



Univerza v Mariboru



Education and Culture

Leonardo da Vinci

ECO-EFFICIENCY COURSE for Vocational Education and Training

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Motivation and Need for the Project

- Lisbon Strategy
- EU Action plan on Sustainable Consumption and Production (climate change, sustainability related goals and products)
- EU and National Strategies for Sustainable Development
- European energy related commitments (COM(2008) 30 final)
- Lack of in-depth-competences targeting different levels of training and education in lifelong learning
- Competence needs of the labour market:
 - **Eco-efficiency, design for sustainability, sustainable consumption, green purchasing, and social responsibility**

LdV Project Results and Outcomes

- **May 2012:**
 - Concept of an **European** Training Course on Eco-efficiency:
 - Training concept, contents, and programme
 - **July 2012:**
 - Concept of **area-specific** training courses in relevant topics in the field of sustainable innovation:
 - Training concept, contents, and programme
- Workshop report and **Final report**

Sectors/Areas of Major Concern

Context of sustainable development and innovation, in line with the focus of EU sustainability and environmental policy:

- Building and construction
- Food
- Mobility, and/or
- Energy related products

Target groups: technical staff from companies and municipalities

- to strengthen and update their knowledge and skills in these very dynamic and demanding areas

What is VET?

Vocational Education and Training (VET):

- Traditionally **non-academic**,
- Prepares trainees **for jobs** that are based on manual or practical activities,
- Totally related to a **specific** trade, *occupation, or vocation*.
- It is sometimes referred to as ***technical education*** as the trainee directly develops expertise in a particular group of ***techniques*** or ***technology***.
- Upper *secondary* (2–4 years) and *post-secondary* education (Life Long Learning, + 2 years)

Definitions of Eco-Efficiency (1)

Organisation for Economic Co-operation and Development (**OECD**):

- Efficiency with which ecological resources are used to meet human needs;
- Efficiency = output : input
- **Ratio** of an **output** (value of products/services by a firm, sector, or economy as a whole), divided by the **input** (sum of environmental pressures by the firm, sector, or economy)

Definitions of Eco-Efficiency (2)

European Environmental Agency (EEA):

- Concept and strategy enabling sufficient **delinking** of the 'use of nature' from economic activity;
- needed to **meet** human needs (wellfare) to allow it to **remain** within carrying capacities;
- and to permit **equitable access** and use of the environment by current and future generations – more welfare from less nature

Eco-Efficiency or Resource Efficiency?

- **Eco-efficiency** (World Business Council for Sustainable Development, WBCSD):
 - The delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle, to a level at least in line with the Earth's estimated carrying capacity
- **Resource-efficiency**:
 - Optimising the environmental and financial benefits from using a material or product that requires the least energy and materials over its life cycle

Eco-Efficiency Objectives (WBCSD)

1. **Reduce** the consumption of **resources**:

- The material and energy consumption should be reduced through enhancing recyclability.
- Producing products with higher quality and longer life times may also lead to improvements within the area.

2. **Reduce** the **impact** on the nature:

- Using **renewable** resources which are sustainably managed
- **Minimizing** emissions, waste disposal and toxic substances

3. **Provide** customers with higher **quality** products and services. The customer benefit can be improved by:

- user **additional services** (e.g. functionality or/and increased life time)
- **without interfering** with the two former objectives.

Identifying Key Elements of Eco-Efficiency

The WBCSD has defined four key elements of eco-efficiency:

- **Re-engineer processes** (to reduce the consumption of resources, reduce pollution and avoid risks, while at the same time saving costs)
- **Revalorize by-products** (zero-waste or 100 % product targets-waste from their processes can have value for another company)
- **Redesign products** (products designed to ecological design rules)
- **Rethink markets** (innovative companies find new ways of meeting customer needs)

Resource Efficiency Course Idea

- **Vertical structure:**
 - From the 2-years course to the postsecondary one – the same contents (chapters)
 - Different levels and times (ECTS) devoted to them
- **Horizontal structure:**
 - The school/teacher decides which chapters and what breadth to take, e.g. for electricians, chemists, nurses
- **Practical and home work:**
 - Laboratory, problem solving, field work, quizzes
- Textbook(s), videos, guide(s), and/or manual(s), Ppts

Introduction to the Course

Challenges: climate change, extinction of fossil fuels, resource scarcity, biodiversity (species extinction), elimination of toxic substances, etc.

