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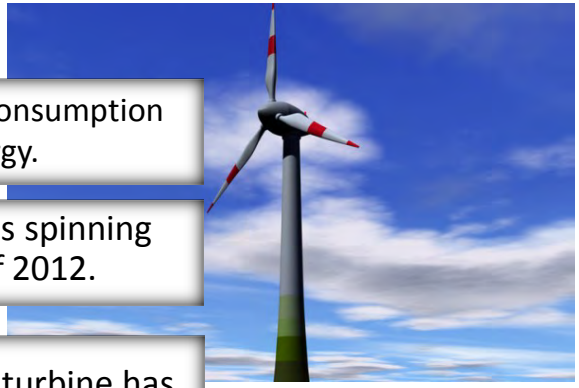
Wind energy is widely commercialized throughout the world.

Using wind as energy is an old concept.

Pioneer phase of the modern wind energy was in Denmark and Germany in 1960‘s and 1970‘s.

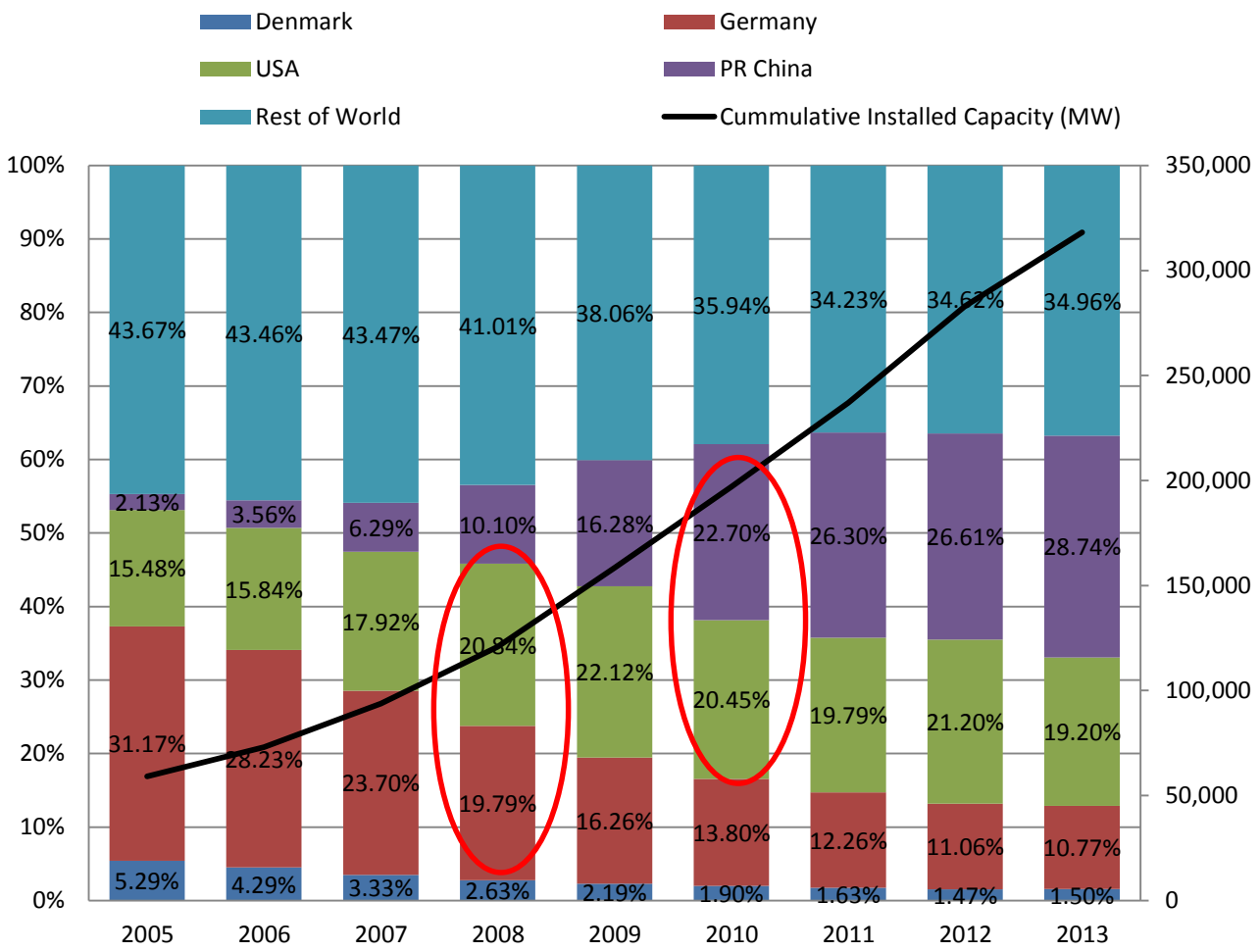
Wind today

30%	Of Denmark’s electricity consumption was covered by wind energy.
225,000	Number of wind turbines spinning around the world end of 2012.
8,000	Number of parts a wind turbine has.
5	Components make a wind power plant: blades, gearbox, generator, tower, electronics



Source: GWEC, Enercon, Nordex

The relative importance of pioneer countries like Germany and Denmark as markets is decreasing.

