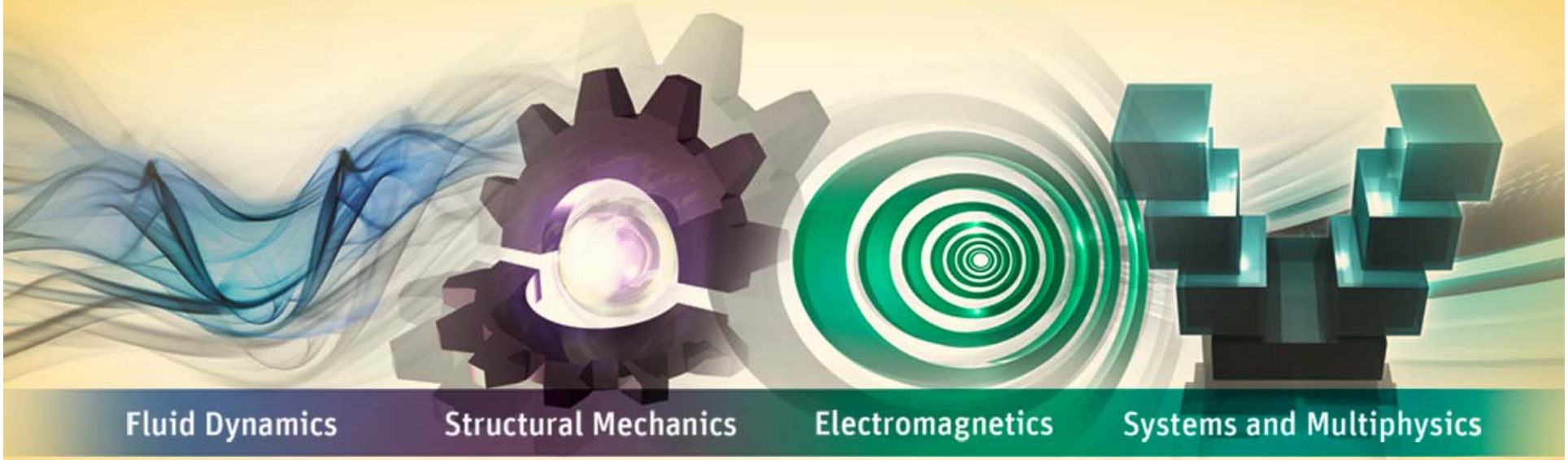
ANSYS

Realize Your Product Promise™

ANSYS Power System Simulation for Clean Energy Integration



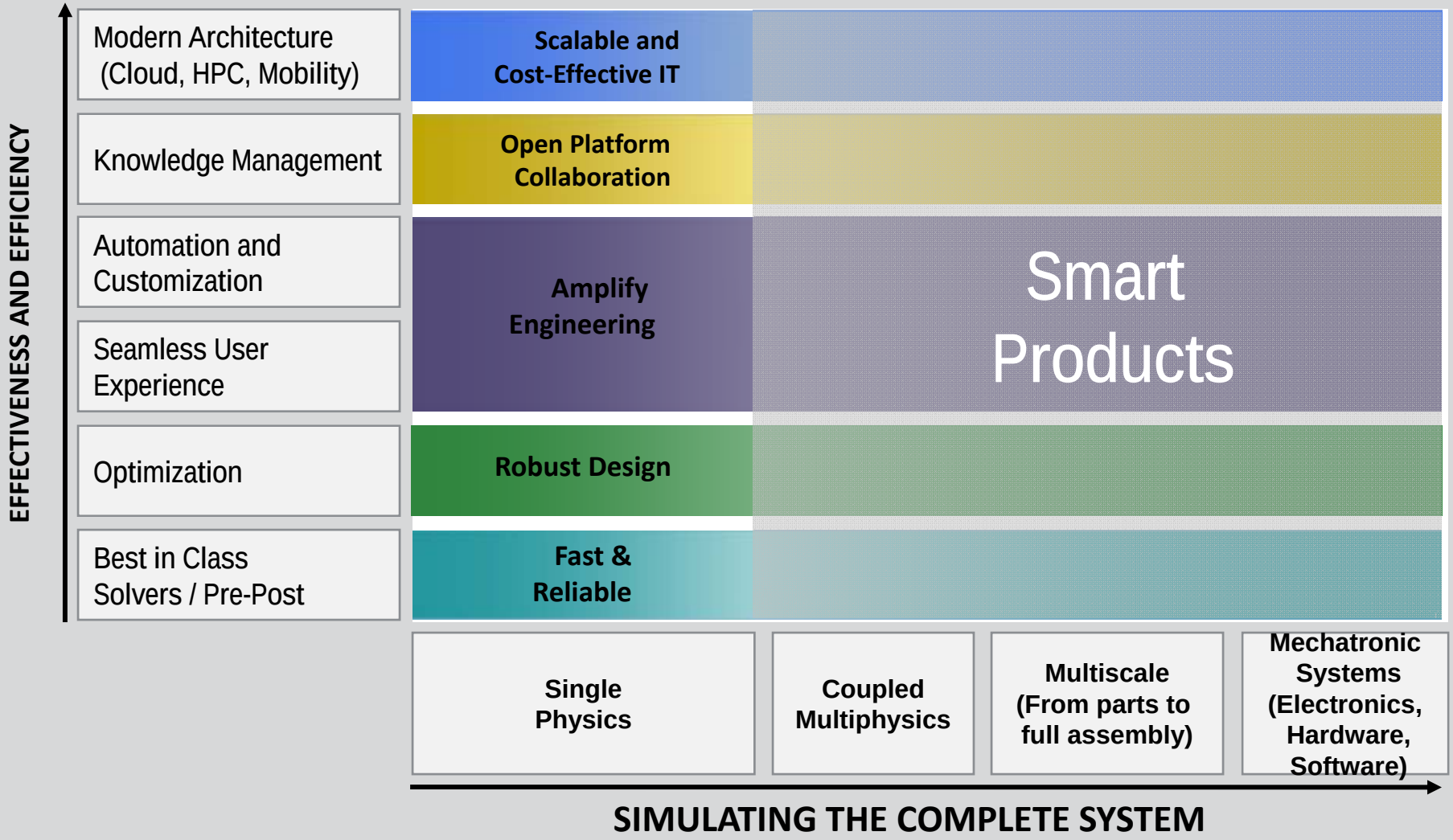
Marius Rosu, PhD

Lead Product Manager

