Fundamentals of Wind Energy

DAY 1

Wind Resource and Weather

The Atmospheric Wind Regime

The Planetary Boundary Layer

The Atmospheric Micro-Scale Wind Flow

The Mesoscale Wind Streams

The Macroscale Wind Resource

DAY 2

History of the Wind Industry

Introduction: Transforming Wind Speed into Electricity

How/when it all started?

Progress in Wind Turbines Technology

Wind Turbines Sizes vs Time

Current Wind Turbine Manufacturers

Global Wind Farm Developers, Investors, and Operators

DAY 3

Part I: Measuring the Wind

Meteorological Masts

Best Practices

Mounting Arrangements

Types of Sensors

Calibrations

DAY 4

Part II: Measuring the Wind

Remote Sensing Devices

LiDAR (Light Detection and Ranging)

SoDAR (Sound Detection and Ranging)

Wind Data Quality Control (QA/QC)

Wind Measurement Campaign Definition

DAY 5

Layout and Mapping

Topography Maps

Ground Coverage (roughness) Maps

Forestry Maps

Wind Farm Layout Optimization

Micro Sitting

DAY 6

Software and Apps for the Wind Industry

Introduction to software that dominates the industry

GIS (Global Mapper and Google Earth Pro)

Wind Resource and Energy Assessment (Openwind, WAsP, WindPro, and WFA)

Global Wind Atlas

Py-wake (DTU)

Floris (NREL)

DAY 7

Wind Energy Production Assessment

Wind Energy Production Assessment (step-by-step)

Energy Loss Factors

Turbines Wake Effect

Blockage Effect

Uncertainty Factors

Follow An Example Project

DAY 8

Offshore Wind

Offshore Wind: Where do we stand?

Best Practices and Differences

Measurement Devices

FLiDAR (Floating LiDAR Devices)

Wakes and Blockage on Offshore Wind Farms

DAY 9

Civil and Infrastructure

Wind Farm Construction Steps

Environmental Permits

Electric interconnection with the national grids

Grid cap (restrictions and curtailments)

Wind Sector Management Strategies

Shadow Flicker Curtailment

Noise Curtailment

DAY 10

Selling the Energy

Different Forms of Selling Wind Energy

PPAs (Power Purchase Agreements)

Free Markets

Regulated Markets

Energy Tenders (Auctions)

Hybrid Projects and Hybrid PPAs