September School 2026 Cape Town

Module 4: Renewable Energy

Prof. Dr.-Ing. Hermann Knaus

31.03.2026

COURSE DESCRIPTION

Why join this course?

Shape the future of energy! In this September School, you will dive deep into how modern energy systems work — and how renewable technologies are transforming our world. You'll not only understand the technical side, but also explore the economic, social, and political factors that drive real-world energy decisions.

What you will explore

This course offers a hands-on introduction to today's most important renewable energy technologies:

- Solar energy (photovoltaics)
- Wind power
- Hydropower

You'll learn how energy is generated, converted, and integrated into modern power systems. Along the way, we connect theory with real-world applications — from system design to grid integration.

COURSE DESCRIPTION

What you will gain - Skills

By the end of the course, you will be able to:

- Understand and compare three key renewable energy technologies
- Analyze how these technologies work and where they are best applied
- Explore how renewable energy can be integrated into existing energy systems
- Critically assess environmental impacts and sustainability aspects

How you will learn

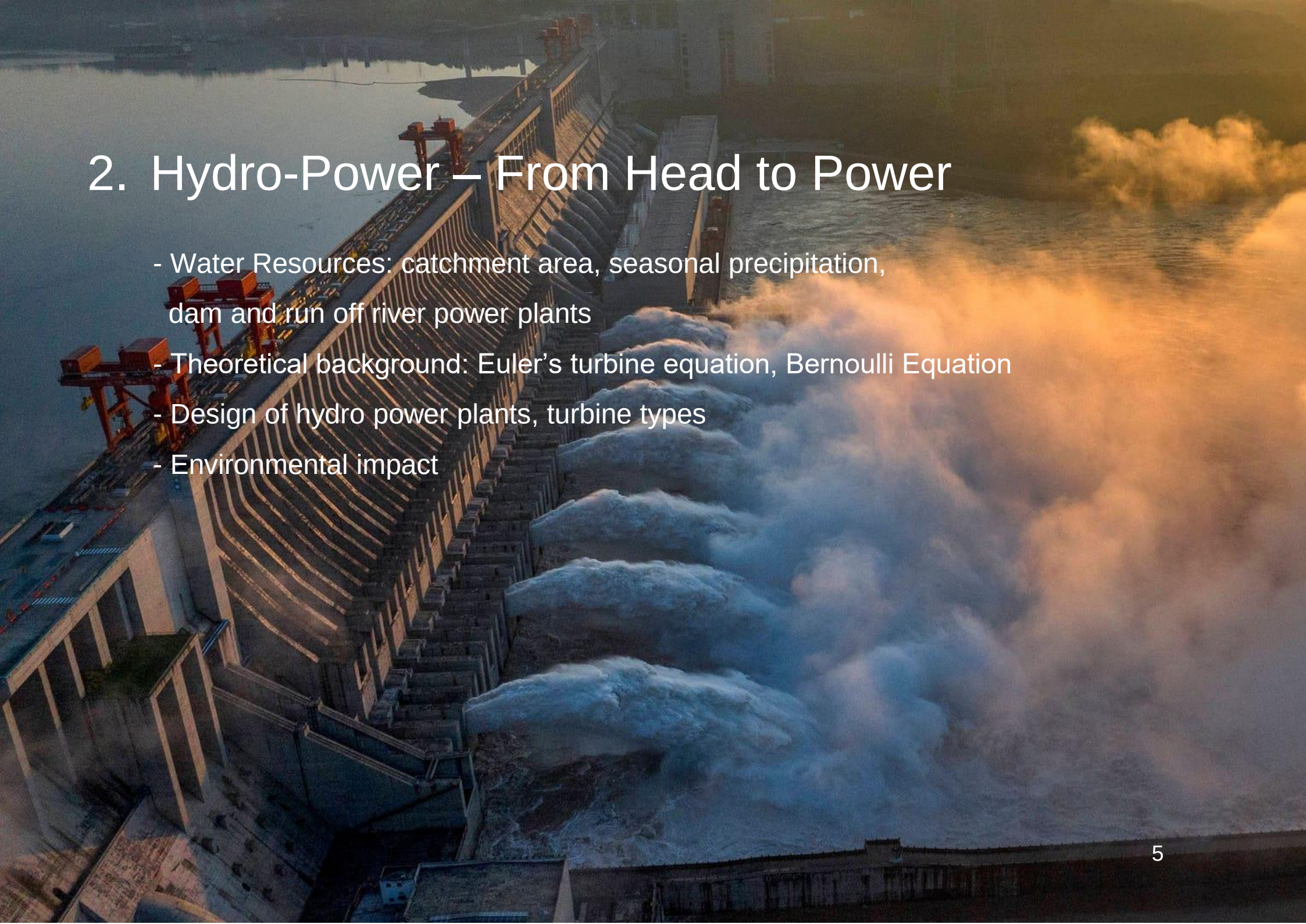
This is not just a lecture-based course:

- Interactive sessions
- Practical exercises
- Discussions

You'll actively apply what you learn and exchange ideas with fellow students from diverse backgrounds.

