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SWT-3.0-101

An example of Systems Engineering

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Siemens Energy Sector: Systems Engineering from primary energy to power distribution

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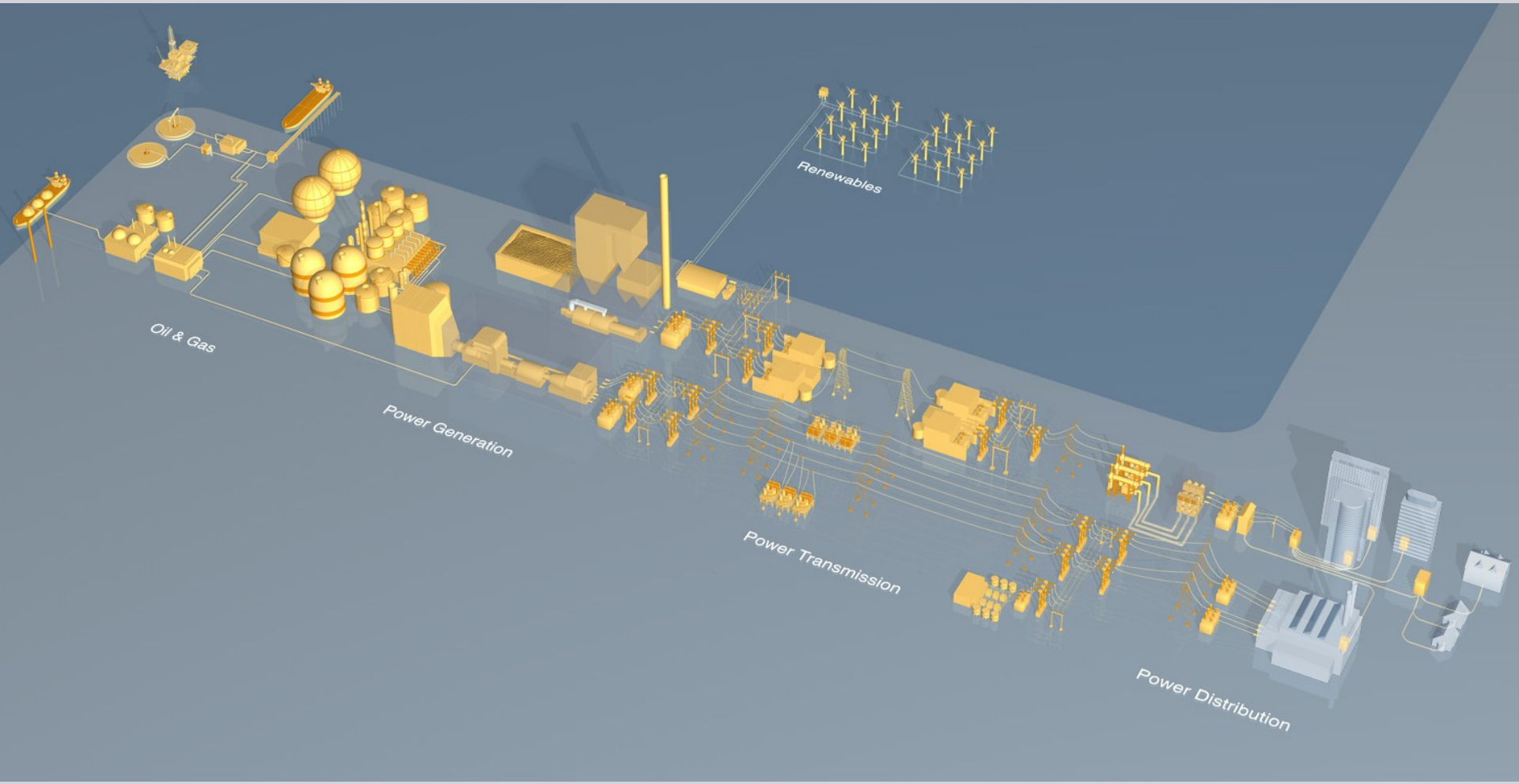