ANSYS Inc.

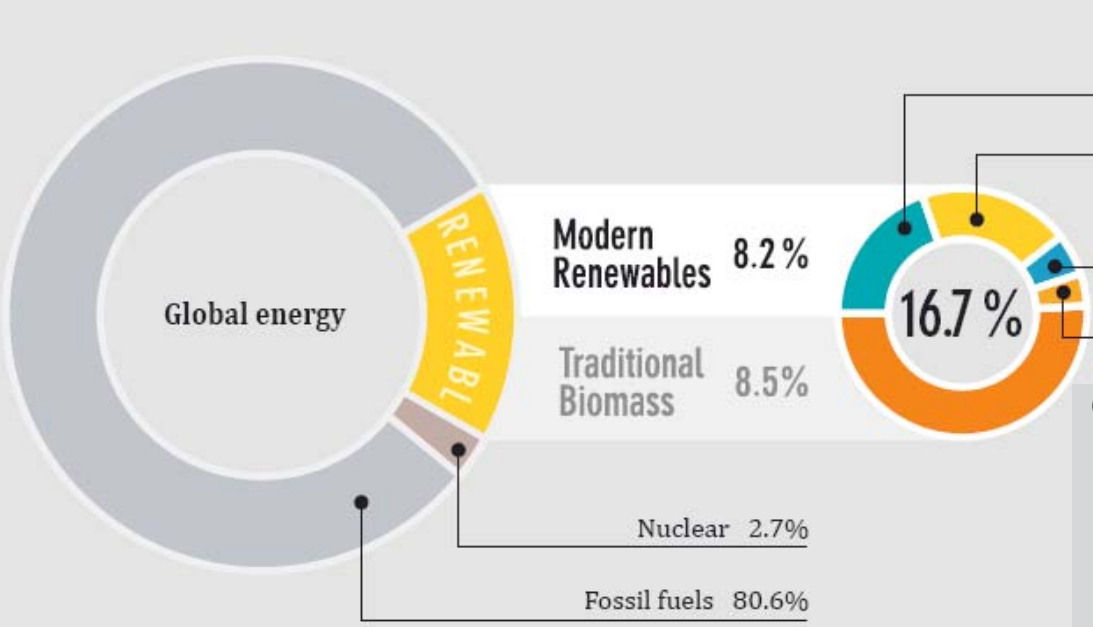
The 7th Annual University of Pittsburgh *Electric Power Industry Conference*

Solving the Current Challenges Requires a Multidimensional View of Engineering Simulation