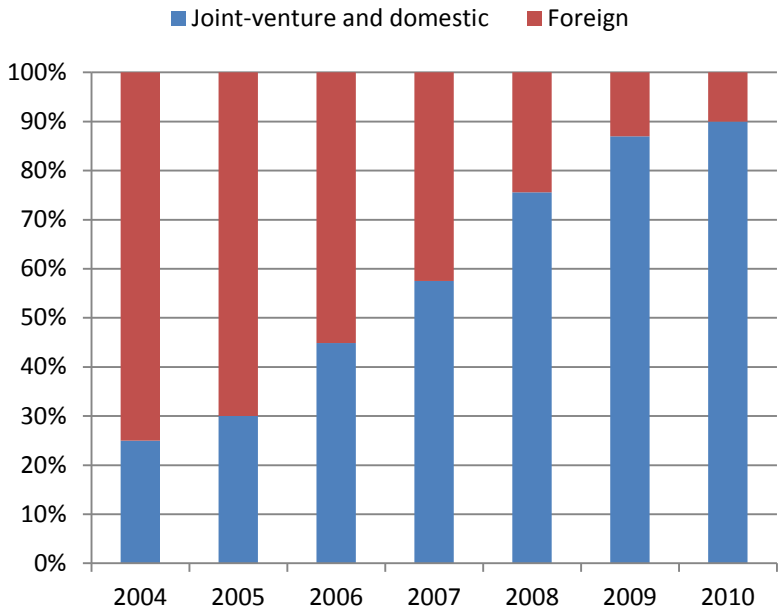


	´06	´08	´10
1	D	USA	PRC
2	USA	D	USA
3	DK	PRC	D

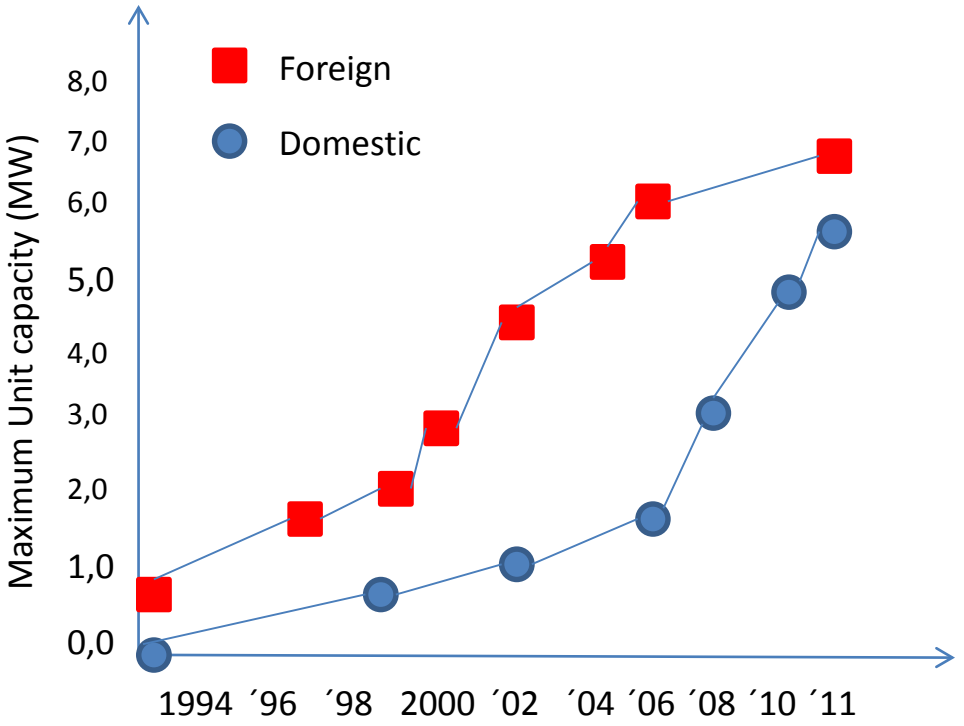
Source: GWEC (2005-2013)

Chinese turbine manufacturer are increasing their domestic market share and are catching up technological development.

Market share



Maximum turbine performance



Source: Ru et al. (2012)

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The research is concerned with a leader-follower issue. To structure my dissertation, I have divided it into three parts.

Research Question: How can countries and their industries maintain first-mover advantage and leadership in renewable energies?

Sectoral Systems of Innovation	Global Value Chains	Value Capture
Macro Perspective • Germany • Denmark • USA • China	**Micro Perspective** Case Studies • Enercon • Vestas • GE • Sinovel	**Macro Perspective** • Where is the Value located? • How has the Value Capture developed over time?

The dissertation uses a stratification between quantitative data & case studies.

Knowledge Creation	From explicit knowledge to explicit knowledge: Combination
Object of Analysis	On-shore wind industry
Unit of Analysis	Sectoral Systems of Innovation Companies active in the wind industry
Type of Analysis	Descriptive and analytical explanatory
Method	Stratification between quantitative data & case studies
Data	Secondary sources (R&D data, Patent data, Data bases (Orbis), Journals, Associations,…) Primary research through expert interviews (Purposive Sample: Researcher, Policy Maker, Engineers,…)

