



Sustainable Development Futures LEARNING MODULES

Energy

Climate Change and Environment

Renewable Energy and Low-Carbon Technologies



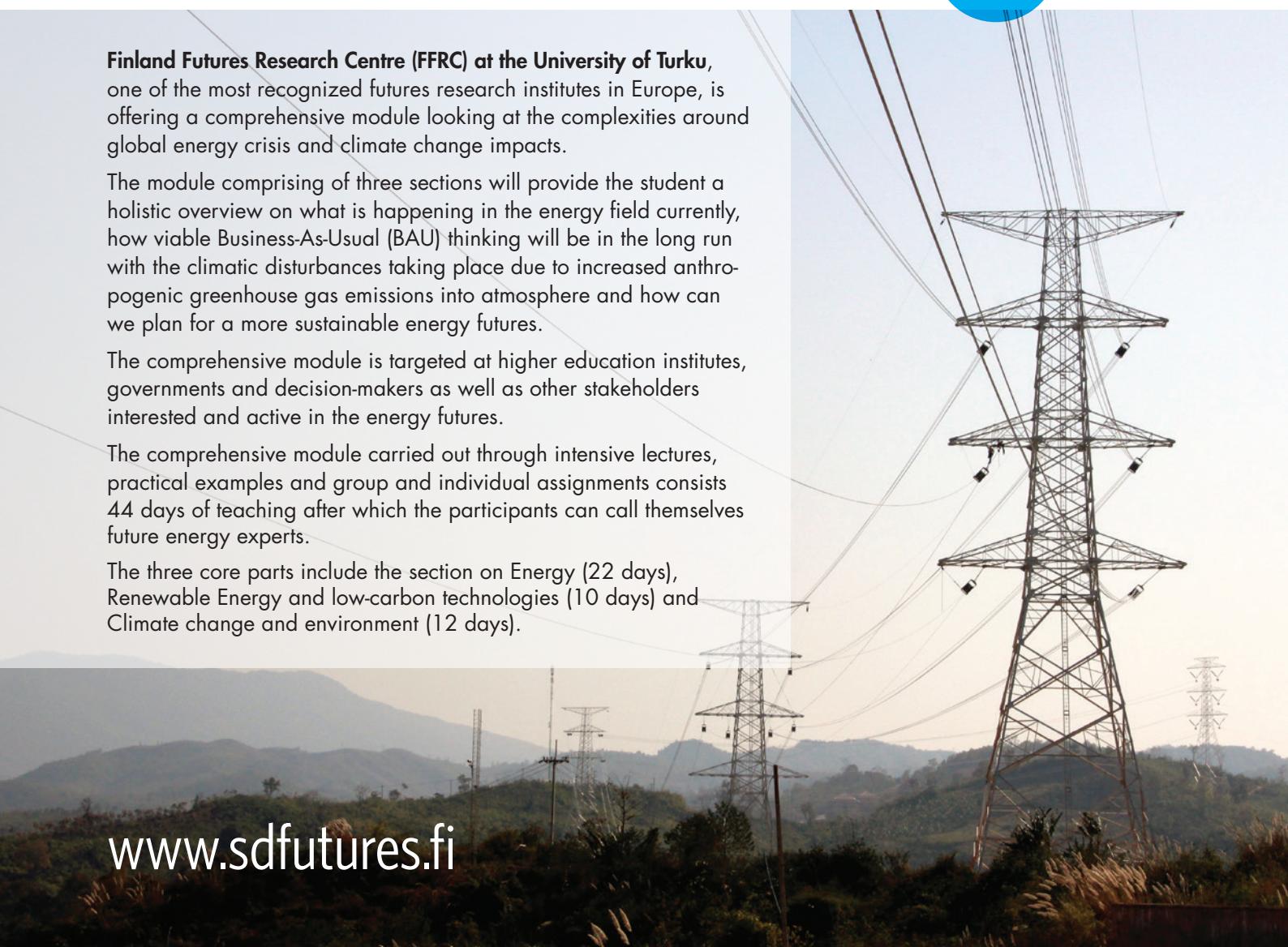
Finland Futures Research Centre (FFRC) at the University of Turku, one of the most recognized futures research institutes in Europe, is offering a comprehensive module looking at the complexities around global energy crisis and climate change impacts.