Renewable Energy Worldwide

Global Electricity Consumption - 2010



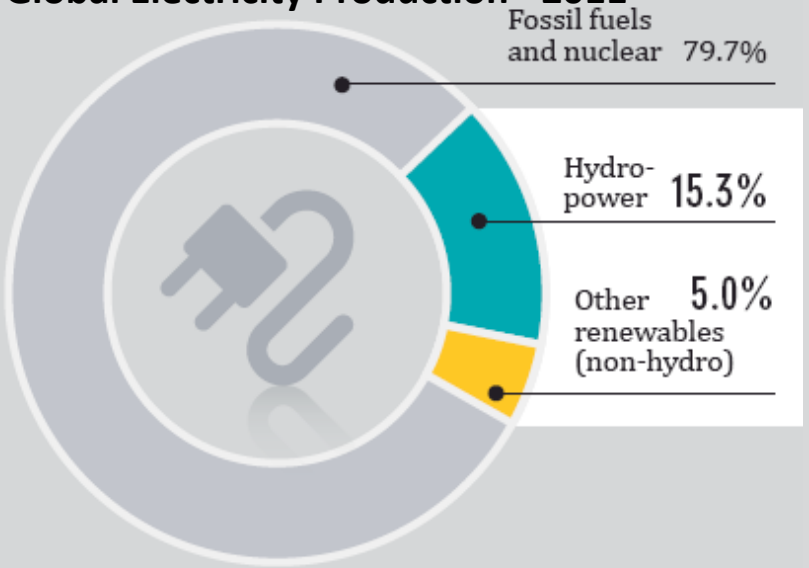
Total Power Generation 2011

5.36TW

Total Renewable Power 2011

1.36TW

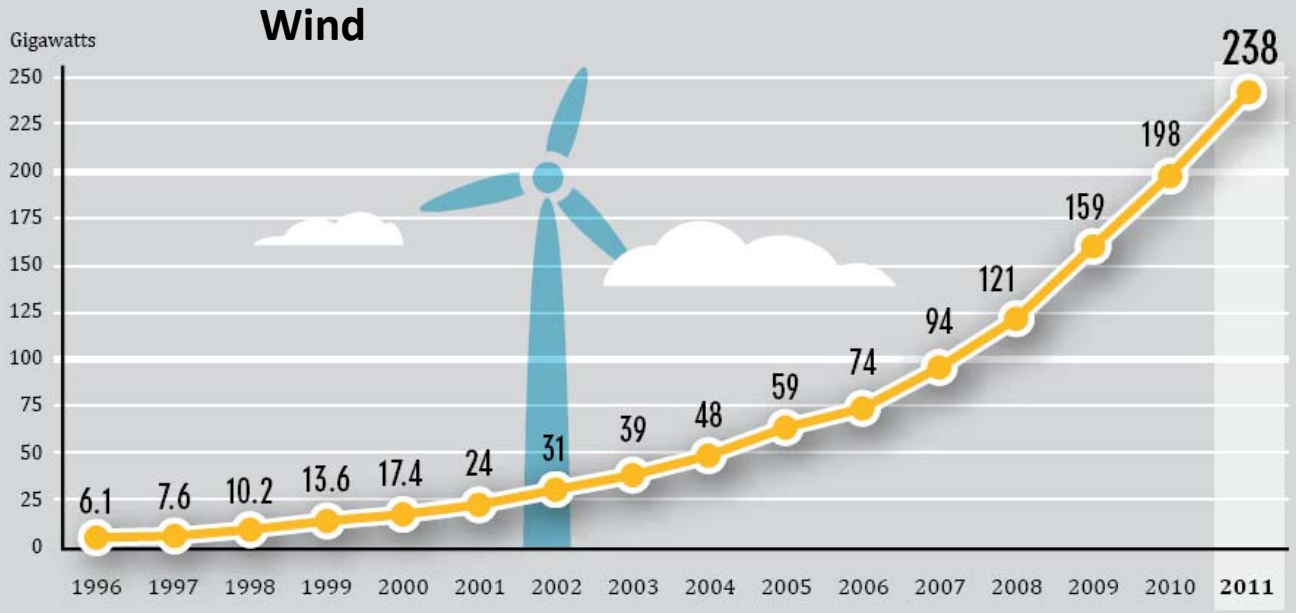
Global Electricity Production - 2011

