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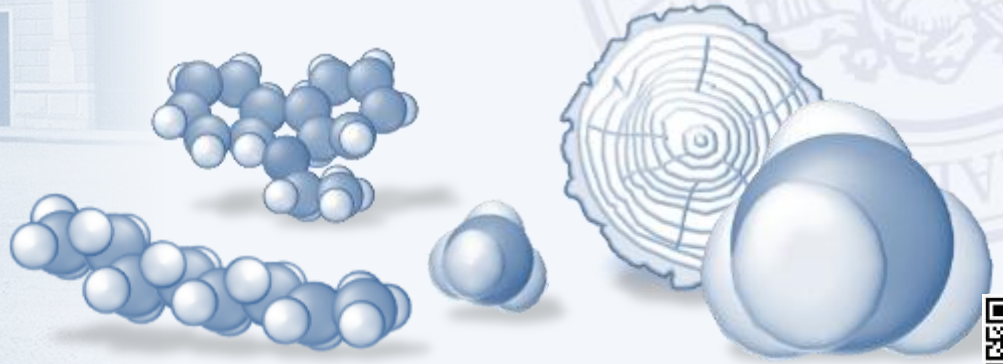
RLS-Sciences at the 8th RLS Conference
München, Residenz, July 15th, 2016

Renewable Energy Network

Jürgen Karl
Chair of Energy Process Engineering
Friedrich-Alexander-Universität
Erlangen-Nürnberg, Germany



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Challenges
The Vision
The Alliance
Next steps
Conclusion

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

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1. Challenges for the World's Energy economy

- Climate change
- Aging of the global Generation system

Folie 3

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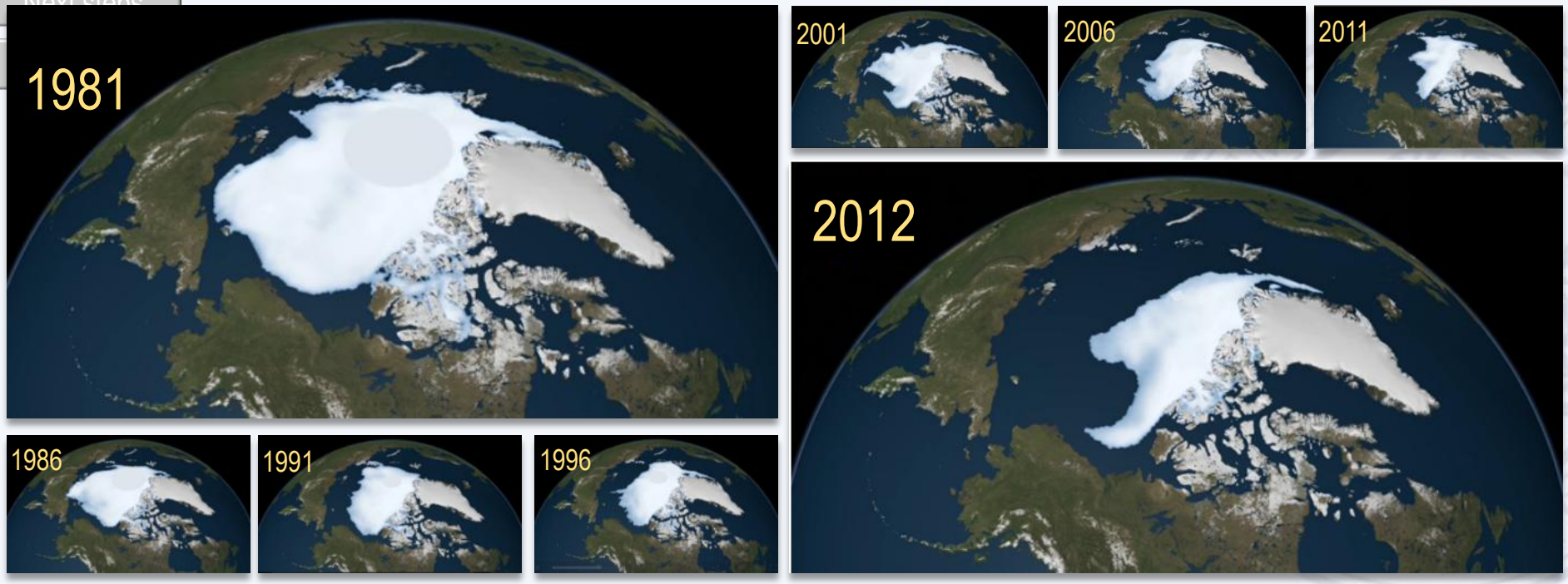
1st Challenge: Impact of Global Warming

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



Quelle: Nasa/Goddard Space Flight Center

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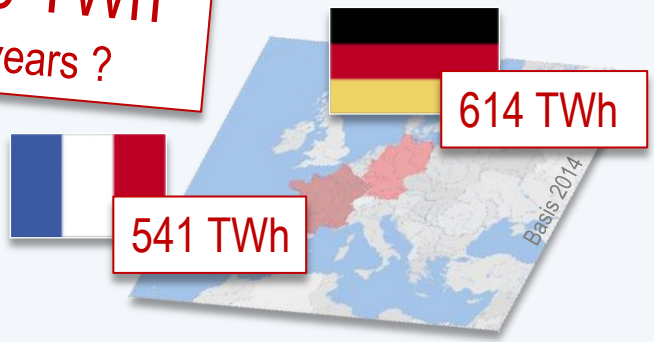
estimated defizit 500 TWh within the next 10 years ?



2nd Challenge:
Age structure of the conventional power plant structure

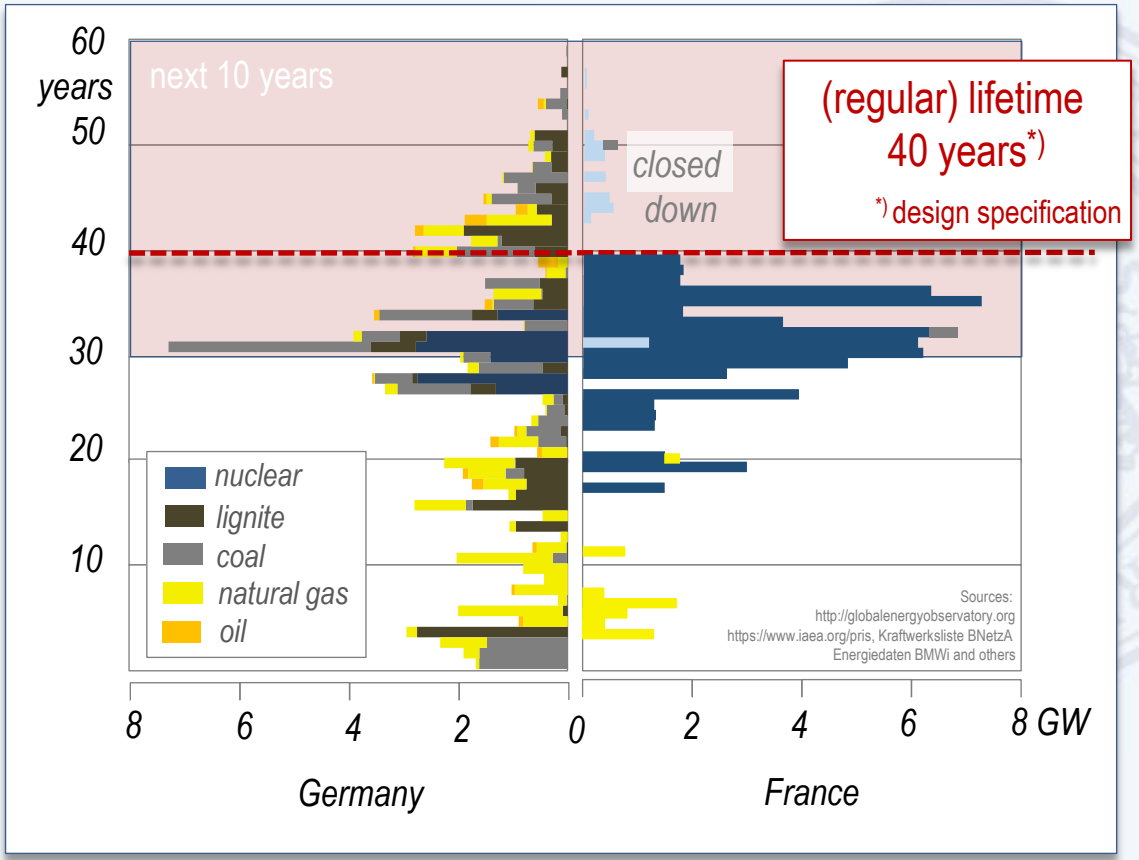
Deficites due to regular shutdowns within the next 10 years:

- 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%)



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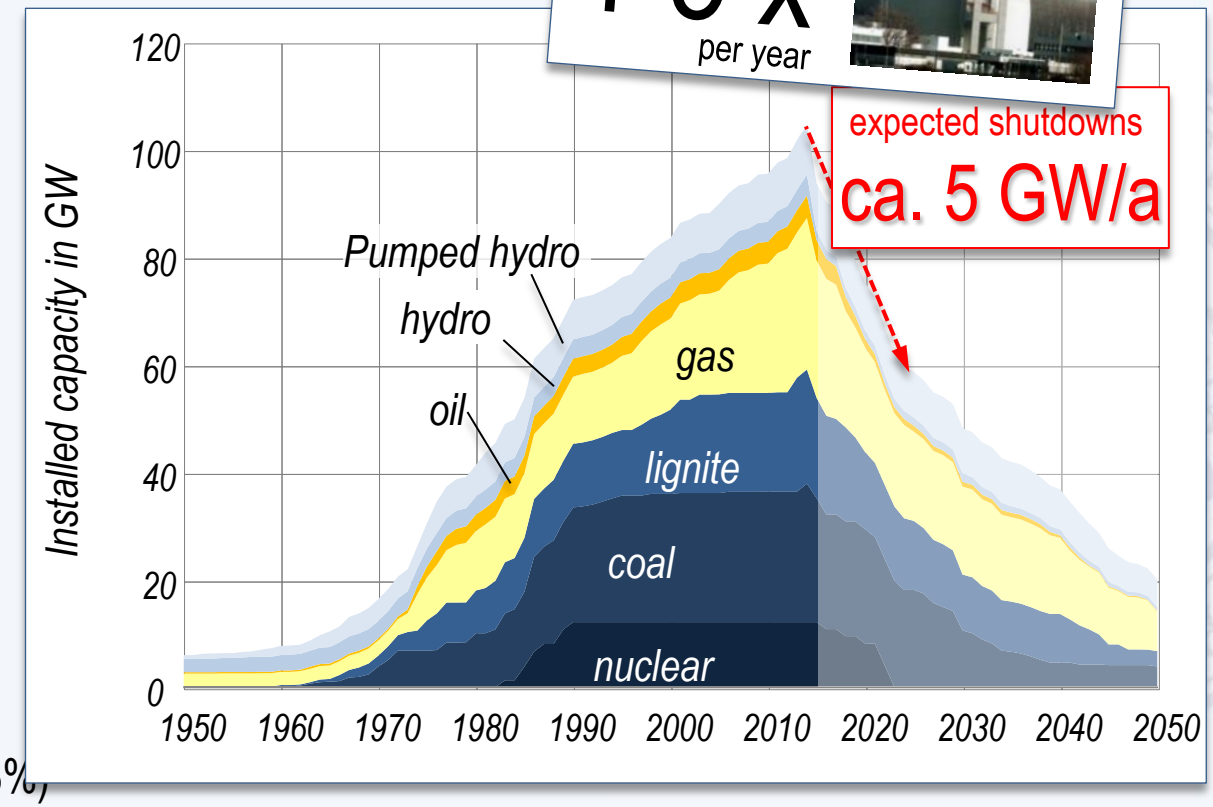
2nd Challenge:
Age structure of the conventional power plant structure

90 GW

4-5 x per year

expected shutdowns
ca. 5 GW/a



Deficites due to regular 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%)

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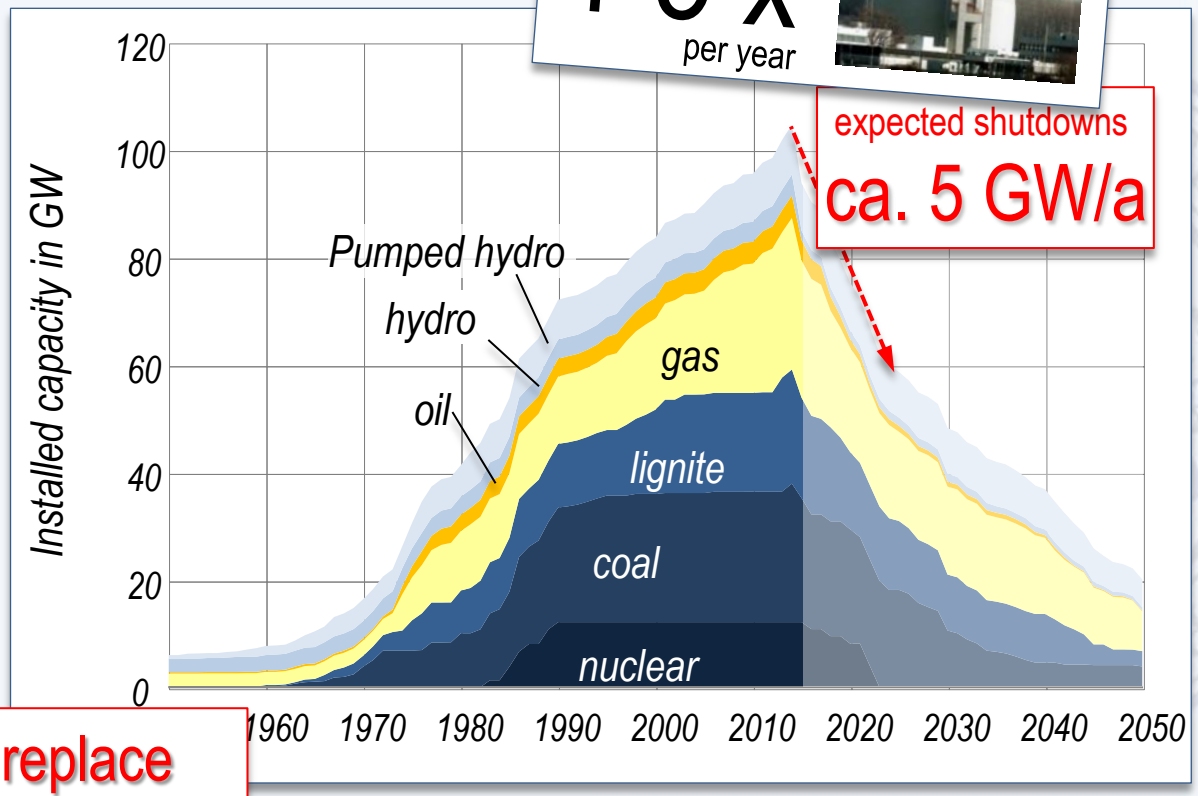