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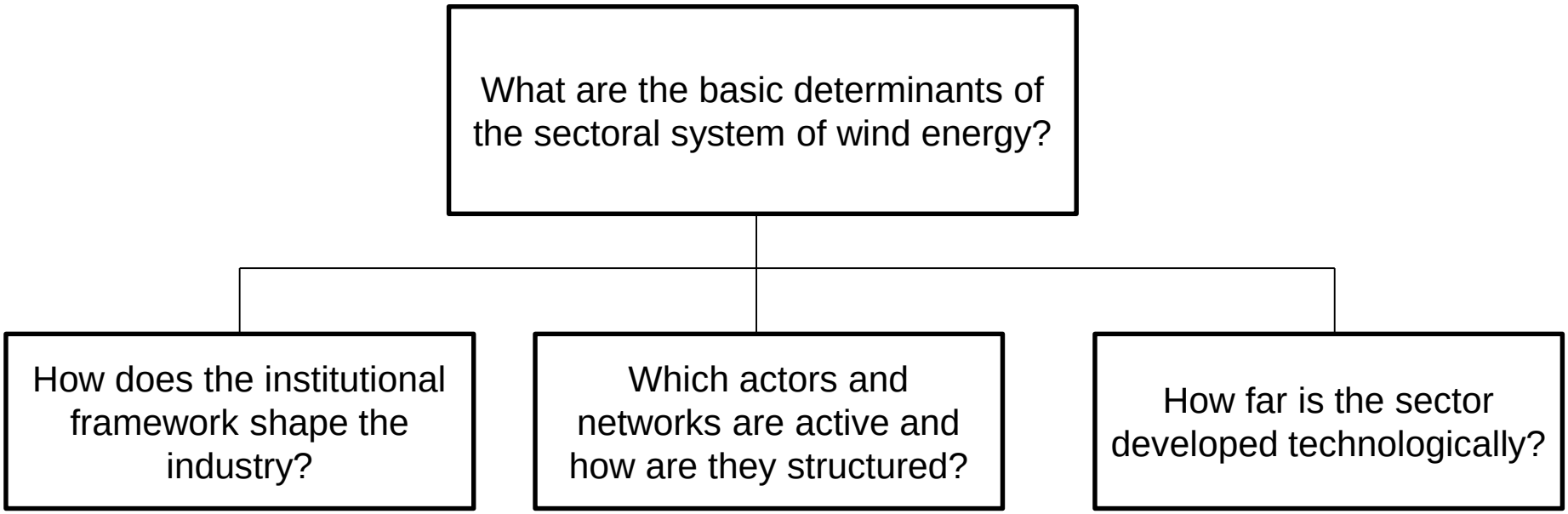
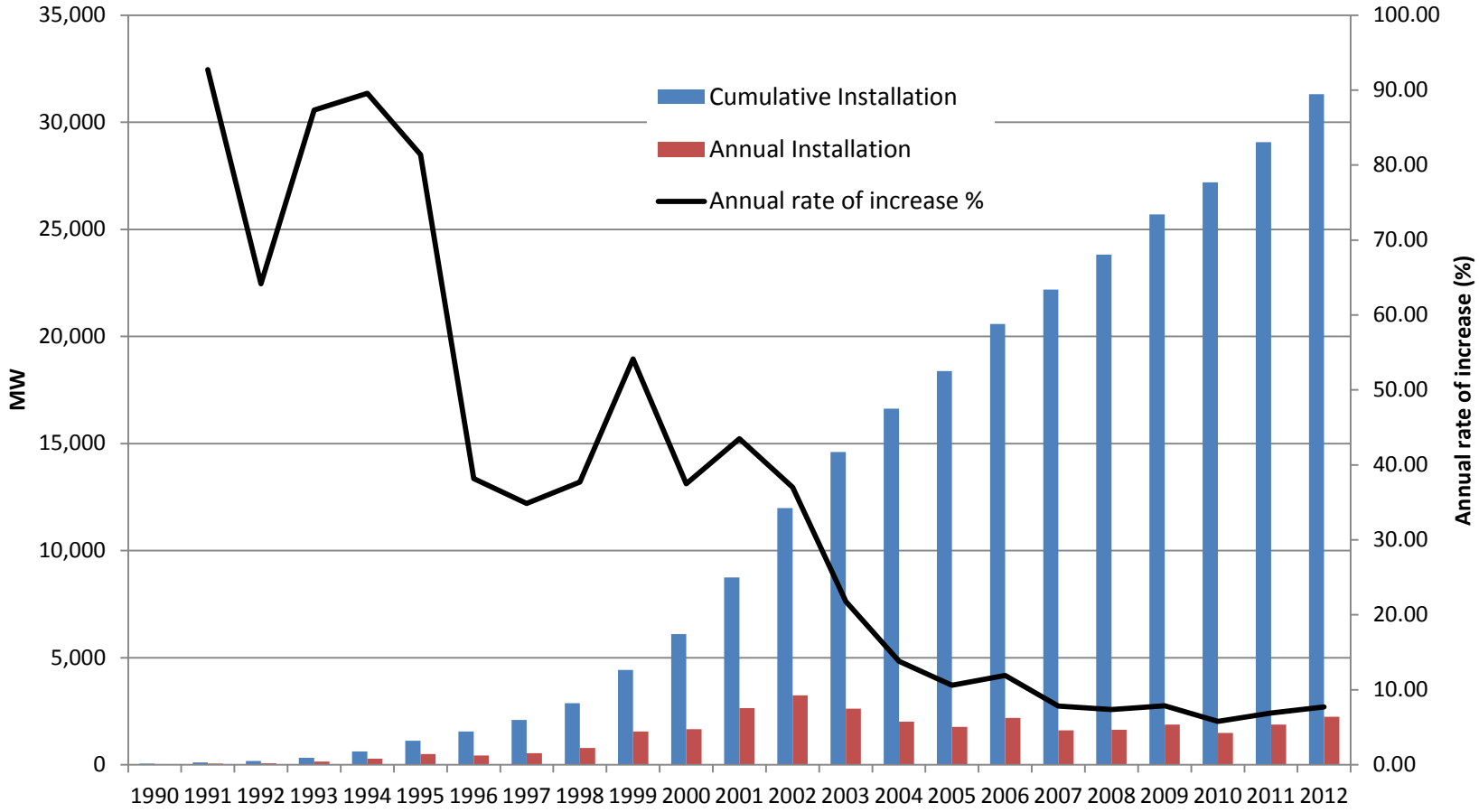
The first part of my dissertation analyzes the Sectoral System of Innovation of D, USA, PRC and DK.