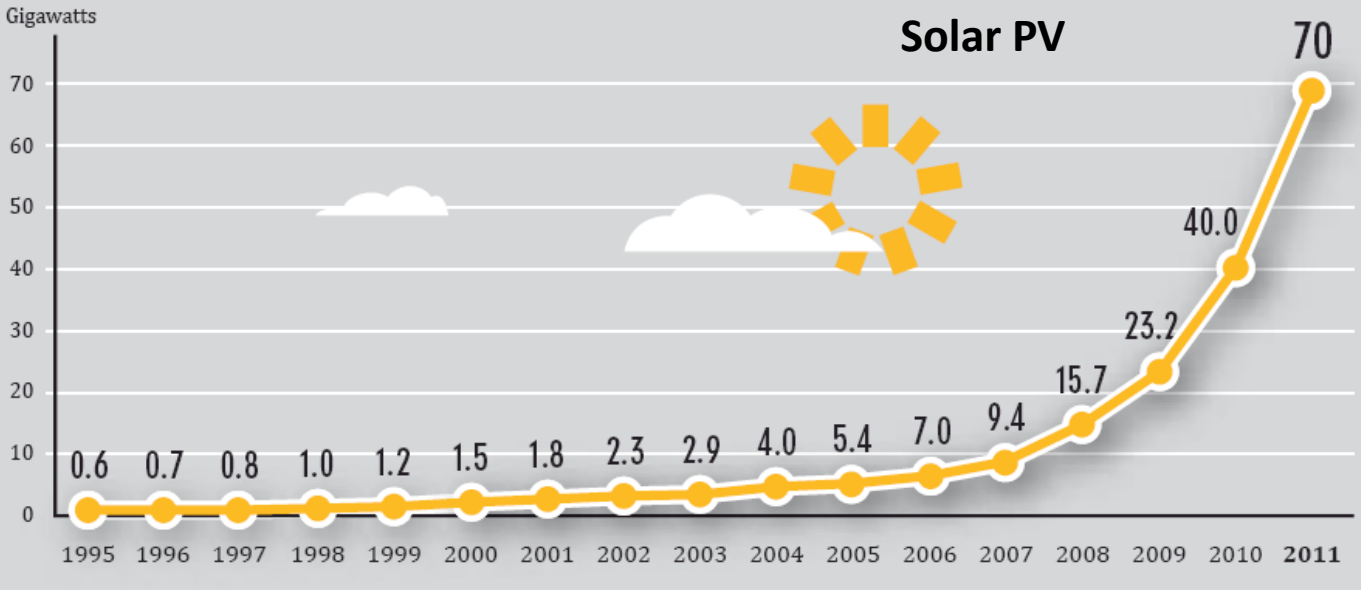


Note: Based on renewable generating capacity in operation at year-end 2011.

Source: REN21 2012 status report:
http://www.ren21.net/REN21Activities/Publications/GlobalStatusReport/tabid/5434/Default.aspx