Impacts of the liberalization of the energy markets

- 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

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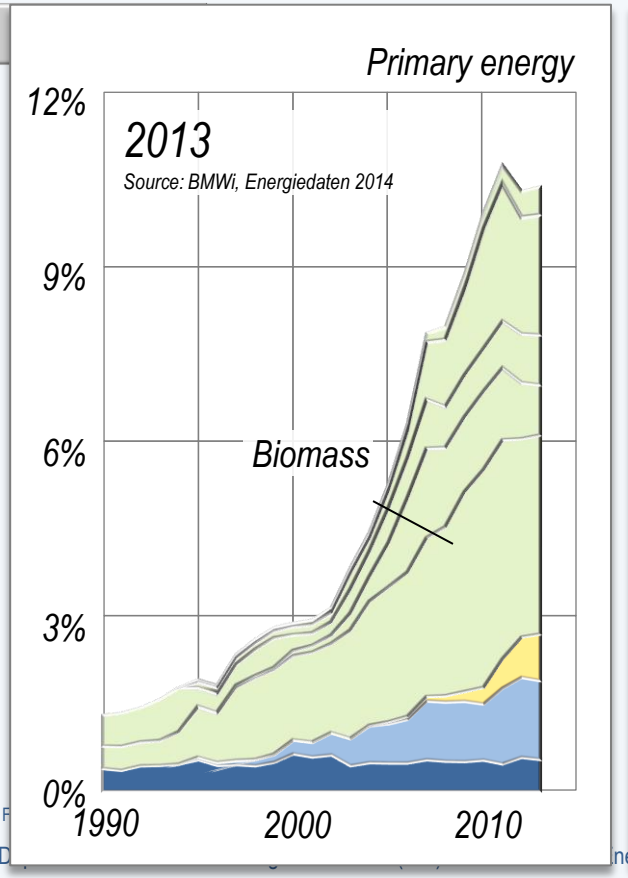
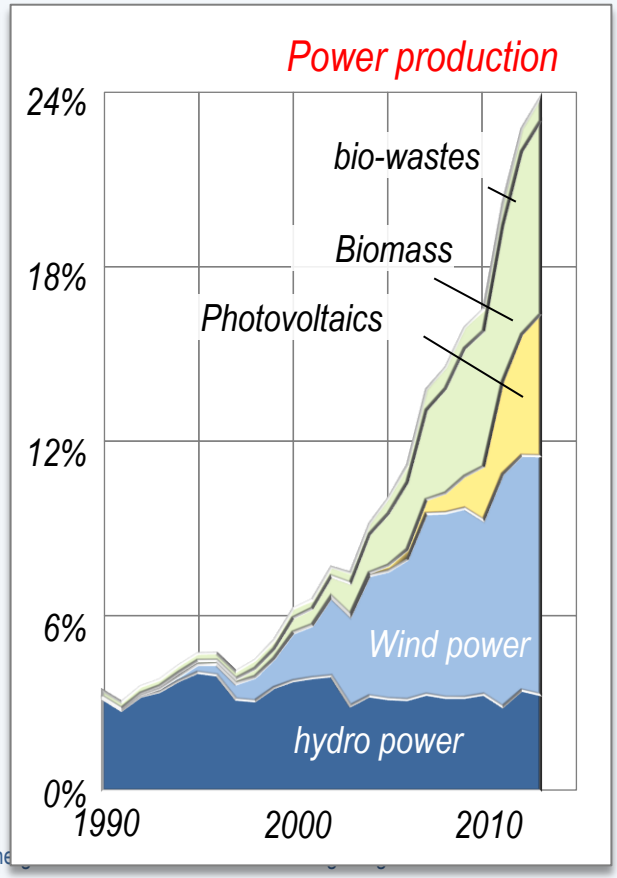
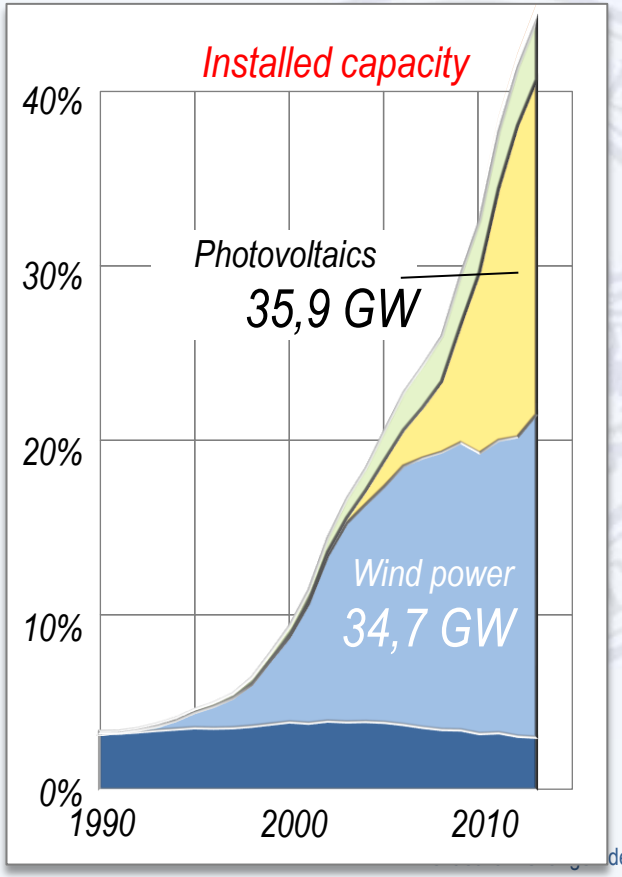
Impact of the Renewable Energy Law in Germany

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







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Impact of the Renewable Energy Law in Germany

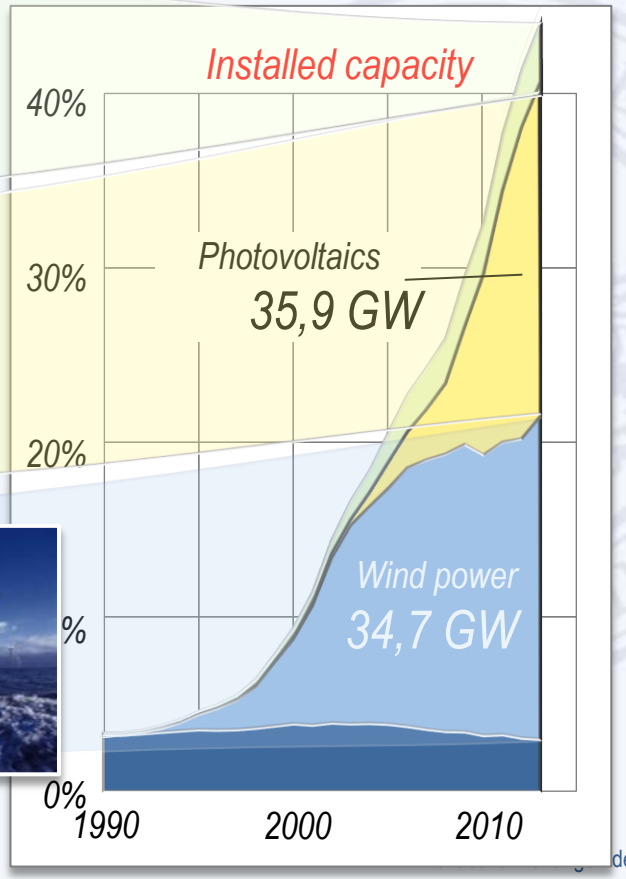
- German Renewable Energy Law („EEG“) initiated a booming industry…
- Wind and PV meanwhile cover (theoretically) more than 90% of Germany’s maximum power demand

Installed capacity(kW)

4 x

30 x

29 x



EEG surpassed all expectations …

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Impact of the Renewable Energy Law in Germany

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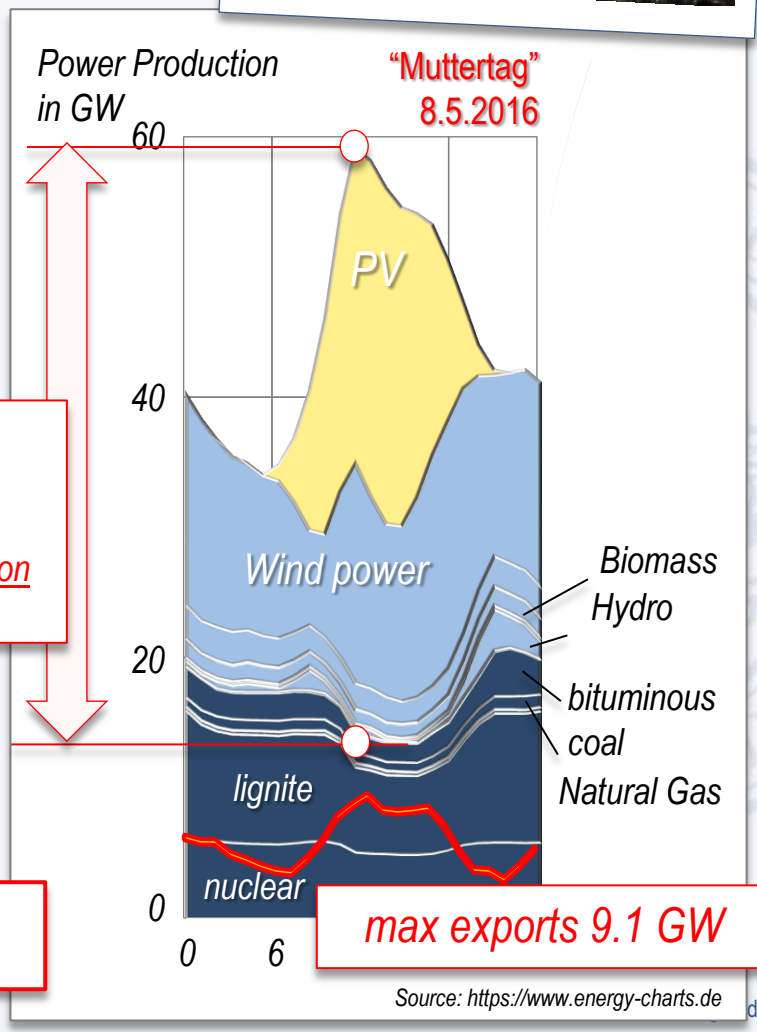
- German Renewable Energy Law („EEG“) initiated a booming industry…
- Wind and PV meanwhile cover (theoretically) more than **90% of Germany's maximum power demand**