A Systems Engineering Approach - Providing Solutions in all phases of a wind power plant project

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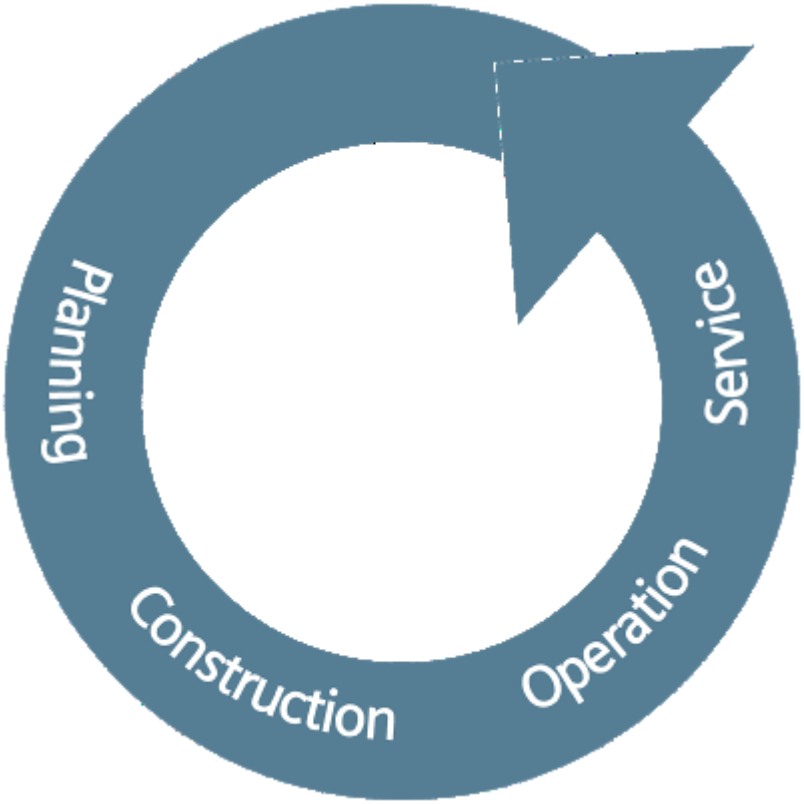
Planning

- Siting guidance
- Financing packages
- Insurance packages
- Network evaluation

Service and Expansion

- Inspections
- Maintenance programs
- Modernizations
- Extensions
- Repairs
- Spare parts
- Training
- Global service network



Construction

- Product delivery
- Project managemen
- Installation
- Commissioning
- Turnkey experience
- Local presence around the globe

Operation

- Operation & maintenance agreements
- Monitoring
- Diagnostics

Siemens SWT-3.0-101: high customer value minimizing the cost of energy

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Summary: SWT-3.0-101

- New drive train design with permanent magnet generator is a technological leap forward
- Simple design with less moving parts reduces complexity and need for maintenance
- The compact and light weight design is major advantage for transportation and installation
- The proven 101 m rotor features high performance aerodynamics at reduced loads

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Agenda

1. Description & Application
2. Performance
3. Siemens direct drive technology
4. Blade design

SWT-3.0-101: Direct drive turbine with 101 m rotor

Technical data

IEC class:	IA
Nominal power:	3,000 kW
Rotor diameter:	101 m
Blade length:	49 m
Swept area:	8,000 m^2
Hub height:	Site specific
Annual output at 8 m/s:	11,600 MWh
Rotor weight:	60 t
Nacelle weight:	73 t
Power regulation:	Pitch regulation, variable speed
Prototype installed:	2009
Pilot series	2010
Serial production:	2011

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Direct drive train enhances the efficiency of the wind turbine