Since the implementation of the Renewable Sources Act in 2000 the growth rate for wind energy in Germany has dropped heavily – yet it remains constant.



Source: Bundesministerium für Wirtschaft und Technologie (2013), own calculations

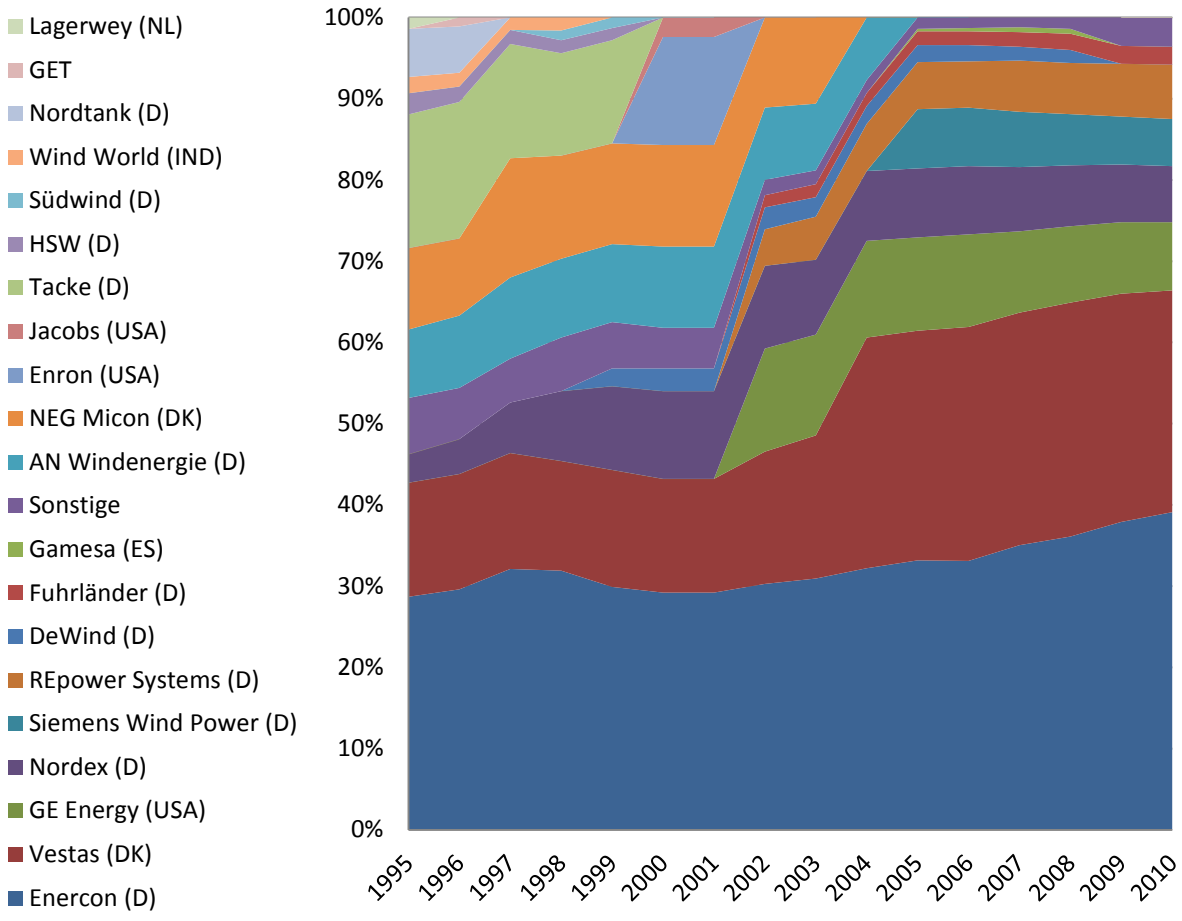
The Institutional Framework shaped a prosperous industry, mainly through the Act on Supplying Electricity from Renewables (1991) and the Renewable Sources Act (2000).