The module comprising of three sections will provide the student a holistic overview on what is happening in the energy field currently, how viable Business-As-Usual (BAU) thinking will be in the long run with the climatic disturbances taking place due to increased anthropogenic greenhouse gas emissions into atmosphere and how can we plan for a more sustainable energy futures.

The comprehensive module is targeted at higher education institutes, governments and decision-makers as well as other stakeholders interested and active in the energy futures.

The comprehensive module carried out through intensive lectures, practical examples and group and individual assignments consists 44 days of teaching after which the participants can call themselves future energy experts.

The three core parts include the section on Energy (22 days), Renewable Energy and low-carbon technologies (10 days) and Climate change and environment (12 days).



MODULE 1.

Energy



TARGET GROUP

This module is targeted at:

- Students of higher education institutions with a background on energy, environment, engineering, economics or other relevant fields
- Private or public sector entities involved in energy planning, energy modeling and economic development
- National institutions and Government policy-makers responsible for energy strategy and planning
- Other stakeholders across the public and private sectors
- Governmental and non-government stakeholders involved in the development and implementation of energy efficiency policy
- Agencies, industry and academics involved in energy planning/development and in low-carbon policy

LEARNING OUTCOMES

The module will provide the participants with a comprehensive overview on energy planning, energy statistics and energy modeling options at different scales. It will also delve into energy markets, energy efficiency measures and tracking energy related information as well looking into policy issues related to energy. After the course the participants should have the necessary background knowledge in order to evaluate different alternatives for energy production and their economics.

STRUCTURE AND LENGTH

The module is an intensive course consisting lectures, practical exercises and demos as well as individual and group assignments with a total length of 22 consecutive teaching days. The module can also be tailored to fit the needs and time constraints of the client on a case by case basis.

CONTENT OF THE MODULE

The module consists of 8 parts:

1. Introduction to non-renewable and renewable energy production: (nuclear, fossil, renewable energy sources)
2. Energy statistics
3. Energy and sustainability indicators
4. Macro and micro level and technology modeling: LEAP, LINDA, International Futures IFs, HOMER, RET-Screen, VIPOR
5. Energy planning: Energy systems, scenario building and forecasting
6. Energy efficiency and policy design
7. Energy markets and security
8. Carbon capture and storage

AVAILABILITY OF THE MODULE

The module is available annually dependent on demand and can be tailor-made to fit the customer's need and time preferences.

REFERENCES

Finland Futures Research Centre (University of Turku, Finland) has been active in the energy strategy and forecasting for since 1990s with a clientele from public and private sector from both the developed and developing countries.

More information can be found from Sustainable Development Futures, www.sdfutures.fi.

DETAILED DESCRIPTION OF THE MODULE

1. Introduction to non-renewable and renewable energy production: (nuclear, fossil, renewable energy sources) (1 day)

The module offers introduction to both renewable and non-renewable energy resources and energy production. It gives a comparative analysis on the pros and cons of each of the available technologies and looks into climatic and environmental effects of different energy production systems.

2. Energy Statistics (2 days)

This module offers introduction to internationally recognized methodologies and tools for collecting and organising national-level energy data by different fuels and sectors of the economy (e.g. IEA). It focuses on creating complete and accurate energy balances through the use of energy statistics with consistent definitions and units, in order to inform national energy policy and enable consistent international reporting.

3. Energy and Sustainability Indicators (2 days)

This module covers the development and application of end-use energy efficiency and sustainability indicators to understand past trends and sustainability, assess the potential for enhanced sustainability in energy sector, energy savings and efficiency and enhance sustainable energy policies. Defining and designing energy and sustainability indicators are then further explored during the course looking at both at national and sectoral level and increasingly indicators related to CO₂ emissions are studied.