Modern Renewable Energy Trends

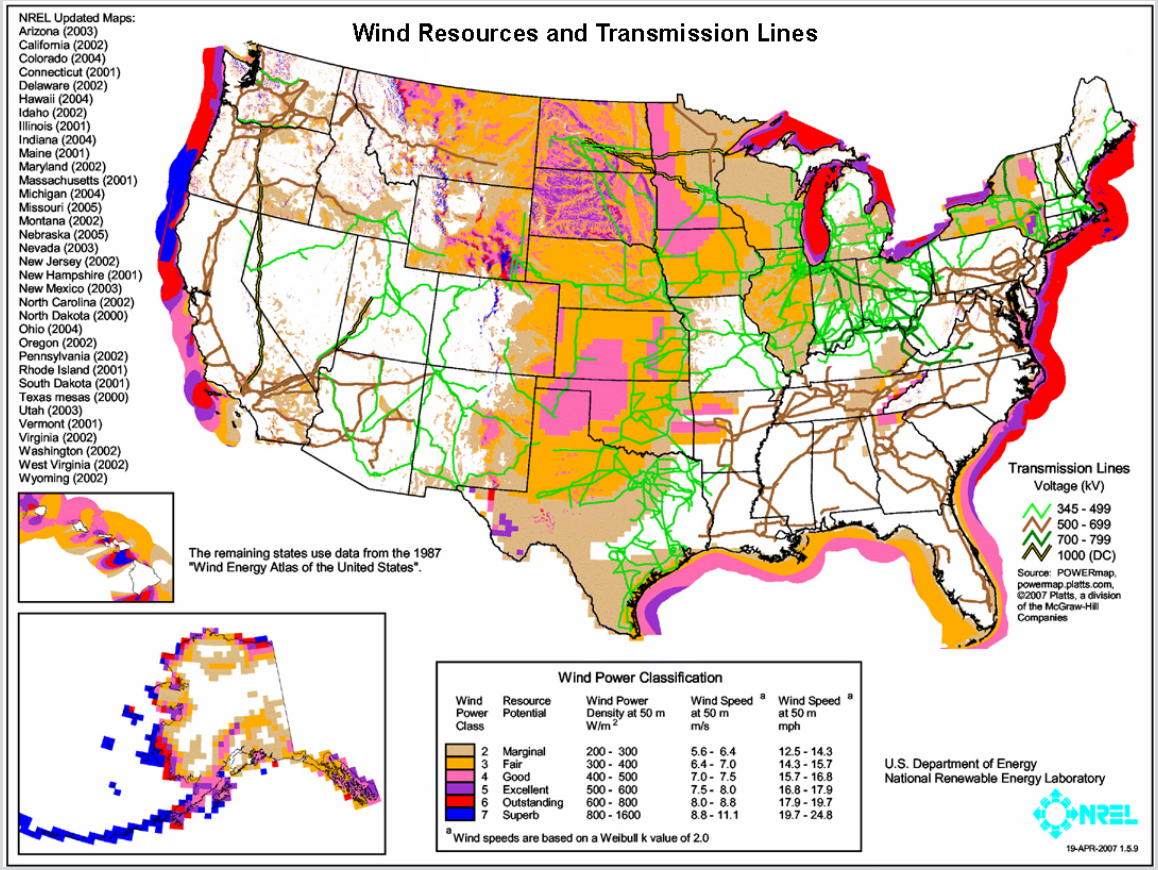




Wind Power Motivation

What is the Wind Power Potential in the US?

- Onshore capacity ~10TW, offshore ~1TW



Wind Power Motivation

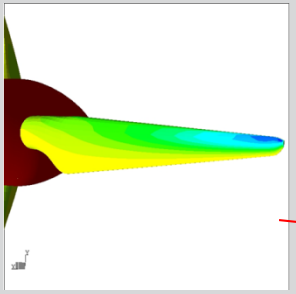
What are Wind Power Challenges?

- Onshore/Offshore
  - Variability in wind speed
  - Radar interference
  - Transmission cost
  - Harsh environment reliability
  - Scaling up size for more power

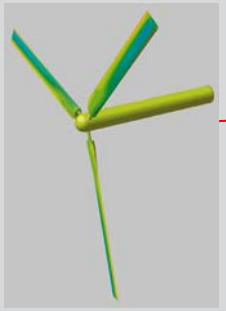
Why is Simulation Important?

- Electrical
  - As wind power is ramped up, the voltage and frequency of the grid becomes less dependent on fixed sources and more dependent on wind dynamics.
- Mechanical
  - As turbines increase in size and number, aerodynamic efficiency, securing foundations and identifying vibration becomes very important.
- Reduce Risk / Increase Reliability
  - Evaluate performance before issues arise