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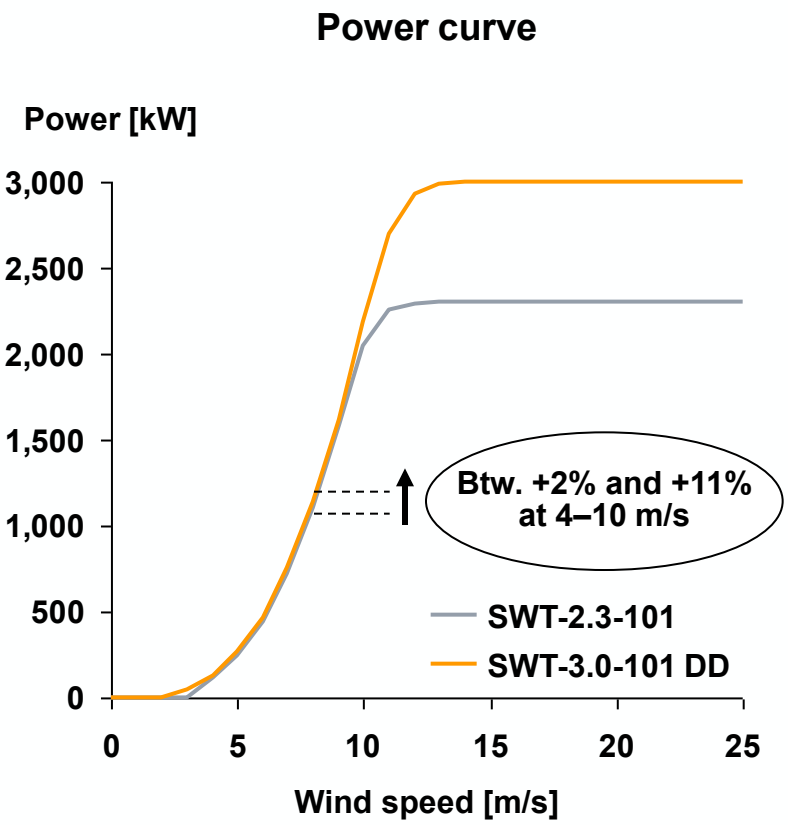
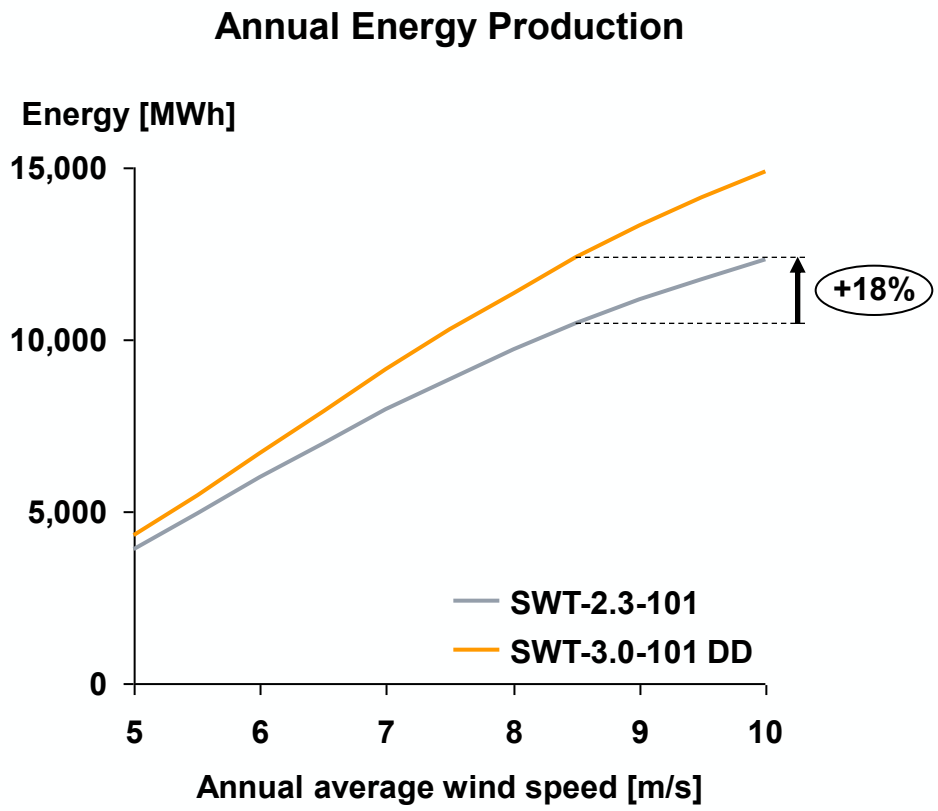
2 Performance: Power curve