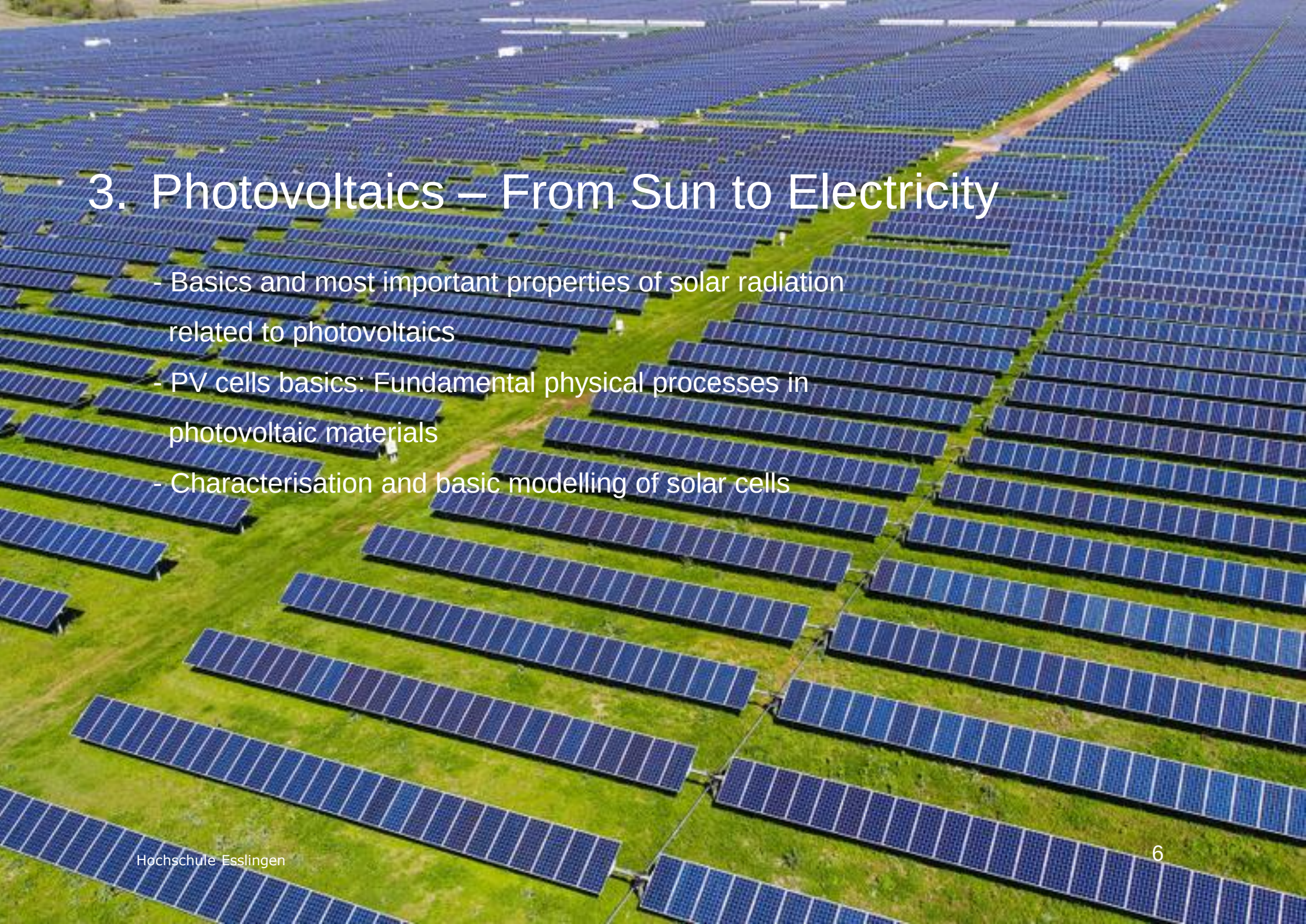
1. Wind Energy – From Wind to Power

- Wind Resources: Wind Atlas, Weibull-Distribution, site assessment
- Aerodynamic aspects of wind energy conversion, Betz's law
- Design of wind turbines
- Environmental impact