Triple bottom line – environmental, economic, social:

- **Environmental issues:**

- **Sustainable development: definition**

- **Sustainable production:** recycling, heat integration, process optimisation

- **Economic issues:**

- **Green Economy Initiative, Investing in the transition, Green Public Procurement, etc.**

- **Social issues:**

- **Sustainable consumption:** recycle, reuse, repair, consumer behaviour, better information on the environmental footprints of products (labelling, declarations), etc.

Motivation

- Human needs and externalities (life cycle costs)
- Main GHGs contributing sectors:
 - 20 % transport
 - 18 % industry
 - 17 % households, etc.
- Regulations (laws and directives, national and EU)
 - European directives
 - ISO and CEN standards
- Roadmap to resource efficiency
- Policy – how to make the things happen

History of Eco-Efficiency Concept

- 1961 – Silent Spring
- 1972 – Limits to Growth, UN Conference on Human Environment
- 1975 – Pollution Prevention (Monsanto: PP Pays)
- 1980s – Environmental movement (Bhopal accident)
- 1987 – The Brundland Report: Our Common Future
- 1989 – Cleaner Production
- 1990s – Setting eco-efficiency targets
- 1992 – UN Conference on the Human Environment, Rio
- 1998 – Factor Four, The Factor 10 Club
- 2002 – World Summit Johannesburg
- 2004–2010 – 3 Internat. Conferences on Eco-Efficiency

Energy: Renewables and Efficiency

- **Renewable energy** sources, RES:
 - hydro, solar, wind, geothermal, thermo-solar, photovoltaics, biomass (wood, lignocellulosis, and waste), etc.
- **Energy efficiency**, EE:
 - Green buildings, innovation in lighting
 - Heat and power (co-/poly-generation), heat pumps
 - Waste-to-energy (thermal treatment, incineration)
 - Green technology, Process intensification
 - Heat integration (Pinch Analysis)
 - Mobility (public transportation, walking, cycling)

