European Training Course on Eco-Efficiency

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Abstract

This report presents the concept for an European training course on eco-efficiency. PREPARE (Preventive Environmental Approaches in Europe) Network has realized that new curricula and new course contents have to be introduced to the young generations at all levels of education. Starting with the Vocational Education and Training (VET) we decided to prepare an up-to-date course on Eco-Efficiency – a brand name for today's Resource Efficiency, using financial support of Leonardo da Vinci Partnership Fund. Four sectors served as areas of major concern: building and construction, food, mobility, and energy related products. Lack of in-depth-competences and needs of the labour market presented the motivation for the project.

An overview of national VET systems in Europe has been conducted. Definitions, objectives and key elementes of eco-efficiency courses have been reviewed and studied. Sustainable resource and life-cycle management are to be used in order to reduce consumption of resources and their impact, provide higher quality products and services, improved by user additional services without interfering with the former two objectives. Vertical (2–5 years education) and horizontal structures (chapter selection) have been built into the course. Subject-specific competences have been defined.

The course contains the following chapters: Introduction, historical development, energy and material efifciencies, methods, management, and organizations. Pratical and home work, textbokos, guides, manuals, PowerPoint Presentations are suggested to be prepared in the near future.

Keywords: vocational education and training, VET, course, resource-efficiency, eco-efficiency

1. Introduction

Developed countries have enjoyed many decades of growth based on intensive use of resources. But today they face the dual challenge of stimulating growth needed to provide jobs, and of ensuring that the quality of this growth leads to a sustainable future. Our economy will thereby require a fundamental transformation in energy, industry, agriculture, fisheries, transport systems, and in producer and consumer behaviour within a generation [1]. Learning **about sustainability** (*accomodation*) is not enough, any more. Education **for sustainability** (*reformation*) of future generations, followed by **re-design** education on sustainability principles (*transformation*) will be crucial for changing the habits and dematerializing the everyday life. From doing things better, we have to do better things and, finally, start seeing things differently [2].

The TRUST IN – European Training Partnership on Sustainable Innovation was formed by a large group of well recognized institutions, members of PREPARE Network. They represent different actors involved in vocational education and training (VET): universities, research centres and other organizations which through network activities and projects have for several years been engaged in education, and in translating innovative sustainability strategies and instruments/tools into training concepts and contents. Funds have been supplied by Leonardo da Vinci Programme which is a part of the European Commission's Life Long Learning Programme.

Taking the climate change and ecological footprint challenges into account, partners have identified the need of an **European training course on eco-efficiency** as a contribution to tackle the EU goal of reducing energy consumption by 20 % below the 1990 levels by 2020, by realizing the 20 % improvement in energy efficiency and thereby reducing greenhouse gas emissions by 20 % [3]. The flagship initiative for a resource-efficient Europe under the Europe 2020 strategy supports the shift towards a resource-efficient, low-carbon economy to achieve sustainable growth [4]. Therefore, the collaborative activities of the present project have been dedicated to developing the concept of a general course on resource-efficiency, targeting technical staff from companies and municipalities who need to strengthen and update their knowledge and skills in these very dynamic and demanding areas.The needs of trainers have also been taken into account, in order to build the necessary capacity for its successful implementation.

Another very important outcome of this partnership is the design of **sector or area specific** training courses, with a similar target group. They are addressing sectors or areas of major concern in the context of sustainable development and innovation, in line with the EU focus on sustainability and environmental policies: building and construction, food, mobility, and energy-related products.

In addition, the partnership aimed to reflect and formulate recommendations on how to successfully **integrate sustainable innovation concepts** and practices into the European VET system. To achieve the above mentioned objectives, the partnership has organized regular meetings, involving not only the partners but also relevant players in VET system from different European countries. Some events were organized in conjunction with two European Roundtables on Sustainable Consumption and Production (ERSCP) and other conferences in the sustainability arena in which some partners have been involved as organizers.

The EU Action Plan on Sustainable Consumption and Production [5], the EU Sustainable Development Strategy [6], National Strategies for Sustainable Development, and the European energy-related commitments [7] pose a major challenge to the VET systems in Europe. Up-to-date and specific know how is required, not only to respond but also to anticipate the competence needs of the labour market in extremely important topics under the umbrella of sustainable innovation such as eco-efficiency, design for sustainability, sustainable consumption, green purchasing and social responsibility, amongst others. The partners are engaged in these topics in different ways – either as universities which include sustainability-related courses or subjects in their offers, or as research and other institutions which perform training activities in the context of Research and Technology Development projects. Over the years they have observed that despite of many good examples of sustainability-related courses and subjects at universities, training centres, etc., there is still a lack of

in-depth competences targeting different levels of VET training and education, and lifelong learning, especially in view of the climate change debate and sustainability related goals of Europe.