4. Macro and micro level and technology modeling (5 days)

This module is designed to teach the principles and application of bottom-up and top-down energy system analysis for a portfolio of technologies. It focuses on different models for exploring least-cost, long-term strategies in a country's or region's energy sector. A combination of theory and practical exercises structure this module so that after the training the participants are able to use micro and macro-level modeling software as well as to design their own energy systems. The course discusses essential inputs and outputs to the models and the limitations and benefits of different models and showcases how to construct multi-regional models and energy balances. In addition the module links energy technology modeling and respective technology costs to support decision making and energy policies for low-carbon energy production.

5. Energy Planning: Energy systems, scenario building and forecasting (3 days)

This module explores the principles, methods and techniques employed to generate comprehensive medium to long-term energy system projections. Its objective is to familiarise the course participants with the complex inputs and analysis necessary to produce plausible scenarios and together with energy technology modeling the scenario

building and forecasting can provide powerful tools to inform policy decisions.

6. Energy Markets and security (1 day)

The training looks at the global markets for oil, gas, coal, biofuels and electricity and the need for thorough analysis to support market transparency, investment planning, policy formation and emergency response. Participants will learn the fundamentals of sourcing data, market analysis, producing reliable results. Emphasis is put on both short and long-term market and policy analysis as well as national and regional approaches outlook – identifying key areas of growth (in both demand and supply) and drivers of price fluctuation, as well as anticipating power supply shortages and emergencies.

7. Energy efficiency and Policy design (2 days)

The module will cover energy efficiency best practice and interventions across the entire economy and discuss specific sectors including buildings and transport. Overview is given on the fundamental elements of good Energy Efficiency policy design, implementation and evaluation. A range of case studies from around the world will be presented, and the course also offers concrete policy development tools and a group problem-solving exercises. The module also discusses on the policy design for energy efficiency governance and indicators in various selected sectors.

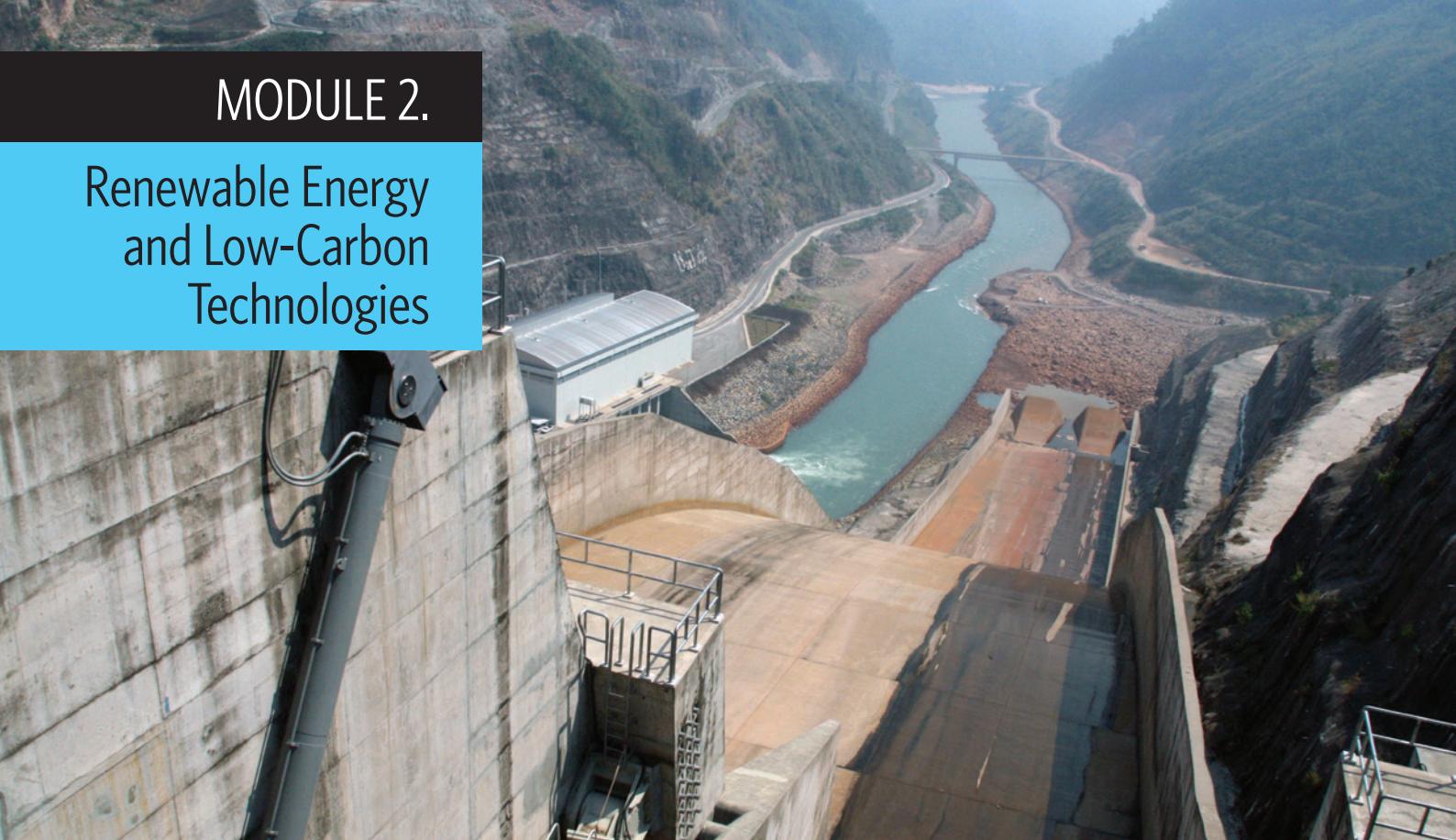
8. Carbon Capture and Storage (1 day)