- Renewables meanwhile cover up **90% of Germany's actual power demand**

42,7 GW

36 x



71 %
of Germany's total power production

88 %
of Germany's total power consumption

EEG surpassed all expectations …

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2. Vision: The "Globalisation" of Renewable Energies

- Renewables in the partner regions
- Three key challenges: storage, logistics and integration!

Folie 11

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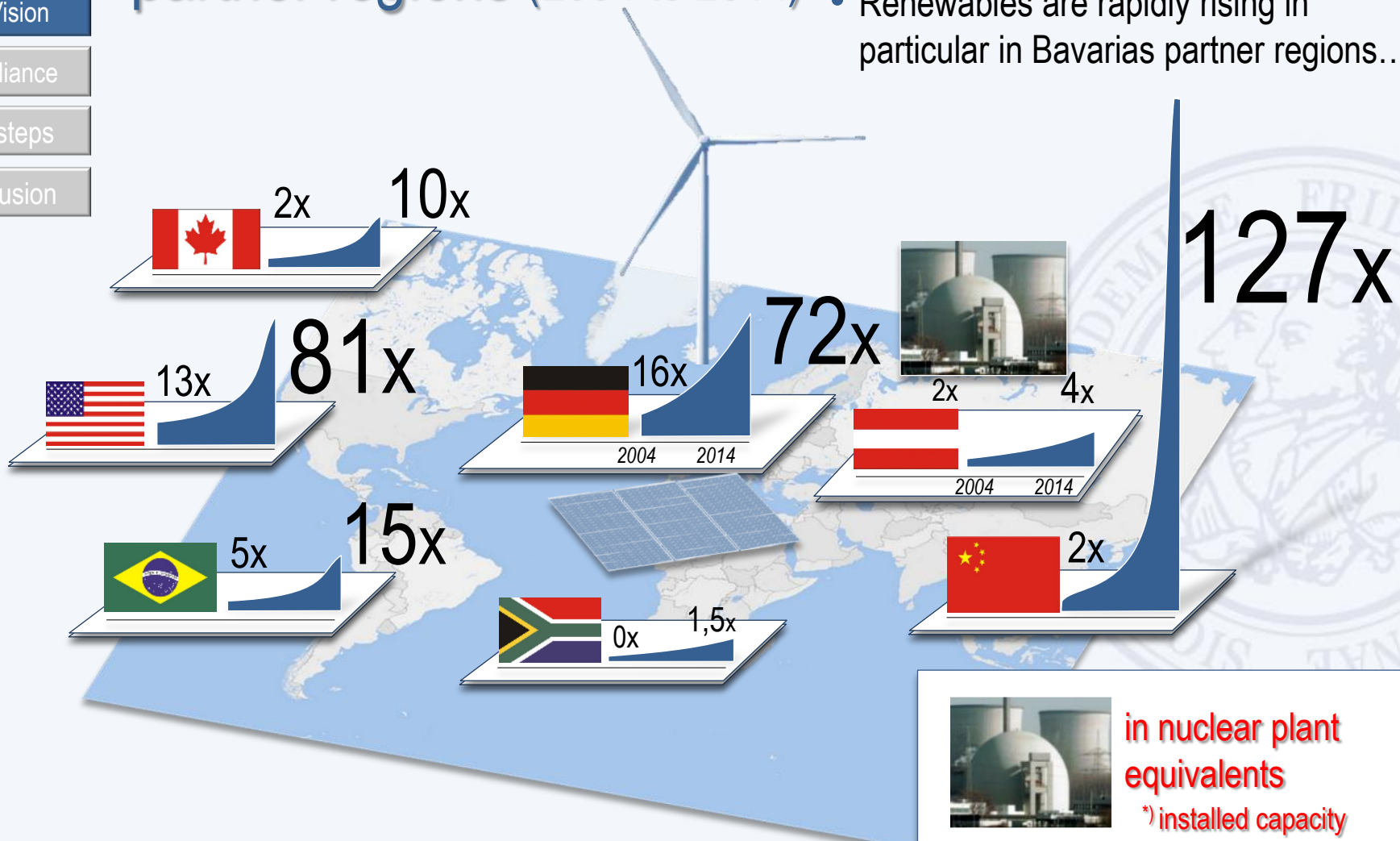
Power from Wind, PV and Biomass in the partner regions (2004 to 2014)