Another important reason behind this proposal is the diversity in sustainability-related VET in Europe, which is a strength in the sense that different countries and their socioeconomic contexts imply different VET systems, but on the other hand a minimum leverage should be achieved to support sustainable development all over Europe. This is why the partnership presents a good geographical coverage, including new EU members and candidate countries from the South-East Europe. With this collaboration, partners intend to bring in different approaches, experiences and knowledge about the gaps of available VET programmes, and market needs on the European level which will allow addressing different needs in partner countries, too.

Partners' previous collaboration in other initiatives such as EU projects and joint organization of conferences and workshops, paved the ground for a successful cooperation within the present partnership. Furthermore, many of them are members of PREPARE (Preventive Environmental Protection Approaches in Europe), a network of experts in the field of sustainable consumption and production successfully working together for over 20 years, and in a formal collaboration with UNIDO (United Nations Industrial Development Organization) in the area of cleaner production.

The objectives of this partnership were to:

- Exchange experiences and formulate recommendations to VET in the field of sustainable innovation, addressing the needs and realities of a wide variety of European countries
- Define the concept of a European training course on eco-efficiency
- Define the concept of training courses on relevant topics within sustainable innovation, addressing critical sectors or areas, to be defined by the partnership in view of its exchanges and debates.

The partnership has organized six meetings, to achieve the above mentioned objectives, involving not only the partners but also relevant players in the VET system of the hosting countries. In addition, expert consultation process was used to optimize the results. Some events were organized in conjunction with relevant conferences in the sustainability arena. Two European Roundtables on Sustainable Consumption and Production (ERSCP) were particularly relevant for this project:

- The ERSCP 2010 in Delft, a joint initiative on Environmental Management for Sustainable Universities (EMSU) – its topic was "Knowledge Collaboration and Learning for Sustainable Innovation".
- The ERSCP 2012 in Bregenz with the moto "SCP Meets Industry".

They have brought opportunities for an active participation with different stakeholders and, therefore, attained significant results.

2. Vocational Education and Training

Vocational Education and Training (VET) is traditionally non-academic and 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*. It embraces upper *secondary* (2–4 years) and *post-secondary* education (usually as a Life Long Learning experience, taking two more years).

Faced with challenges such as intensified global competition, high numbers of low-skilled workers and an ageing population, VET is vital to prepare individuals for today's society and ensure Europe's future competitiveness and innovation ability. Actions to improve vocational education and training help to provide the skills, knowledge and competences needed in the labour market. As such, they are an essential part of the EU's 'Education and Training 2020' work programme.

The European Commission acts together with EU Member States and other countries to strengthen VET across Europe. The 'Copenhagen Process', established in 2002, with 33 European countries involved, lays out the basis for co-operation in VET. Recently, the European Commission presented a 10 years vision for the future of vocational education and training [8].

3. Eco-efficiency or Resource efficiency?

The term **eco-efficiency** is a management strategy of doing more with less. It was coined by the World Business Council for Sustainable Development (WBCSD) in its 1992 publication "Changing Course" [9]. It is based on the concept of creating more goods and services while using fewer resources, and creating less waste and pollution. Eco-efficiency is increasingly becoming a key requirement for success in business. Several definitions of it exist [10]:

- 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**.**
- Organisation for Economic Co-operation and Development (OECD): Efficiency with which ecological resources are used to meet human needs; it is defined as the ratio of an output (the value of products/services by a firm, sector, or economy as a whole), divided by the input (the sum of environmental pressures by the firm, sector, or economy)
- 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.
- United Nations Environment Programme (UNEP): Eco-efficiency is a management philosphy that encourages business to search for environmental improvements that yield parallel economic benefits. It focuses on business opportunities and allows companies to become more environmentally responsible and more profitable. It is a key business contribution to sustainable societies. Eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality to 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.
- Industry Canada: Eco-efficiency is achieved through the pursuit of three core objectives [11]:
  1. Increasing product or service value
  2. Optimizing the use of resources, and
  3. Reducing environmental impact.

WBCSD has defined the following eco-efficiency objectives [12]:

- Reduce the **consumption** of resources**:** The material and energy consumption should be reduced by enhancing recyclability. Manufacturing products with higher quality and longer life times may also lead to improvements within the area.
- Reduce the **impact** on the nature by using renewable resources which are sustainably managed, and minimizing emissions, waste disposal and toxic substances.
- Provide customers with higher **quality** products and services. The customer benefit can be improved by offering him additional services (e.g. functionality or/and increased life time) without interfering with the two former objectives.

Eco-efficiency offers a number of practical **benefits** for businesses [11], including:

- Reduced costs – through more efficient use of energy and materials;
- Reduced risk and liability – by "designing out" the need for toxic substances;
- Increased revenue – by developing innovative products and increasing market share;
- Enhanced brand image – through marketing and communicating the improvement efforts;
- Increased productivity and employee morale – through closer alignment of company values with the personal values of the employees; and,
- Improved environmental performance – by reducing toxic emissions, and increasing the recovery and reuse of "waste" material.