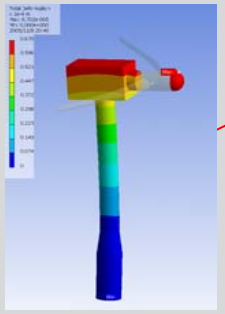
ANSYS CAE for Wind Power



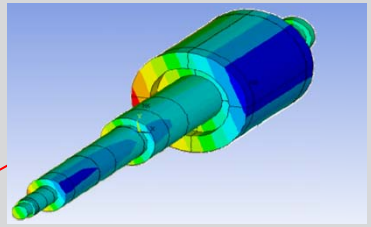
Blade design



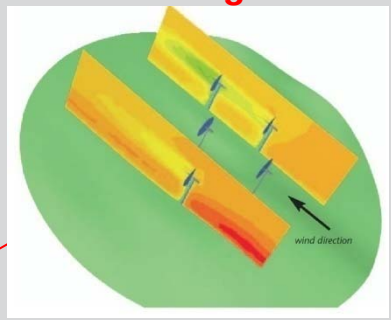
Rotor Sizing



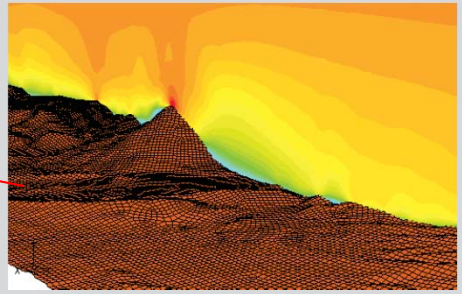
Tower design and FSI



Generator and shaft design

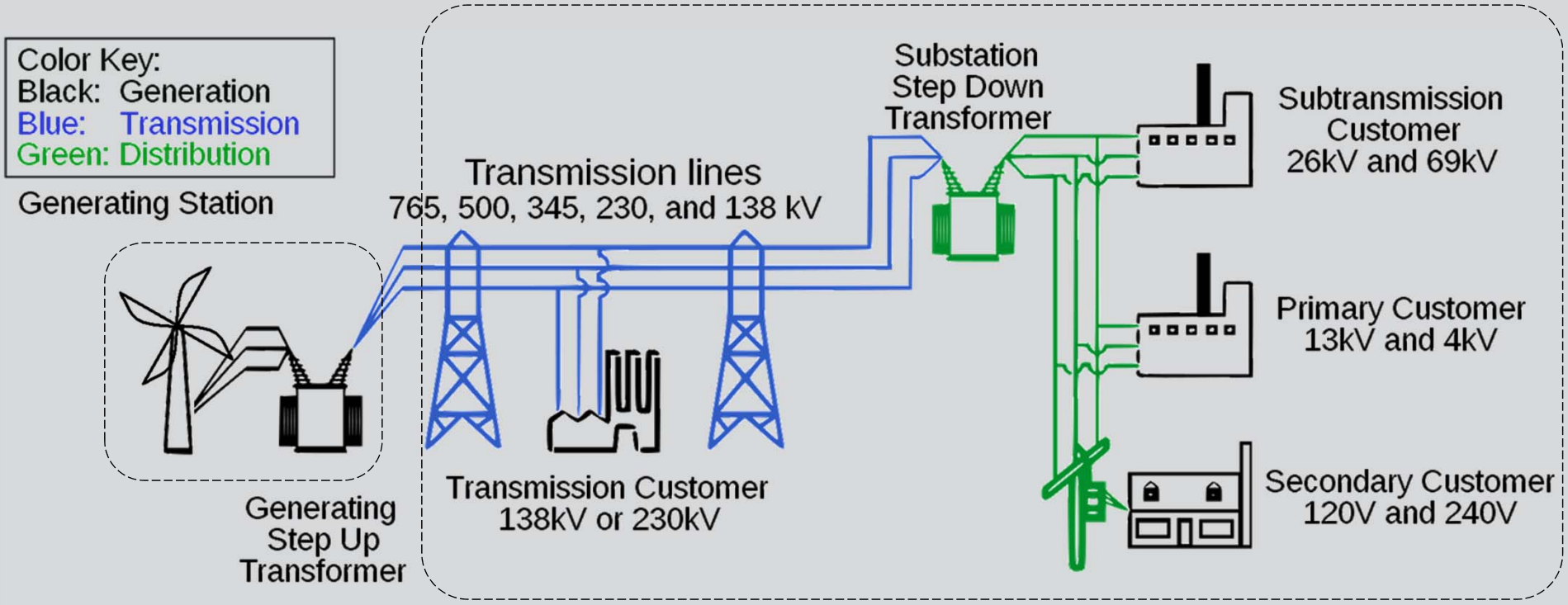


Wind farm configuration



Site selection

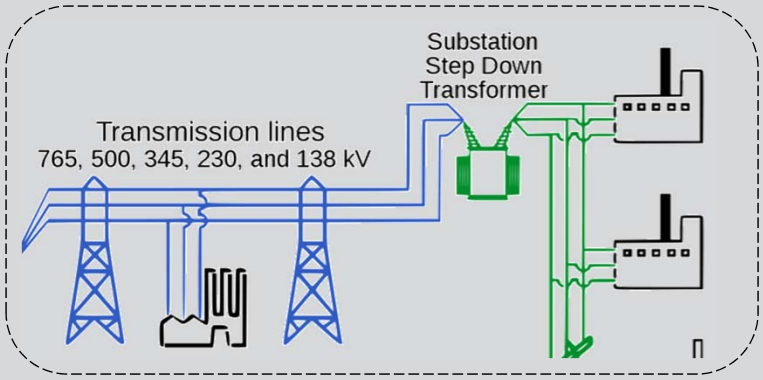
Power Grid



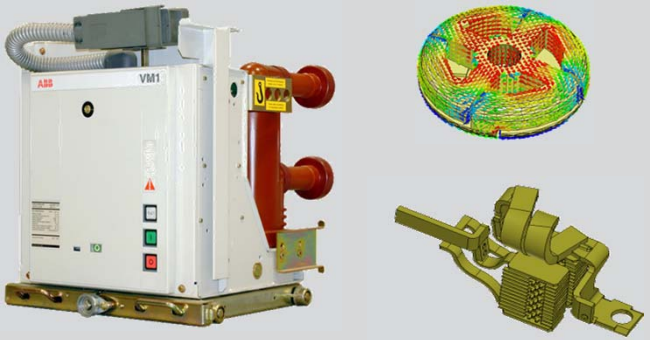
http://commons.wikimedia.org/wiki/File:Electricity_grid_simple-_North_America.svg
Original source: http://www.ferc.gov/industries/electric/indus-act/blackout/09-06-final-report.pdf