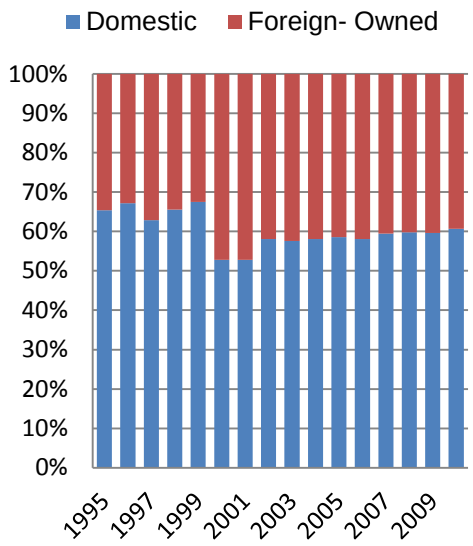
Goals/ Recommendations	CO2 30% by 2005 50% by 2050 Based on 1987			CO2 40% by 2020 80-90% by 2050 Based on 1990 levels
Policy			Act on Supplying Electricity from Renewables	Renewable Sources Act
Feed-In Tariffs		€0.03/ kWh	€0.04/ kWh	Fixed for 20 years €0.091/ kWh For at least 5 years, Afterwards depending On site quality
Programms	GROWIAN	100 MW	250 MW	

1974 1982 1986 1988 1991 1995 2000 ´02 ´14

Sources: Bechberger and Reiche, 2004; Jacobsson and Lauber, 2006; Laird and Stefes, 2009; Frondel et al., 2010; Lauber and Mez, 2006; Böhringer et al., 2014; own Interviews

Domestic players claim the major market share in Germany. Enercon is the dominant company.





Industry structure, as of 2012:

Tier level	Number of companies
OEM	10
Tier 1	32
Tier 2	86
Tier 3	47

Source: DEWI (1993-2010); VDMA (2012); own calculations and interpretations.

Enercon‘s Value Chain is solely national – and highly integrated.

Enercon

Pioneer and early mover

Dominates the German market

National supply chain

High vertical integration: 60-80%

Siemens

Entered the market through acquisition

Multinational Corporation

Global supply chain

Vertical integration: 40-60%

…and just won the project to build the largest on-shore wind park in the USA (1050MW)

Source: own research in collaboration with students; Kammer, 2011; Siemens press release

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Hypothesis: A Value Chain with a global scope is condition for a sustainable competitive advantage in an industry where scale economies are important.

Global Value Chain Analysis

German pioneer companies focus on home markets (Enercon, Nordex).

Multinational companies (Siemens, GE Energy) enter the market through acquisition.

The global wind market scales up rapidly.