This module explores a variety of strategic, technical, legal and regulatory aspects of Carbon Capture and Storage (CCS) technologies. It provides a better understanding of the potential of these technologies, their current and future challenges, and their deployment globally. The module also looks into potential environmental impacts of CCS.



MODULE 2.

Renewable Energy and Low-Carbon Technologies



TARGET GROUP

This module is targeted at:

- Students of higher education institutions with a background on energy, environment, engineering, economics or other relevant fields
- Government officials involved in renewable energy and climate policies
- Renewables regulators, utilities and other key stakeholders
- Agencies, industry and academics interested in renewables markets

LEARNING OUTCOMES

The module will provide the participants with a comprehensive overview on renewable energy and energy management, finance and options. After the course the participants should have the necessary background knowledge in renewable energy, its management and financing as well as the applications.

STRUCTURE AND LENGTH

The module is an intensive course consisting lectures, practical exercises and demos as well as individual and group assignments with a total length of 10 consecutive teaching days. The module can also be tailored to fit the needs and time constraints of the client on a case by case basis.

AVAILABILITY OF THE MODULE

The module is available annually dependent on demand and can be tailor-made to fit the customer's need and time preferences.

CONTENT OF THE MODULE

The module consists of 7 parts:

1. Introduction to renewable energy – key concepts and technologies
2. Biomass
3. Wind
4. Solar Thermal and Photovoltaics (PV)
5. Wave, tidal and hydropower
6. Renewable energy management and finance
7. Renewable energy solutions

REFERENCES

Finland Futures Research Centre (University of Turku, Finland) has been active for decades in the renewable energy planning and capacity building with a clientele from public and private sector from both the developed and developing countries.

More information can be found from Sustainable Development Futures, www.sdfutures.fi.



DETAILED DESCRIPTION OF THE MODULE

1. Introduction to Renewable energy (1 day)

By 2050 nearly 50% of global electricity could come from renewable energy sources. In many countries large-scale deployment of proven renewables solutions has started while technological innovation continues. A sizeable renewables portfolio could contribute to a country's energy security, emissions reduction and access to energy. Still, serious hurdles remain concerning the financing, affordability, and grid integration of renewables. In this module participants will investigate state-of-the-art renewable energy technologies, assessing their cost-effectiveness and possibility for large-scale deployment. The training explores specific issues relating to policy objectives and implementation pathways and milestones.