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Streamlined and effective design with few and highly efficient components

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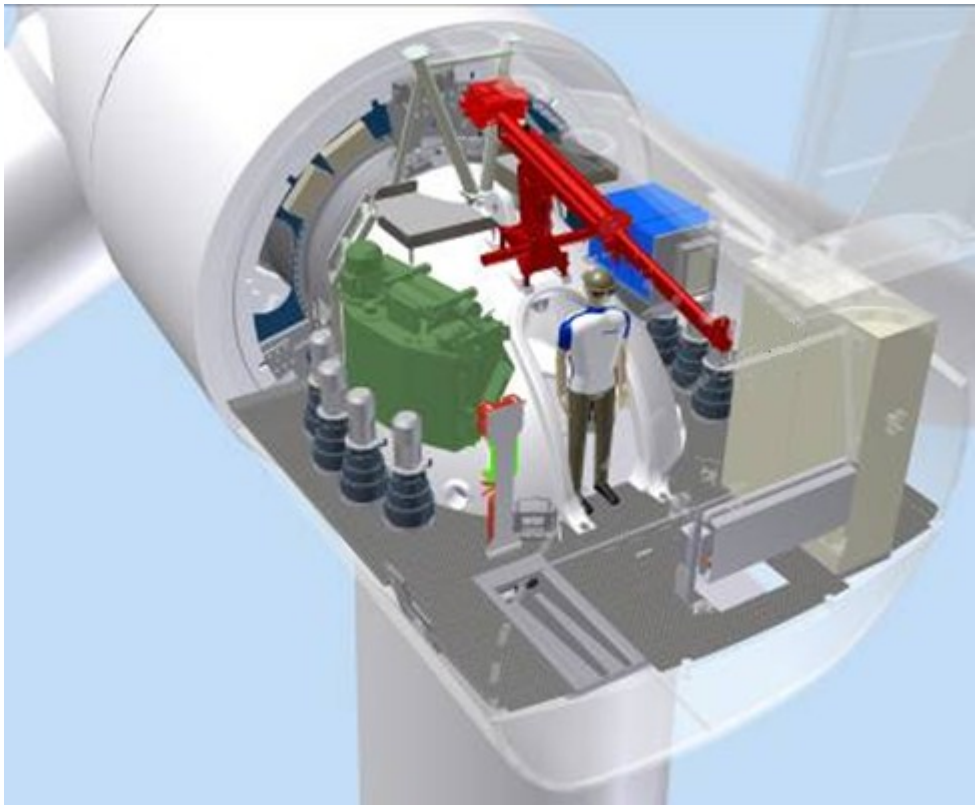
- Direct drive with permanent magnet generator
- Simplified nacelle design with 50% less components
- Passive liquid cooling system
- Service-friendly design
- Previous proven solutions for the remaining components (blades, hub, power conversion, etc.)



