H₂** → **CH₄** + 2 H₂O + heat
- **CO** + **3 H₂** → **CH₄** + H₂O + heat
- **CO** + **2,2 H₂** → **Biomass-to-Liquid (BtL)** + heat
- **2 CO** + **4 H₂** → **Dimethylether (DME)** + 2 H₂O + heat

**LOHC** + **H₂** → **“synthetic fuels”**

Further examples: hydrogen, alcohols, ammonia...
The Global renewable energy markets vision

Challenges

The Vision

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Next steps

The Global renewable energy markets vision

• Renewables are rapidly rising also in Bavaria's partner regions...

• Global renewable energy markets are needed to transfer renewable energy from regions with an excess of natural resources to regions with limited own sources.

Our objective:

• Exploring and establishing synergies between the partner regions..

• … for a sustainable Globalization of Renewables!
Conclusions

1. Renewables are often competitive and emerge world-wide.

2. World-wide renewable resources have to substitute fossil fuel deliveries to highly populated regions in the medium and long-term.
3. The RLS Renewable Energy Network

- The energy networks achievements
- Further challenges and opportunities
The RLS Renewable Energy Network

- Initiated in 2012 as a follow-up of the RLS meeting in São Paulo
- geographical scope and diversity of the regions provide a wide range of research topics in order to promote synergies and mutual cooperation …

RLS-Partners:

Université Sherbrooke (Québec)
Fonds de recherche du Québec (Nature et technologies) (Québec)
Unicamp, University of Campinas (São Paulo)
Chinese Academy of Sciences (Shandong)
Johannes Kepler Universität Linz (Upper Austria)
Stellenbosch University (Western Cape)
Friedrich-Alexander-Universität Erlangen-Nürnberg (Bavaria)
The RLS Renewable Energy Network

- Initiated in 2012 as a follow-up of the RLS meeting in São Paulo
- geographical scope and diversity of the regions provide a wide range of research topics in order to promote synergies and mutual cooperation …
4. Planned activities

- Results of the iSEneC conference
- The **Regional Renewables Alliance**
The Global renewable energy markets vision

- Renewables are rapidly rising also in Bavarias partner regions…
- Global renewable energy markets are needed to transfer renewable energy from regions with an excess of natural resources to regions with limited own sources.

Our mission:
- establish active partnership on scientific, industrial and governmental level

Challenges
The Vision
The Alliance
Next steps
Conclusion
Joint Research Program for a Regional Renewable Alliance

- joint research project „Regional Renewables Alliance"

Objectives

- Promotion of the global integration of renewable energies
- **Exchange, joint research and training** for the development, evaluation and demonstration of **key technologies**

through transcontinental cooperation at three levels:

- Science and universities
- SMEs and industries
- NGOs and regional associations
Joint Research Program for a Regional Renewable Alliance

- joint research project „Regional Renewables Alliance

Implementation

phase 1:
- Monitoring report and web based science and technology map that describes renewable energy resources, technologies and key players in industries and universities
- Training courses and student exchange

phase 2:
- Regional Renewables Alliance – Master plan
- Work program for transnational demonstration projects 2018

phase 3:
- Preparation transnational Best-Praxis projects 2022
Conclusions

1. renewables are often competitive and emerge world-wide

2. World-wide renewable resources have to substitute fossil fuel deliveries to highly populated regions in the medium and long-term

3. up-coming challenges require transatlantic cooperation on an economic, political and scientific level

Regional Renewables Alliance