2. Hydro-Power – From Head to Power

- Water Resources: catchment area, seasonal precipitation, dam and run off river power plants
- Theoretical background: Euler's turbine equation, Bernoulli Equation
- Design of hydro power plants, turbine types
- Environmental impact

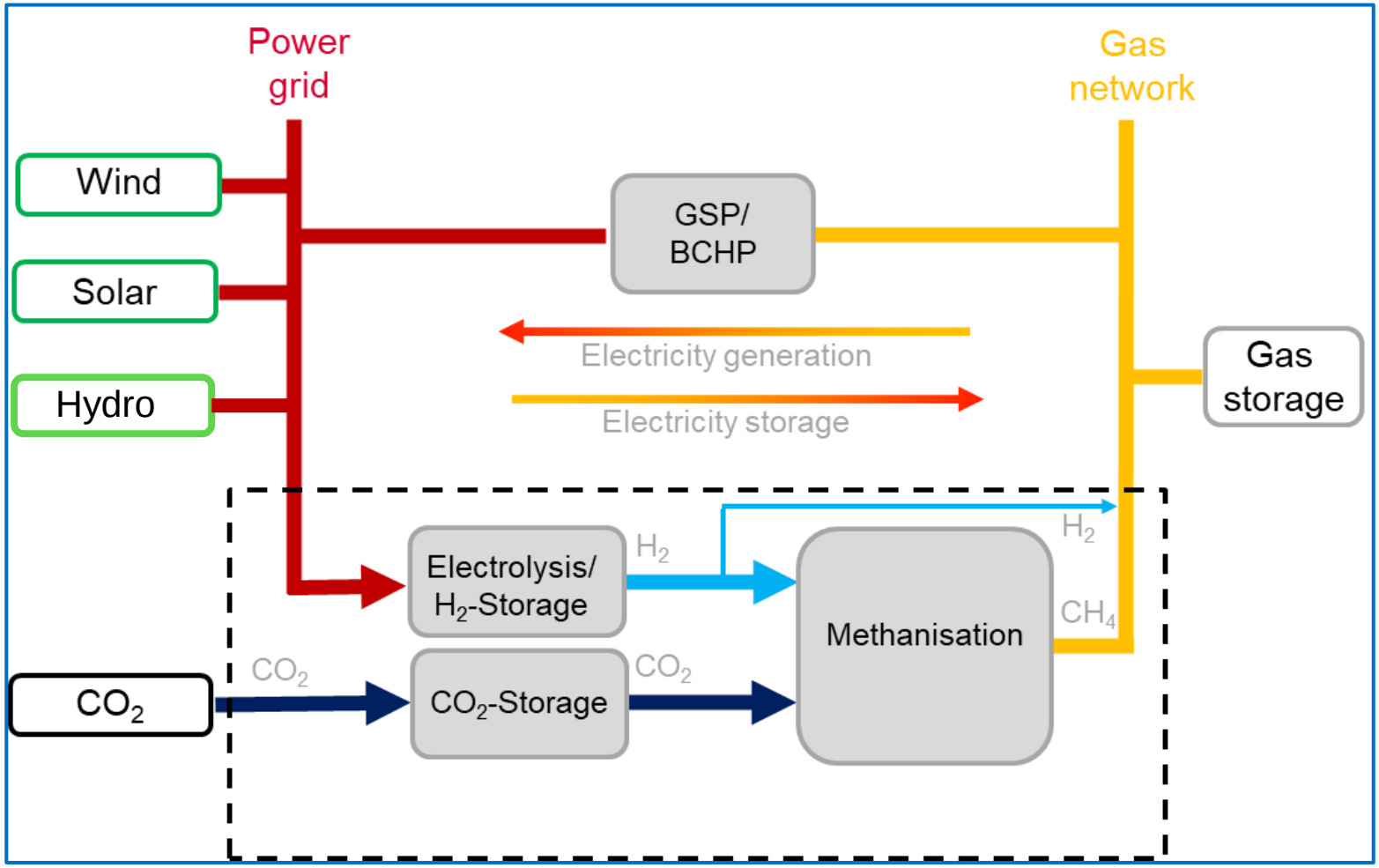


3. Photovoltaics – From Sun to Electricity

- Basics and most important properties of solar radiation related to photovoltaics
- PV cells basics: Fundamental physical processes in photovoltaic materials
- Characterisation and basic modelling of solar cells