- Renewables are rapidly rising in particular in Bavarias partner regions…



Conclusions

1. renewables are meanwhile often competitive and emerge world-wide

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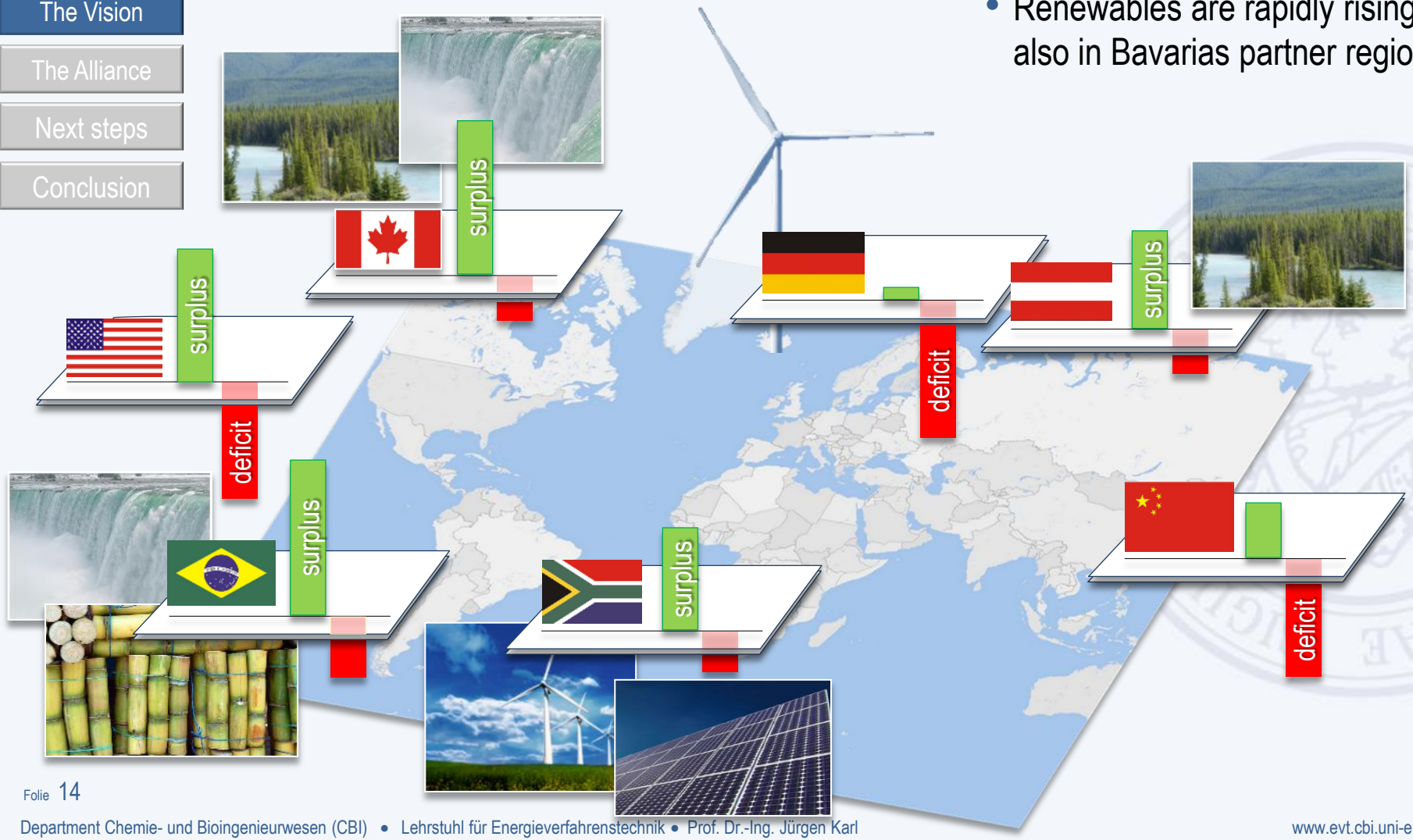
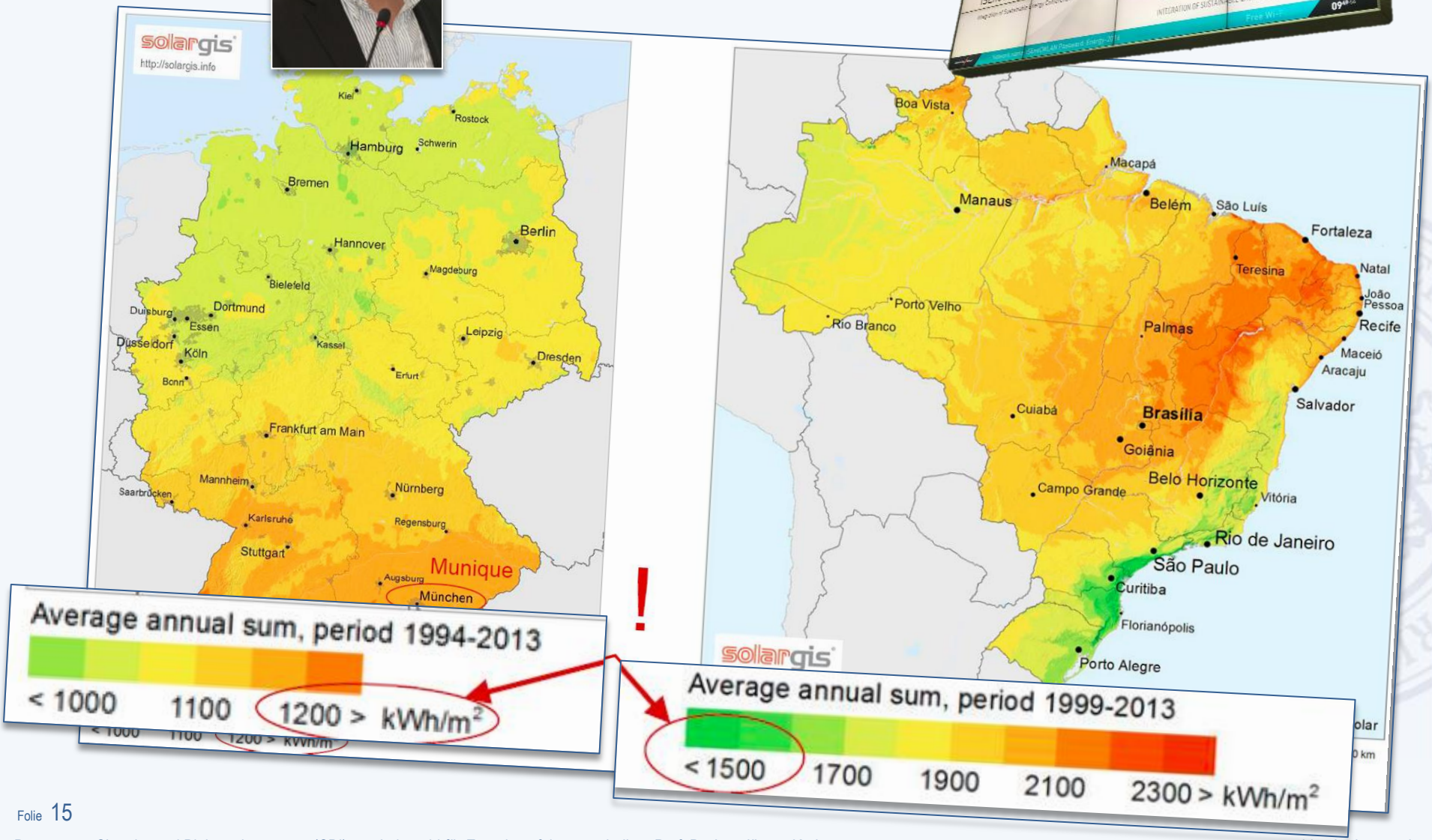
The Global renewable energy markets vision

- Renewables are rapidly rising also in Bavarias partner regions…



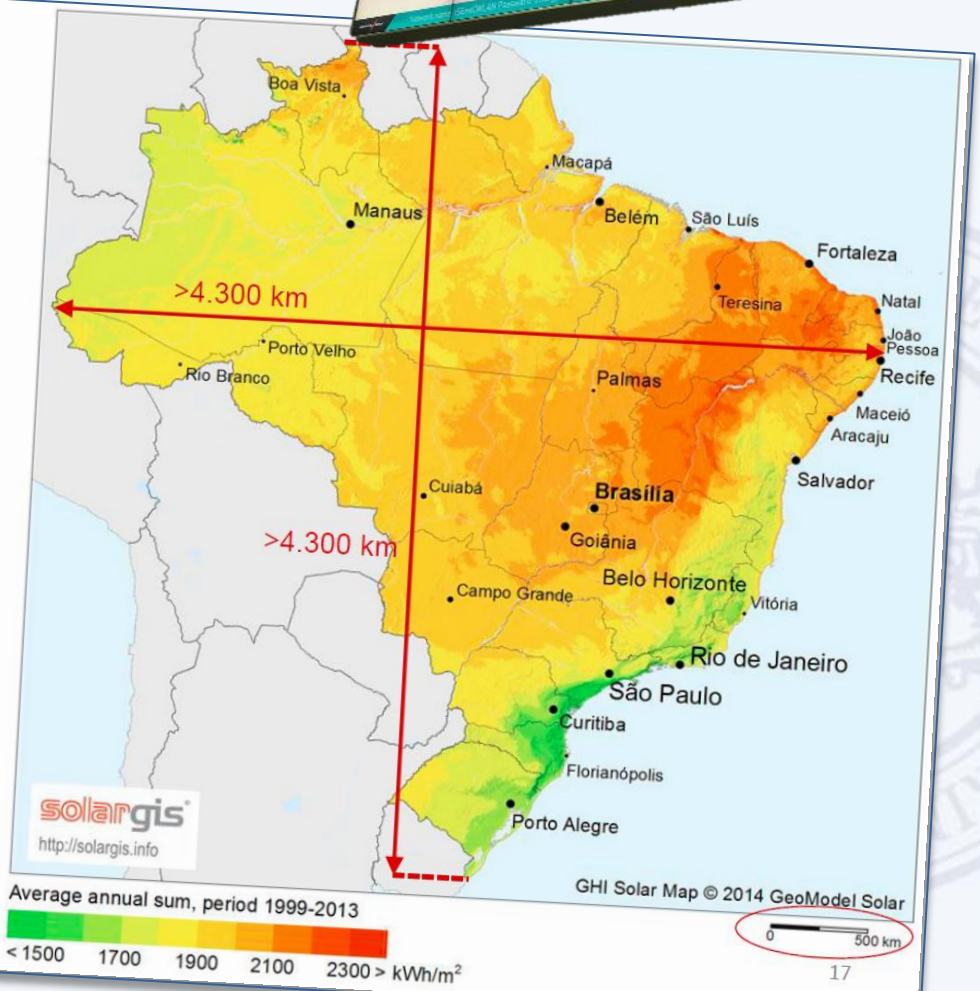
- Prof. Gilberto Jannuzzi,
- iSEneC, RLS Session, Nürnberg 12.7.2017