2. Biomass (2 days)

The course introduces the participant into basic concepts of biomass looking at factors such as sustainability, properties of biomass, feedstocks and technology types. Furthermore it goes in depth in looking at resource availabilities and potentials, feedstock, and different processes and applications of anaerobic digestion, liquid biofuels and in combustion, pyrolysis and gasification. It examines the different raw materials and available technologies and looks at pros and cons of different alternatives. The mode of teaching is through lectures, case studies and practical exercises.

3. Wind (1 day)

The module looks at the basic science behind wind power: turbines, different scales of wind power plants, both off shore and on shore, aerodynamics, classification of plants and available technologies but also into economics, markets and incentive structures and policies related to adoption of wind power. It also outlines some of the environmental impacts and other impacts related to wind power.

4. Solar Thermal and Photovoltaics (PV) (2 days)

The module introduces the science behind solar power and some of the basic terminology involved such as solar radiation/illumination, photovoltaic energy, effect and cells, composition of the light, daily/annual energy but also into technology options in solar thermal and PV markets, costs, rate of returns and economics and installing, operation and maintenance related aspects. It also talk about the efficiency, practical solutions and pros and cons of solar power applications.

5. Wave, tidal and hydropower (2 days)

This module outlines the basics of wave, tidal and hydro power with the analysis of the physics principles of different technologies. It also looks into economics, best available technologies, different scales and environmental and social impacts hydropower through case studies. It also discusses the pros and cons of each of the technologies and provides an overview of the available simulation tools.

6. Renewable Energy Management and finance (1 day)

This module looks into renewable energy finance outlining some of the key factors such as feed-in tariffs, basic technical calculations on energy production, economics and emissions, looking at Life Cycle Assessments (LCAs) and Environmental Impact Assessments (EIAs) and discussing on the different policies and incentives in place globally e.g. EU. It also looks into project finance calculations to examine the most feasible options for energy production. The module will be carried out through case studies and lectures.

7. Renewable energy solutions (1 day)

The module gives an overview of the different renewable energy technologies and assists in making the best choices in various conditions. It also looks into economics and payback times of each of the technologies as well as their potential environmental impacts. It also presents some of the latest innovations in the renewable energy applications such as Solar Geometry, Solar Chimneys, Solar Wall and solar paints, Natural Ventilation and Solar heating and cooling, earth ducts, printable solar cells etc. Finally it discusses hybrid systems and provides some guidance on available software for planning renewable energy systems.



MODULE 3.

Climate Change and Environment



TARGET GROUP

This module is targeted at:

- Students of higher education institutions with a background on energy, environment, engineering, economics or other relevant fields
- Government officials in charge of formulating climate policies and/or mitigation of environmental impacts from investments
- Private or public sector entities subject to GHG reduction policies (voluntary or binding), and in particular those with an interest in – using international carbon markets in reaching their goals
- Private sector interested in corporate environmental and social responsibility

LEARNING OUTCOMES

The module will provide the participants with a comprehensive overview on climate change adaptation and mitigation as well as carbon markets, impact assessments and corporate environmental and social responsibility. After the course the participants should have the necessary background knowledge in climate change impacts, mitigation and adaptation, the voluntary and binding carbon markets as well as impact assessments and CSR&CER.

CONTENT OF THE MODULE

The module consists of 6 parts:

1. Introduction to greenhouse effect and climate change
2. Climate change impacts, mitigation and adaptation
3. CDM, carbon markets and climate related policies
4. Emission controls and technology
5. Impact assessments and analysis (Environmental, social, vulnerability)
6. Corporate social and environmental responsibility

STRUCTURE AND LENGTH

The module is an intensive course consisting lectures, practical exercises and demos as well as individual and group assignments with a total length of 12 consecutive teaching days. The module can also be tailored to fit the needs and time constraints of the client on a case by case basis.

AVAILABILITY OF THE MODULE

The module is available annually dependent on demand and can be tailor-made to fit the customer's need and time preferences.

REFERENCES

Finland Futures Research Centre (University of Turku, Finland) has been active for decades in the climate change related problematic and capacity building with a clientele from public and private sector from both the developed and developing countries.

More information can be found from Sustainable Development Futures, www.sdfutures.fi.