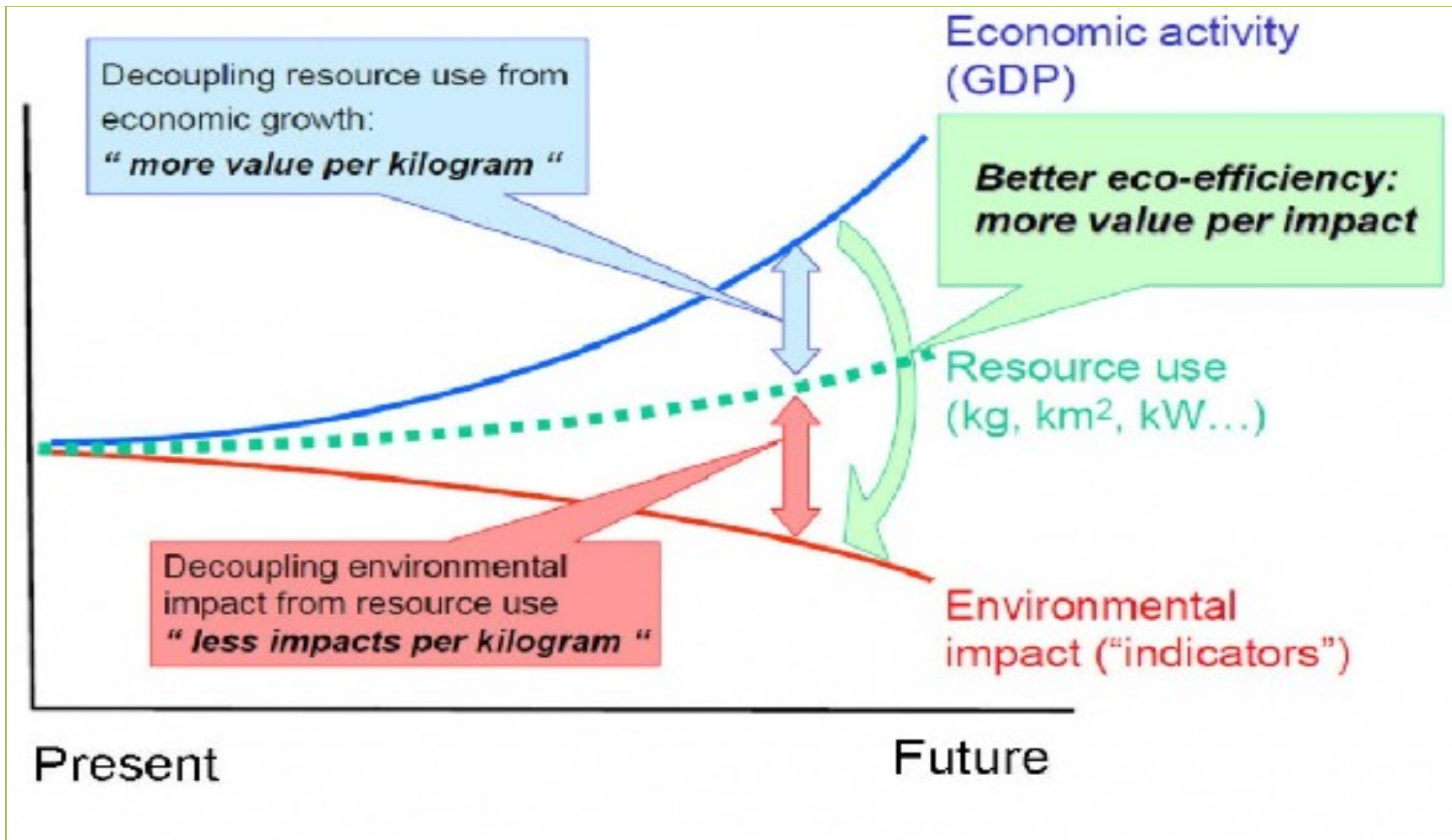
Energy: Modern Approach

- Low-carbon technologies/society
- Passive and active (energy producing) buildings
- Product groups (lighting, air conditioning, etc.)
- System functions (overall optimization)
- Integrated Pollution Prevention and Control (IPPC) – EU Bureau in Sevilla
- Best Available Techniques (BAT)
- Strategies on transportation and mobilities

Materials Efficiency

- Water minimisation and purification
- Raw material **recycle, recover, reuse, repair, ...**
- By-product utilisation (industrial ecology, industrial symbiosis)
- Higher quality products (quality assessment)
- Longer lifetimes (extended product duration)
- Minimising emissions, waste disposal, and toxic substances release
- Rare metals and minerals
- System function – Lego principle in buildings

Decoupling Resource Use, Economic Growth, and Environmental Impact



Methods

- **LCA** (Life Cycle Assessment), LCM, LCI, LCIA, EEA*
- **Pollution Prevention**
- **Cleaner Production**
- **Zero waste**
- **RECP TVET Toolkits**
- **Eco-Innovation**
- **Design** for the Environment (Eco-Design),
Design for Sustainability
- **Deming Cycle** of continuous improvements
- **Footprints** (carbon, nitrogen, water, energy, social, etc.)

Management

- Corporate Social Responsibility (CSR, ISO 26000)
- Environmental Management System (EMS, EMAS)
- Eco-industrial parks
- Voluntary approaches, e.g. Responsible Care by chemical industry
- Ecological economics
 - Environmental Accounting (EA)
- Environmental Reporting (Global Reporting Initiative, GRI)
- Environmental law
- Environmental policy

Management (ctd.)