- Prof. Gilberto Jannuzzi, São Paolo
- iSEneC, RLS Session, Nürnberg 12.7.2017

Germany and Brazil

- Comparison



Sources: http://solargis.info/doc/free-solar-radiation-maps-GHI; www.cia.gov/library/publications/the-world-factbook/

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The Global renewable energy markets vision

Challenges
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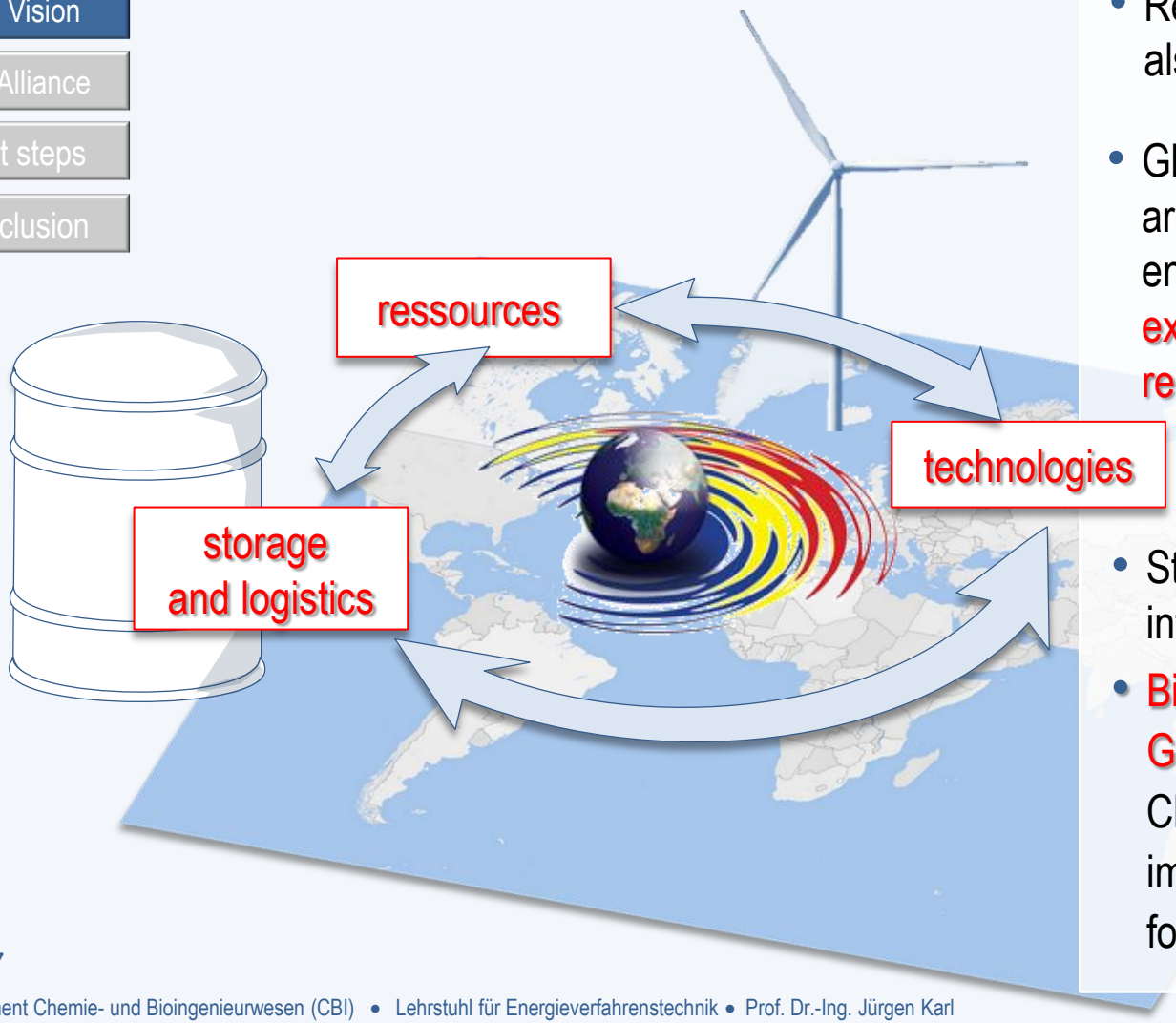
Next steps
Conclusion



- 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 challenge:

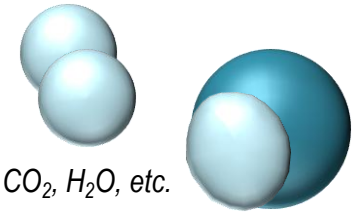
- Storage, transportation and integration of renewable energy
- Biofuels, Substitute Natural Gas, Hydrogen and other Chemicals are particularily important as storage options for other renewable sources

Examples for Second Generation Fuels: Substitute Natural Gas (SNG)

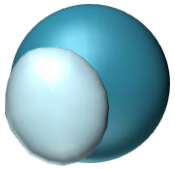
- Production of synthetic „natural gas" from biomass ("Methanation")

1. Step:
Thermal gasification

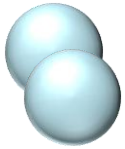
$$\underset{\text{(Biomass)}}{CH_xO_y} + H_2O \xrightarrow{\text{gasification}} CO + 3\,H_2 + CO_2,\ H_2O,\ \text{etc.}$$



CO



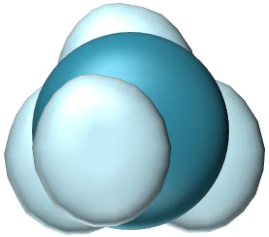
+ 3



hydrogen

$$\xrightarrow{\text{hydrogenation}}$$

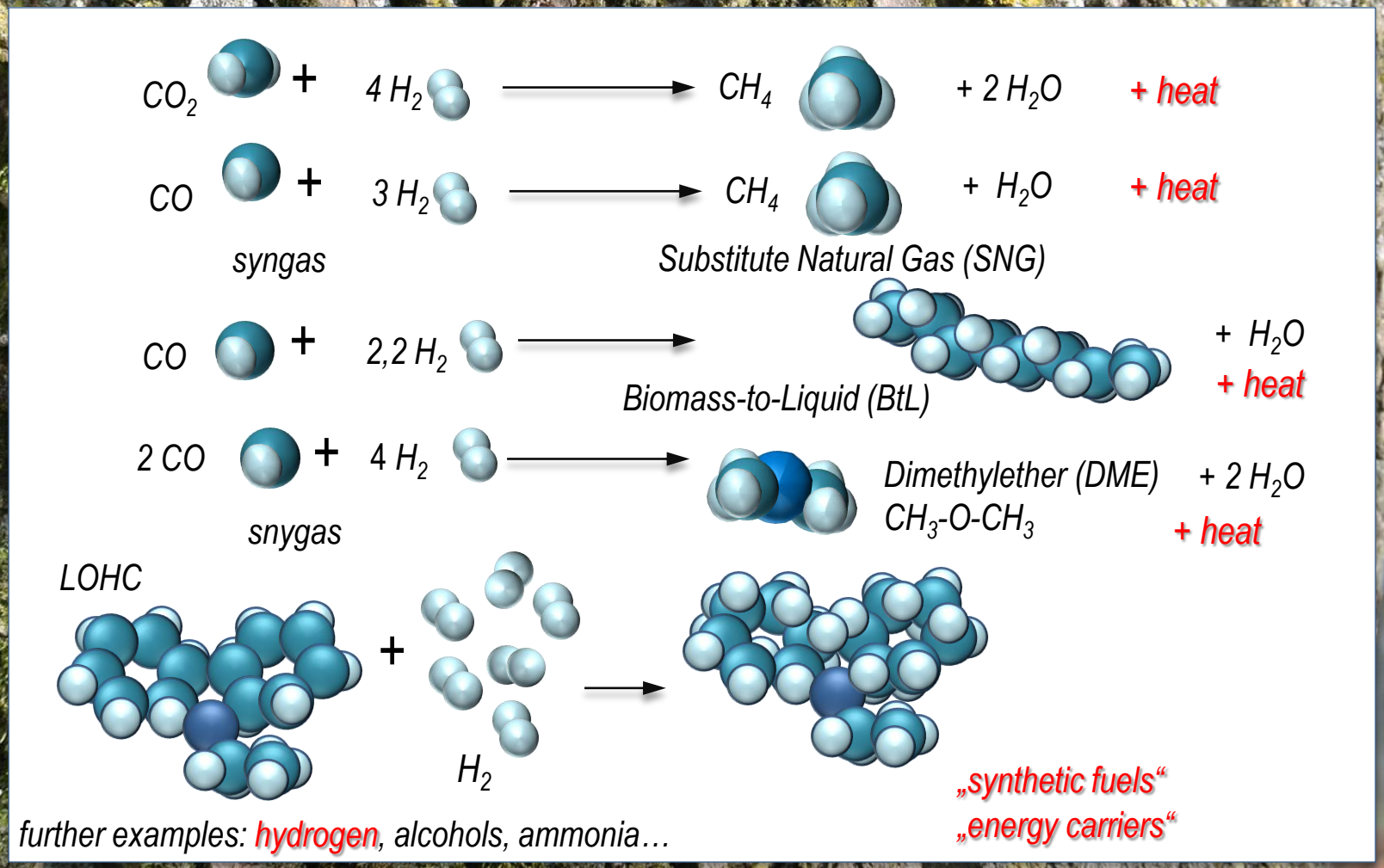
CH_4



+ H_2O, CO_2, … *heat*

2. Step:
Methanation

Examples for Second Generation Fuels:



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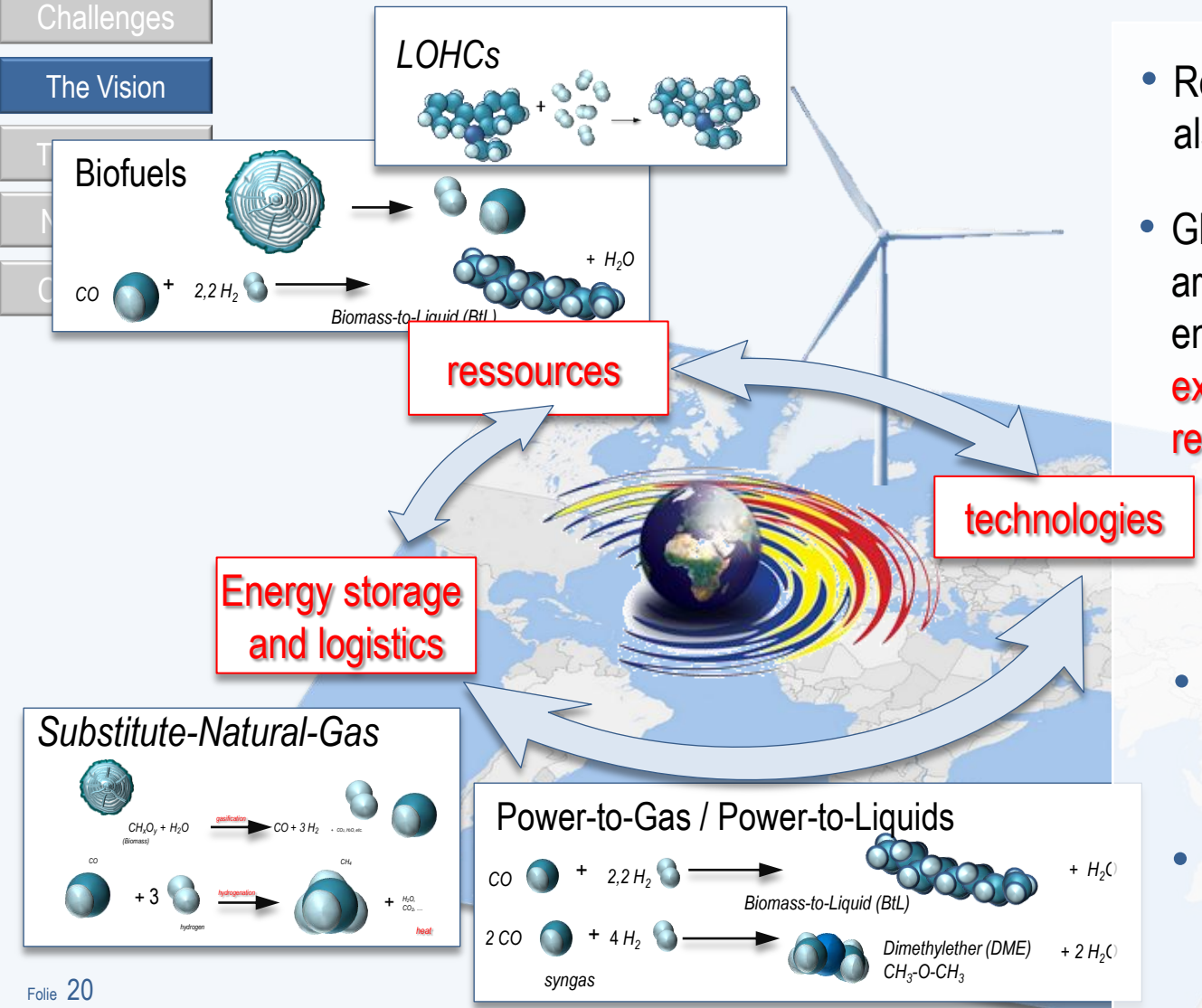
The Global renewable energy markets vision

Challenges

The 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 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

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3. The RLS Renewable Energy Network

- The energy networks achievements
- Further challenges and opportunities

Folie 22

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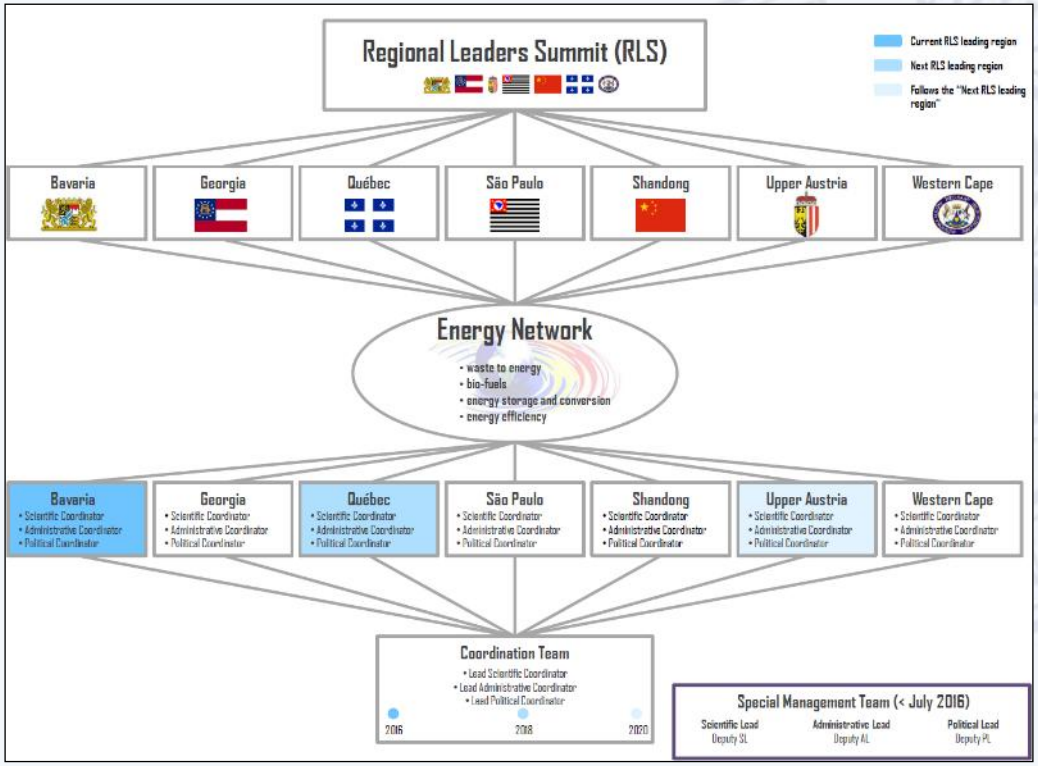
The RLS Renewable Energy Network

Challenges
The Vision
The Alliance
Next steps
Conclusion

- 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)



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The RLS Renewable Energy Network

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- Initiated in 2012 as a follow-up of the RLS meeting in São Paulo
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iSEneC 2016
INTEGRATION OF SUSTAINABLE ENERGY CONFERENCE