DETAILED DESCRIPTION OF THE MODULE

1. Introduction to greenhouse effect and climate change (1 day)

This introductory lecture will explain the basic science behind the greenhouse effect and climatic change. It examines the current understanding of climate scientists on the greenhouse effect and current global warming trend due to anthropogenic emissions. Furthermore it studies in detail the major underlying causes of climate change and its impacts to people and the environment.

2. Climate change impacts, mitigation and adaptation (3 days)

The course is designed for participants familiar with the basic science of climate change and the international negotiations that have occurred since the drafting of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992.

The course draws on diverse fields ranging from economics to international relations and energy systems analysis. We examine climate change from an international perspective, with particular emphasis placed on the world's developing countries. The course opens with a brief review of the latest scientific findings, the most recent developments in climate change policy, and an overview of common tools that analysts use to examine the climate question.

The lectures will look into climate change impacts and issues of vulnerability and adaptation to climate change. We then devote roughly half of the term to examining climate change impacts and adaptation and half to mitigation. In looking at impacts and adaptation, we examine social and biophysical vulnerabilities to environmental change and explore the policies and measures that have been proposed to minimize the impacts of climate change. In examining mitigation, we discuss technological options, policies, and socioeconomic impacts of mitigation measures. The course consists of practical exercises on adaptation planning and vulnerability analysis.

3. Clean Development Mechanism (CDM), Carbon markets and climate related policies (2.5 days)

This module looks at the different climate policy options for putting countries on a low-carbon growth path. It explores domestically focused policies, as well as market mechanisms linked to the international carbon market. Carbon markets are relatively new and evolving rapidly, and therefore can be challenging to understand. Countries pursuing low-carbon growth face many choices concerning policy options and how to combine them. Distinguishing which choices will be the most fruitful at the national level is key, as is the ability to enter and benefit from the international carbon markets. The module looks into policy instruments for climate mitigation, introduction to carbon market mechanisms and carbon market readiness.

The module will look into strategies aimed at reduction and prevention of pollution. This movement represents a major shift in policy from a regulation/control model to a technical assistance and education model. Managers, both in the government and in the private sector, need to develop new skills which will allow them to identify op-

portunities for pollution prevention, develop strategies for effecting change in businesses, and linking those strategies to available technologies. Planning for pollution prevention is recognized as a vital component of this process. In addition we will review the maximum and best available control technology standards and compliance for pollution prevention and the "lowest available control technology" and 'reasonable available control technology'.

4. Impact assessments (2.5 days)

The Module is designed to provide a critical overview of the theory and practice of Environmental and Social Impact Assessments as operated internationally to participants who need to understand Impact assessments including academics, government participants and practitioners. The module covers purpose and aims of IAs, key elements of the IA process, undertaking an EIA, role of public participation, stages that follow EIA, the costs and benefits of undertaking EIA and understanding of the strengths and limitations of EIA.

The module will also explain the importance of IA's for reducing environmental and social impacts of development and its role in decision-making and as part of responsible management of developments. The module will consist both lectures and practical exercises.

5. Corporate environmental and social responsibility (3 days)

The module his one-day course for environmental managers provides an introduction to concepts of sustainability and corporate social responsibility (CSR). This course is beneficial to corporate and facility level environmental personnel interested in becoming familiar with the concepts of environmental sustainability and how companies can achieve competitive business advantage through sustainable business approaches.

Through this course, the attendee will learn how to develop and implement an effective, value-added business sustainability program. Successful corporate sustainability programs will be presented and discussed. Elements that will be reviewed include sustainability reporting and generating reliable metrics and indicators (environmental, financial, and social) in accordance with the Global Reporting Initiative (GRI) guidelines. Finally, a case study and class exercise will allow the attendee to apply the concepts learned.



Sustainable Development Futures (SDF) research group

at the Finland Futures Research Centre conducts energy and climate research and designs and implements capacity-building in the developing regions of the world, namely the Mekong region and the Caribbean, as well as increasingly in Sub-Saharan Africa. Long-term partnerships in the region involve ministries, academia, research institutions, civil society organizations, funding agencies and other stakeholders.

More information can be found from Sustainable Development Futures website:

www.sdfutures.fi