Chinese competitors (Sinovel, Goldwind) apply a very high learning curve, scale up production and dominate their large home market. They currently start internationalizing.

A Global Value Chain Analysis should give insights about how to create a sustainable competitive advantage.

Global Value Chain Analysis

Case Studies on Enercon (D), Siemens (D), Vestas (DK), GE (USA), and Sinovel (PRC)

How do companies configure their Value Chain?

What are the lead firms?

How is the Value Chain governed?

What are the capabilities along the Value Chain?

How can companies realize scale economies?

How to establish a Global Value Chain?


Q & A

Backup

Issues and threats for Germanys Sectoral System of Innovation are manifold.

Existing Literature

Renewable Sources Act does not support technological Innovation (Böhringer et al., 2014; EFI, 2014).

The coexistence of the Renewable Sources Act (and other Feed- In tariffs) with the Emissions Trading Scheme results to a climate effect close to zero (Böhringer et al., 2014; Frondel et al., 2010; Traber and Kemfert, 2009).

Own Research

Important domestic companies (early-movers) follow a national supply chain strategy.

Hypothesis

A Value Chain with a global scope is condition for a sustainable competitive advantage.

What is the best way to analyze Value Capture?

What is Value Capture?

<table>
<tr><td rowspan="6">Sales Price</td><td rowspan="2">Cost of goods sold</td><td>Purchased inputs</td><td></td><td></td></tr>
<tr><td>Direct labor</td><td rowspan="5">Value added</td><td></td></tr>
<tr><td colspan="2">Selling, general, and administrative</td><td rowspan="4">Value capture</td></tr>
<tr><td colspan="2">Research and development</td></tr>
<tr><td colspan="2">Depreciation</td></tr>
<tr><td colspan="2">Net profit</td></tr>
</table>

Ways to assess Value Added/ Capture

1. Using macro data
   - No industry classification for wind industry (German Federal Office of Statistics, OECD)
   - Combination of mechanical and electrical engineering, Services, Suppliers
2. Analyzing certain products
   - E.g. Value Capture of an IPhone and IPad (Kraemer, Linden and Dedrick, 2011)

Source: Dedrick, Kraemer, Linden (2008); NSF (2012)

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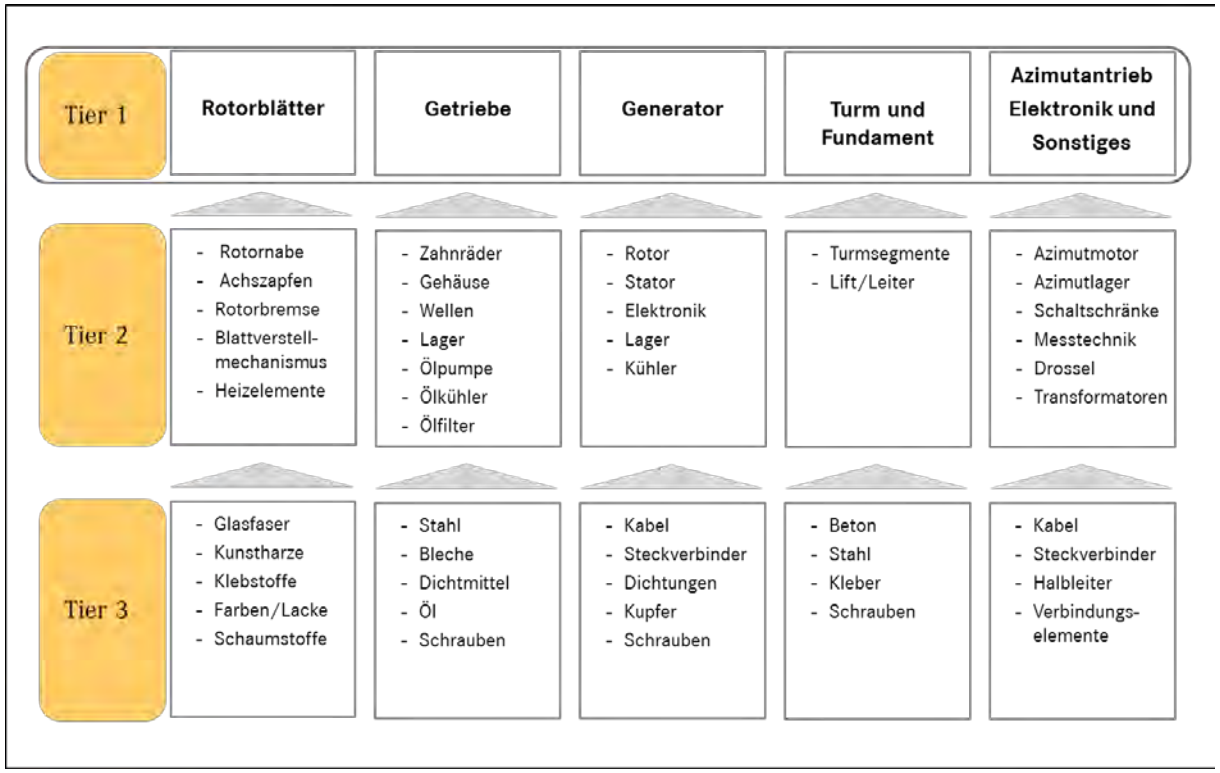
Tab. 2: Vertigungstiefe der WKA-Hersteller und Komponentenversorgung
Quelle: Eigene Darstellung in Anlehnung an Kammer (2011, S. 164)