A wind turbine designed to minimize the cost of energy

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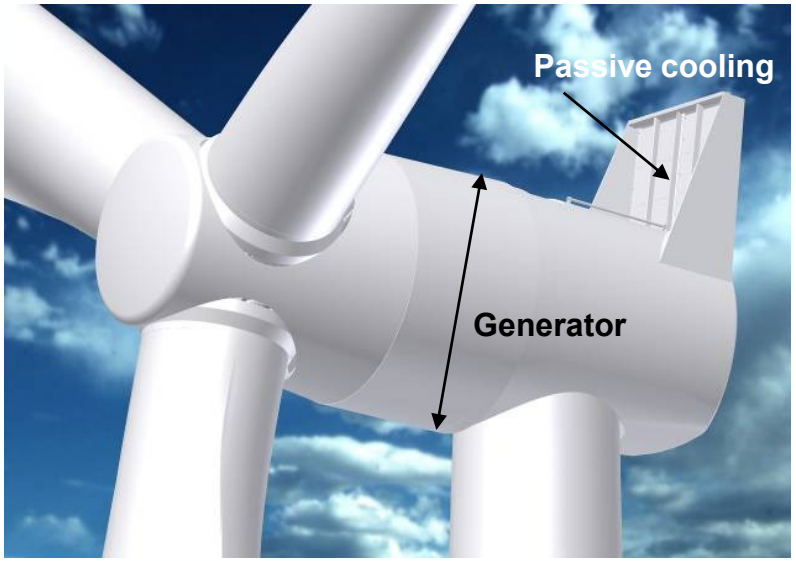
Technology advantages…

- Increased efficiency due to minimum losses in drive train, generator and cooling system
- Reduction in number of wearing parts due to the simplified drive train
- Compact (nacelle Ø = 4.2m) and light weight design (nacelle weight = 73 t)



… bring down the cost of energy

- Enhanced performance
- Reduced effort in maintenance
- Designed for lean transport and installation

Compact and light weight design, major advantage for transportation and installation

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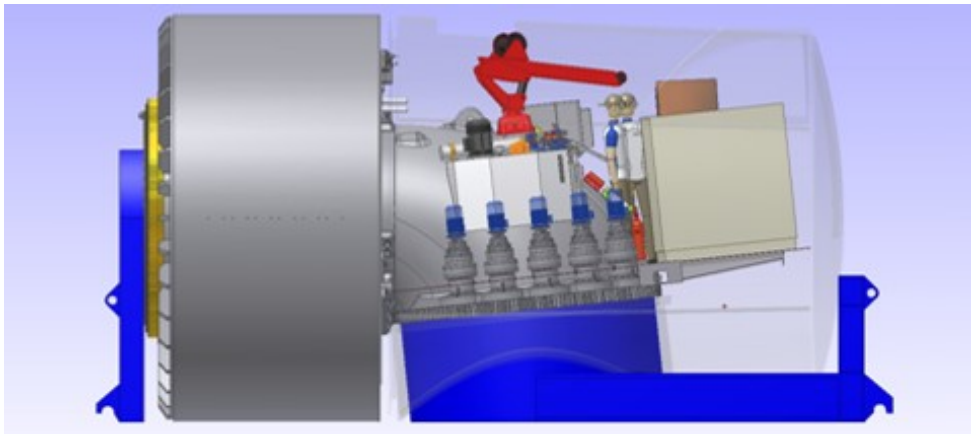
- Designed for standard transport limitations
- Only requires trucks and tools available in high numbers worldwide
- Nacelle transported in one piece to minimize expensive and risky on-site assembly of critical components



Product and service offering designed to optimize maintenance and reduce customer risk

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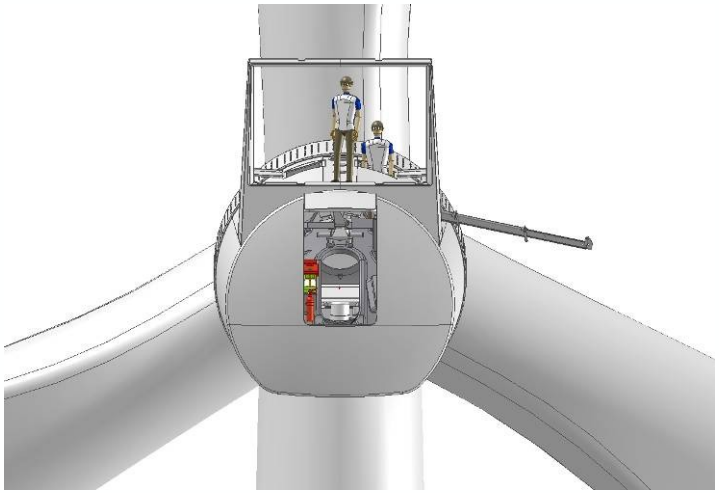
Product features optimize maintenance