- Public and investors' involvement
- User engagement
- Sustainable consumption
- Triple helix (business, academia and society)
- TRIZ – Theory of Inventive Problem Solving (TIPS): problem identification and solving
- Operational management
- Case studies

Implementing Eco-efficiency

REDUCES:

- **R**educe material intensity
- **E**nergy intensity minimized
- **D**ispersion of toxic substances is reduced
- **U**ndertake recycling
- **C**apitalize on use of renewable sources
- **E**xtend product durability
- **S**ervice intensity to be increased

Organisations

- Intergovernmental Panel on Climate Change, IPCC
- UN Environment Programme (UNEP)
- UNIDO: Cleaner Production Centers (CPCs) → RECP
- World Business Council for Sustainable Development
- Environmental Agencies: EEA, US EPA, national, ...
- International Orgn. for Standardisation (ISO 14000, ...)
- Sustainable and Socially Responsible Universities
- UN University Institute of Advanced Studies (UNU-IAS)
- PREPARE network, and ERSCP (society)
- Resource Efficient CP (RECP) network, etc.

Organizations (ctd.)

- Professional organizations
 - National
 - European
 - Global
- Retail organizations
- NGOs, consumer organizations, trade unions
- Forums, Round tables, Panels
- Chambers of industry and commerce

Anex and Literature Sources

- Anex:
 - Definitios and
 - Glossary
- Practical and Home Work, Quizes
- Textbooks, Guides, Manuals, Ppts, Videos
- Literature:
 - Proceedings of the three Eco-efficiency conferences and
 - Proceedings of the ERSCPs – past/last

Practical and homework

- Carbon footprint calculation
- Energy use and emissions using different ways of transportation (airplane, car, railway, bike)
- Energy consumption and emissions in electric appliances (energy classes, life cycle analysis)
- Energy and water efficiencies in buildings
- Food and biofuels (bio-diesel, -gas, -ethanol)
- Calculation of energy efficiencies
- Resource efficiency factor

RECOMMENDATIONS FOR TEXTBOOK(S), GUIDES(S), AND MANUALS

- ❑ **Energy Audits: A Workbook for Energy Management in Buildings - to be simplified on VET level**
 - Author: Prof Tarik T Al-Shemmeri, Staffordshire University, UK – to be simplified on VET level
- ❑ **Energy Efficiency Manual - general guide**
 - Author: Donald R. Wulfinghoff, Wheaton, Maryland, USA
- ❑ **Handbook of Water Use and Conservation: Homes, Landscapes, Industries, Businesses, Farms**
 - Author: Amy Vickers, Massachusetts, USA
- ❑ **Renewable Energy, Fourth Edition: Physics, Engineering, Environmental Impacts, Economics & Planning**
 - Author: Professor Dr. Bent Sorensen, Roskilde University, Denmark
- ❑ **Sources and Reduction of Greenhouse Gas Emissions (Environmental Science, Engineering and Tehnology)**
 - Edited by Steffen D. Saldana, New York, USA

VET Courses in Slovenia

- Professional and technicians education
 - Mechanical technician: Energy efficiency
- Postsecondary education
 - Electrician: Energy efficiency and renewables
- University education
 - 1) Integrated environmental protection
 - 2) Rational use of energy
 - 3) Materials for SD, 4) Fuels for SD
 - 5) Material and waste recovery, etc.

Future Work at TRUST-IN

Meetings:

Tomorrow

1. Collect and compare eco-efficiency related VET courses in partner's own country, and in one or two other countries, e.g. USA, Australia
2. Prepare Eco-efficiency course contents:
 - i. Chapters
 - ii. Practical and home work
 - i. Laboratory, problem solving, field work, quizzes
 - iii. Textbook(s), guide(s), and/or manual(s), Ppts

Work Plan for May and June

- Workshop in Education, ERSCP May 4, Bregenz
 - TRUST IN introductory presentation (PG)
 - Sector specific presentations (Stig, Johanees, Kim, Arnold?)
 - Template (Peter, Stig, Pavel), 6. 2. 2012
- Dissemination Action Plan, Copenhagen, June 7–8:
 - Presentation at national professional meetings
 - Sending to vocational schools, Chambers of industry and commerce, Ministries for education

Thank you for your attention

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