	Sinovel	Repower	Nordex	Vestas	Gamesa	Siemens	Enercon
Anteil der internen Fertigung	**0**	**10-20 %**	**10-20 %**	**30-40 %**	**40-60 %**	**40-60 %**	**60-80 %**
Tendenz	=	+	=	=	+	+	+
Rotorblätter	LM Zhongfu Lianzhong	LM A&R **Powerblades**	LM **Nordex** Baoding	LM **Vestas**	LM **Gamesa**	LM **Siemens**	**Enercon**
Generatoren	Lanzhou Yongji Dalian	ABB	ABB Loher (Winergy) Elin	**Weier** Elin ABB LeroySomer	**Cantarey** ABB Ingeteam	Loher (Winergy) ABB	**Enercon**
Getriebe	Chongqing Moventas	Eickhoff Moventas Winergy	Eickhoff Bosch Rexroth Winergy	Bosch Rexroth Hansen (ZF) Winergy Moventas u.a.	**Echesa** Hansen (ZF) Windery Moventas	Hansen (ZF) **Winergy**	Getriebelos
Türme	Unbekannt	SIAG Ambau Martifer Hendricks	SIAG Ambau TowerTech	**Vestas** Ambau Trinity S. Hendricks	**Gamesa** TowerTech	**Siemens** Ambau Trinity S. Hendricks Blandt	**Enercon**


Tier 1
Rotorblätter
Getriebe
Generator
Turm und Fundament
Azimutantrieb Elektronik und Sonstiges
Tier 2
- Rotornabe
- Achszapfen
- Rotorbremse
- Blattverstell-mechanismus
- Heizelemente
- Zahnräder
- Gehäuse
- Wellen
- Lager
- Ölpumpe
- Ölkühler
- Ölfilter
- Rotor
- Stator
- Elektronik
- Lager
- Kühler
- Turmsegmente
- Lift/Leiter
- Azimutmotor
- Azimutlager
- Schaltschränke
- Messtechnik
- Drossel
- Transformatoren
Tier 3
- Glasfaser
- Kunstharze
- Klebstoffe
- Farben/Lacke
- Schaumstoffe
- Stahl
- Bleche
- Dichtmittel
- Öl
- Schrauben
- Kabel
- Steckverbinder
- Dichtungen
- Kupfer
- Schrauben
- Beton
- Stahl
- Kleber
- Schrauben
- Kabel
- Steckverbinder
- Halbleiter
- Verbindungs-elemente