2013
- Launching workshop in São Paulo (3-6 April, 2013)
- Preliminary meeting in Munich (18 October, 2013)

2014
- Second workshop in Cape Town (10-12 March, 2014)

2015
- Internal meeting held by Upper Austria (23 June, 2015)
- Meeting in Québec (23-25 November, 2015)

2016
- Meeting in Nürnberg (10-12 July, 2016)

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Challenges
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Conclusion

4. Planned activities

- Results of the iSEneC conference
- The Regional Renewables Alliance

Folie 25

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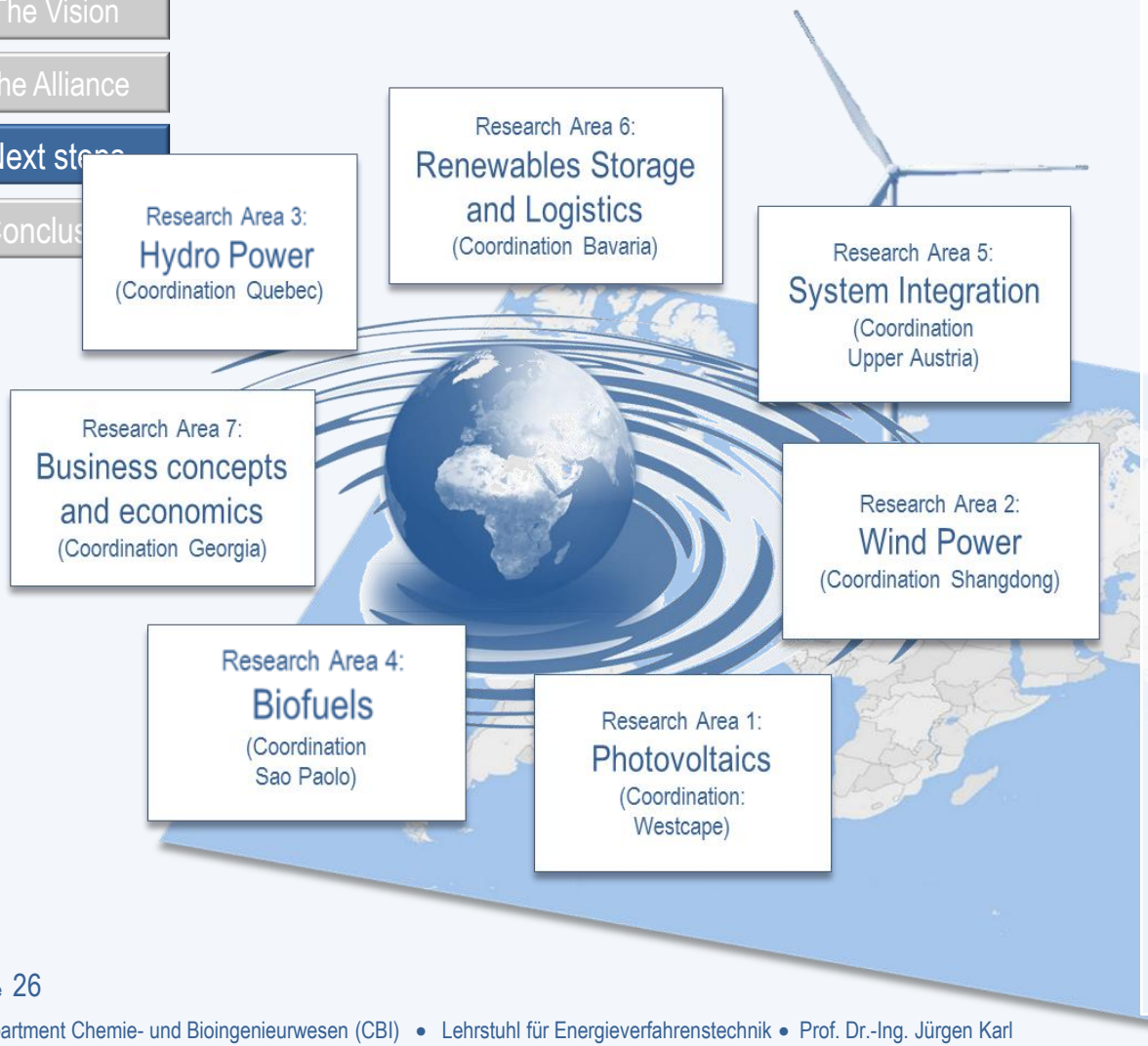
The Global renewable energy markets vision



- 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

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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

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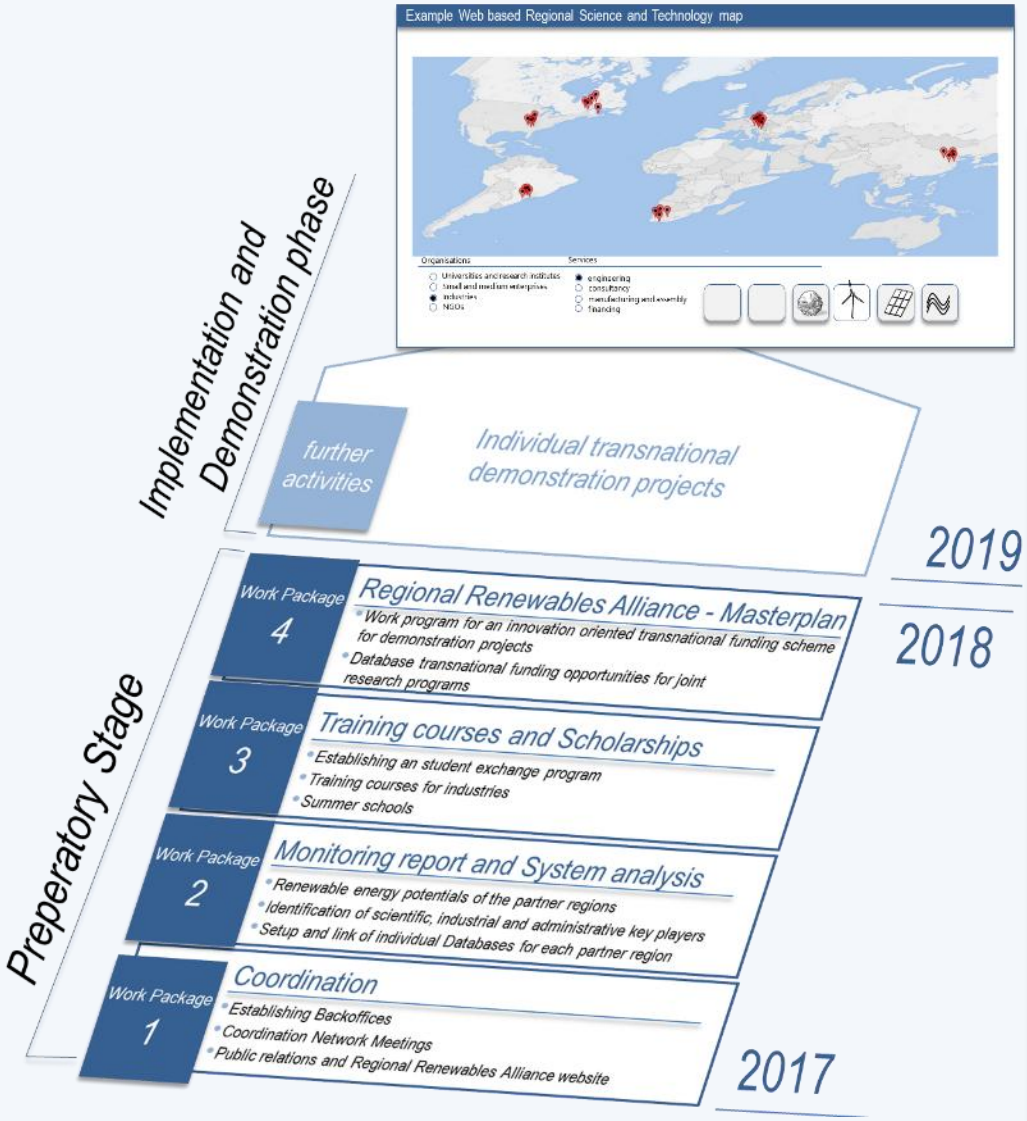
Joint Research Program for a
Regional Renewable Alliance



- 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

and

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

Regional Renewables Alliance