- Gear box removed to increase reliability and optimize maintainability
- Simplified spare parts handling with 50% less components
- Service conditions improved by easier accessibility



Service offerings reduce customer risk

- Worldwide network of highly trained Siemens service technicians to safely manage the new technology
- Safe Investment: Long term service program offered already from day one (incl. parts warranty)
- Advanced preventive maintenance

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A twist of revolution: 15% larger swept area with the same loads

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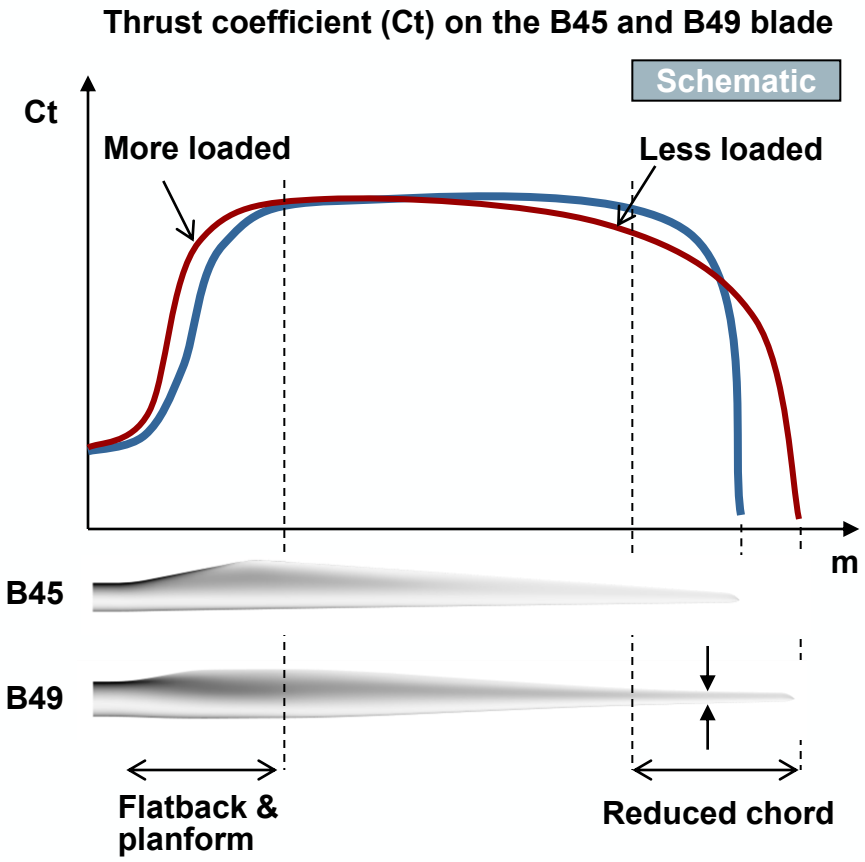

- New aerodynamic profile redistributes loads in the B49 blade, reducing the cumulative bending moment
- The root section is more heavily loaded due to the use of special flatback airfoils, and a larger planform (more chord)
- The tip section is less heavily loaded due to reduced chord length