4. System Integration

- Power-to-X (PtX)
- Decentralised vs. centralized energy production



ORGANISATION – STUDY ASSIGNMENT

HOCHSCHULE ESSLINGEN

Virtual Period

| Introduction in Module 4 „Renewable Energy“ and release of self-study task: 24 August 2026, 11:00 – 12:30, Webex online meeting

| Self-study task has to be finished by 21 August 2026 and submitted on bwSync&Share

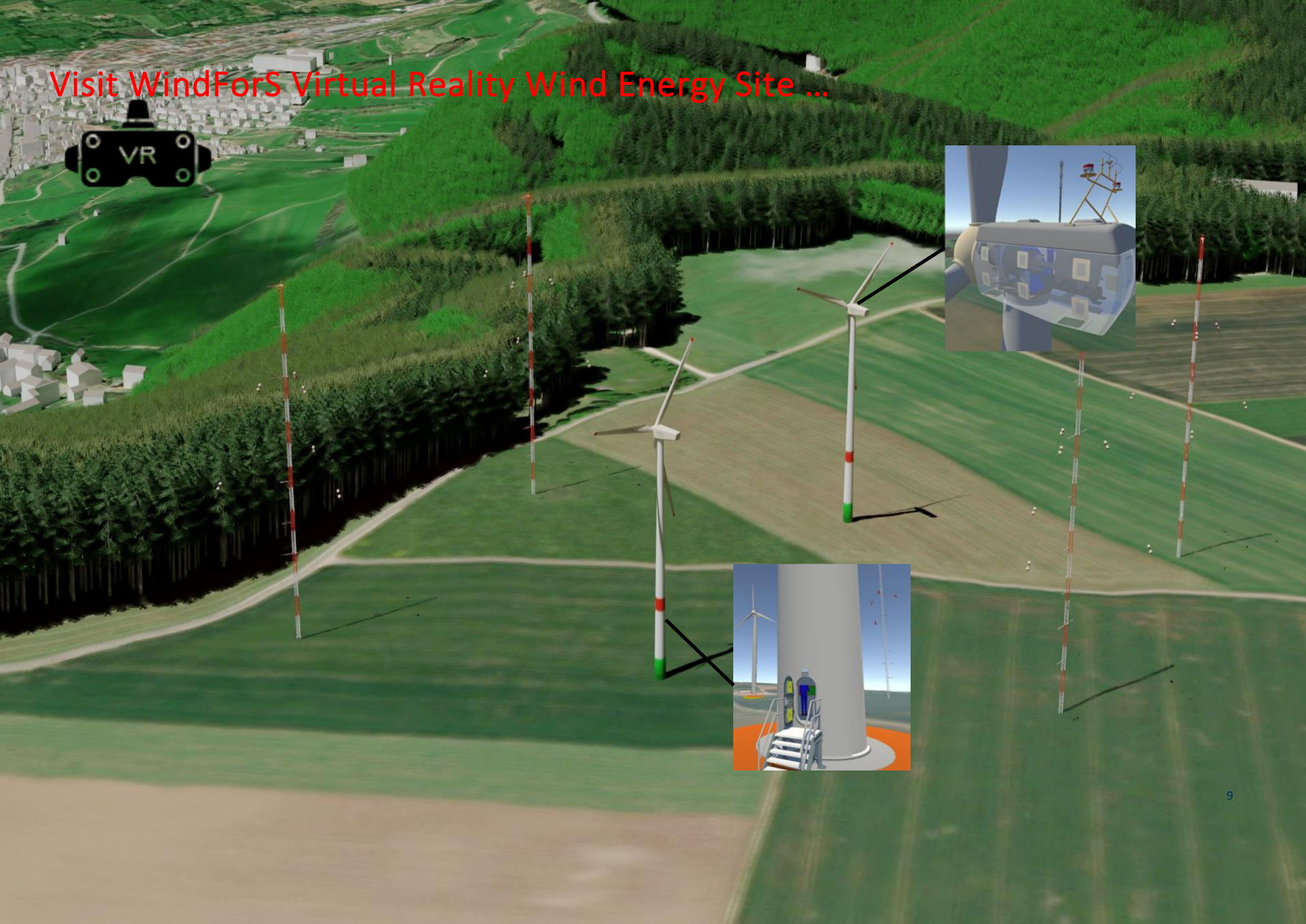
Physical Period

| Module 4, „Renewable Energy“, 30 August 2026 – 12 September 2026

Study Assignment

| Submission by Saturday, 26 September 2026 on bwSync&Share

Visit WindForS Virtual Reality Wind Energy Site …



… and visit South African Renewable Energy Technology Centre (SARETEC)