Electromagnetic Simulation

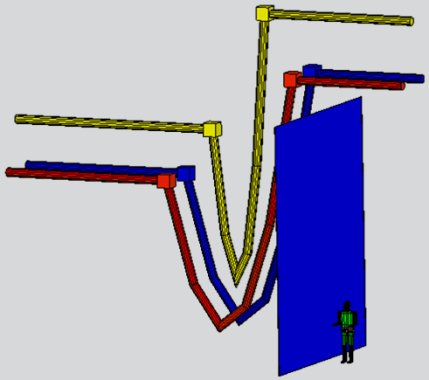
Power Transmission and Distribution



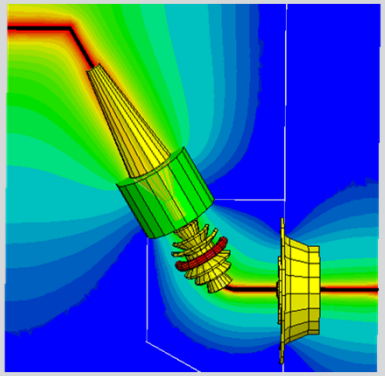
Switch Gear



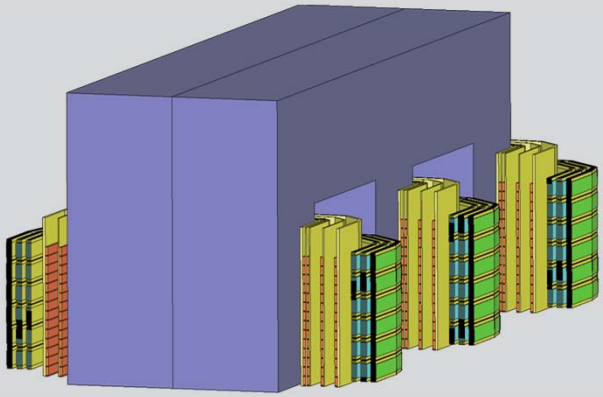
Power Lines



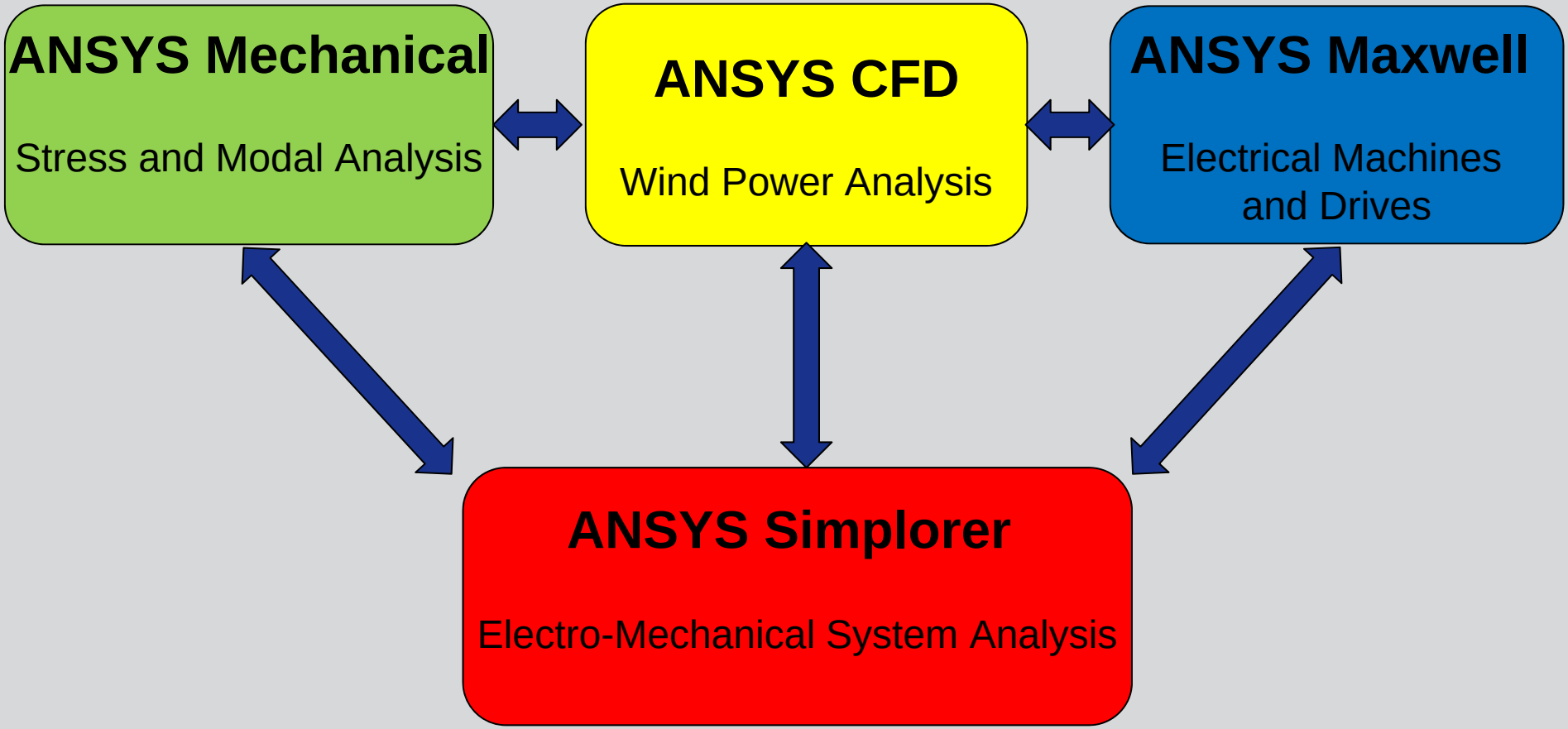
HV Terminations



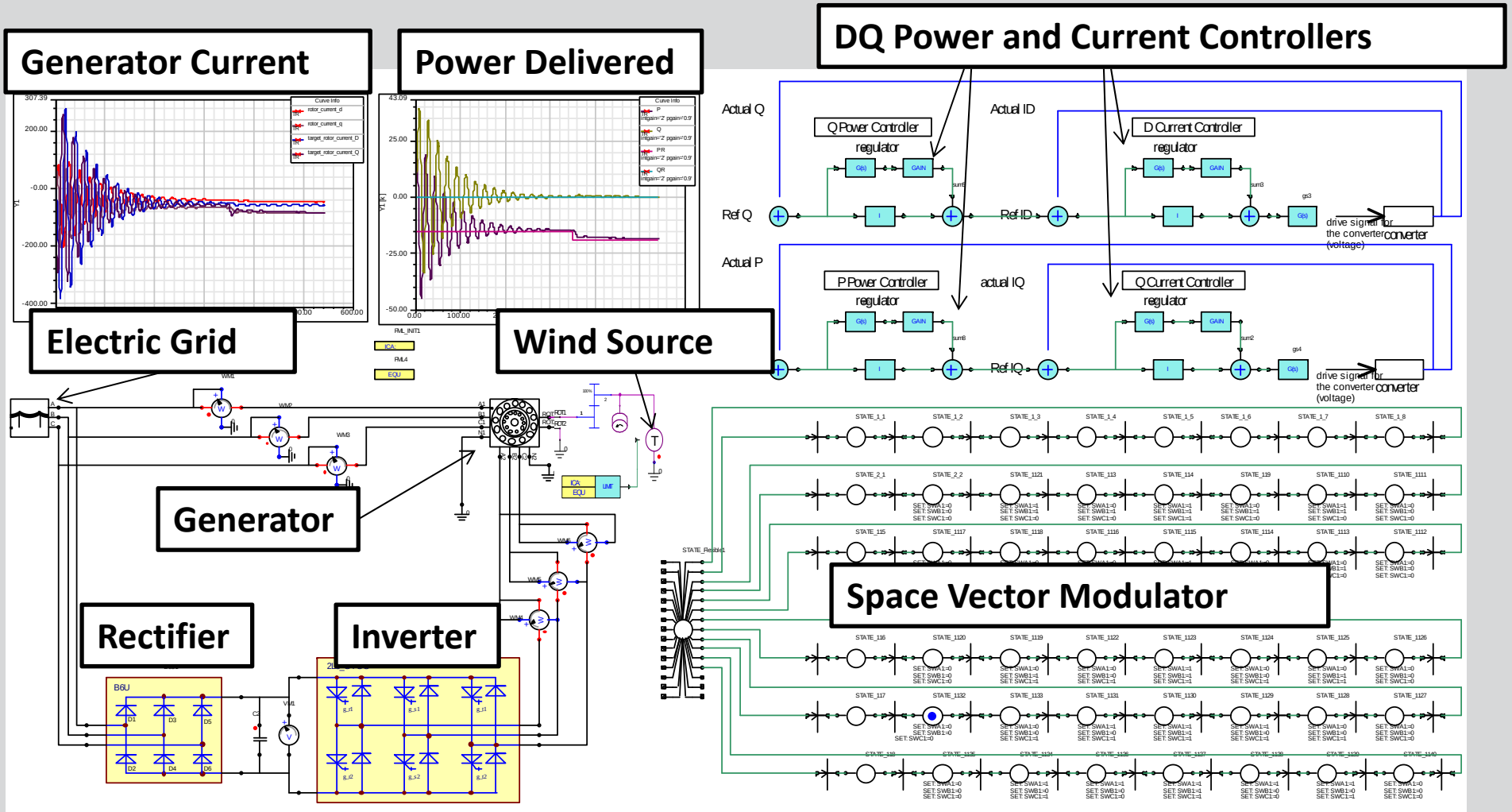
Transformers



ANSYS Multiphysics Solutions



Complete Turbine System Simulation



Summary

- Renewable energy has a strong future in the global energy sector
- Simulation helps predict reliability and capability
- ANSYS tools enable simulation for complete systems from generation, transmission, and distribution using comprehensive physics from fluid dynamics, mechanics, and electronics

ANSYS

THANK YOU