B45

B49

The new SWT-3.0-101 blade employs new “flatback” profile in root section

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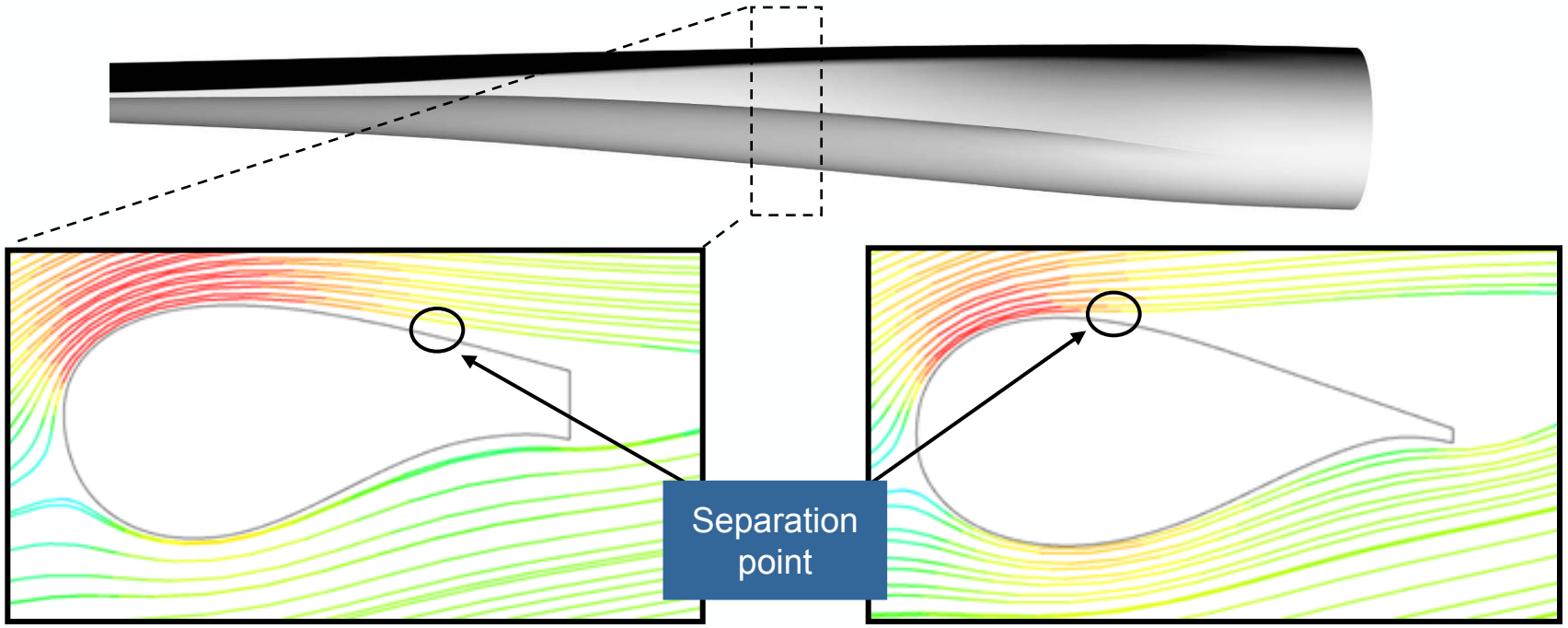

SWT-3.0-101 Blade profile

Traditional blade profile

- Flat back airfoil ‘opens up’ the trailing edge
- Separation point moved further towards the trailing edge giving increased lift

Increasing capacity and U.S. content

- **Ft. Madison Plant Expansion**
  - Warehousing
  - Manufacturing
  - Machining, rough & fine finish, and painting
  - Direct rail shipping
  - ~500 employees/3 shifts
  - Manufactures B45 & B49 Wind IntergralBlade®

- **New Nacelle Plant in Hutchinson, KS**
  - Capacity of 1500 MW per year
  - Creating more than 400 jobs
  - Initially assemble the 2.3MW nacelle, moving to 3.0DD
  - First nacelle this month!

Siemens Wind Power has a goal of 90% US dollar content by 2012

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Thank you for your attention!