The WBCSD has defined four key elements of eco-efficiency [10]:

- **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 % waste reuse from their processes can have value for another company

- **Redesign** products by using renvironmental design rules for product development
- **Rethink** markets – innovative companies find new ways of meeting customer needs.

The global financial crisis in 2007–2012 heralded the start of the sixth major wave of innovation – that of **resource efficiency** [13], the former five being: 1. the industrial revolution; 2. the age of steam and railways; 3. the age of steel and electricity; 4. the age of oil, cars and mass production, and 5. the age of information and communication [14, 15]. One of the flagship initiatives of the Europe 2020 strategy is indeed the resource-efficient Europe which provides a long-term framework for actions in many policy areas, supporting policy agendas for climate change, energy, transport, industry, raw materials, agriculture, fisheries, biodiversity, and regional development. This is to increase certainty for investment and innovation, and to ensure that all relevant policies support the resource efficiency in a balanced manner [4].

Resource-efficiency deals with the relationship of resource inputs to economic output, optimising environmental and financial benefits from using a material or product that requires the least energy and materials over its life cycle. It has several other definitions, too:

- European Commission: Resource efficiency means using the Earth's limited resources in a sustainable manner. We depend on resources like metals, minerals, fuels, water, timber, fertile soil and clean air for our survival, and they all constitute vital inputs that keep our economy functioning [16].
- United Nation Environment Programme (UNEP) [17]: Decoupling economic growth from environmental impact and creating the 'space' for poor people to meet their basic needs will require producers to change design, production and marketing activities. Consumers will also need to provide for environmental and social concerns – in addition to price, convenience and quality – in their consumption decisions.

The prefix *eco-* can be related to ecological or environmental terms. Ecology is the scientific study of the relations that living organisms have with respect to each other and their natural environment. Therefore, the prefix *eco-* shall not be used instead of the adjective *environmental*. Resources originate from the Earth and from living organism, but their treatment is human trechnology related. Therefore, *resource* efficiency might be a better term than eco-efficiency. Nevertheless, the term eco-efficiency is the brand name for resource efficiency and will be used in parallel with the latter for some period because of the tradition described above.

4. Training Course for the Sectors of Major Concern

In industrialized countries nutrition, housing and mobility are typically responsible for 70–80 % of all environmental impacts. These sectors are also key to addressing the challenges in energy and climate change dealt with in complementary long term strategies, which combine together synergies under the Resource Efficiency Flagship [1]. Therefore, the main objective of the project is to outline an European Training Course on Eco-efficiency for four sectors of major concern: building and construction, food, mobility, and energy related products.

4.1 Food

The food and drink value chain in the EU causes 17 % of our direct greenhouse gas emissions and 28 % of material resource use, with our consumption patterns having global impacts, in particular related to the consumption of animal proteins. It is a major user of high-quality water, which is essential for its success. A combined effort of farmers, food industry, retailers and consumers is needed. Resource-efficient production techniques, sustainable food choices in line with the World Health organization (WHO) recommendations on the animal proteins consumed per person, including meat and dairy products, and reduced food waste can contribute to improving resource efficiency and food security at a global level [1].

4.2 Building and construction

Better construction and use of buildings in the EU would influence 42 % of our final energy consumption, about 35 % of our greenhouse gas emissions [18], and more than 50 % of all the extracted materials; it could also help us save up to 30 % of water [19].

The development of green building has the potential to deliver many other benefits, beyond that of carbon emission reduction. It provides opportunities for enterprises, not only for construction firms but also for businesses offering the technologies, materials and services required. Investment in green building offers considerable scope for generating employment opportunities, a key public policy concern in many countries. Employment in the construction sector has suffered badly during the economic crisis. Many workers, now unemployed, possess construction skills relevant to green building, but need retraining and upskilling. Although training in green building skills has increased over recent years, employers still face difficulties in finding qualified people to undertake certain jobs. In the case of green building, the main reason for labour shortages is that skill requirements change as green building technologies and practices are introduced or changed, so that previously satisfactory skill sets are no longer adequate. Skill gaps, therefore, are mainly a consequence of the rapid greening of building activity, and of advances in techniques and technologies which change skill requirements faster than education and training systems can respond [20].

4.3 Mobility

A modern, resource efficient mobility system, serving both passengers and freight can contribute significantly to competitiveness and sustainability. The Transport White Paper [21] puts forward a wide range of options for pursueing the required holistic transport policy. Dependency on fossil fuels is to be reduced by improved fuel efficiency, renewable energy use, phasing out conventionally-fuelled cars in cities by 2050, improved multimodal logistics, better transport networks, and more efficient vehicles [1].

4.4 Energy related products

Effective action on energy-consuming equipment and appliances requires steps on two fronts: standards for the energy yield of appliances and an appropriate, consumer-focused system to label and evaluate energy performance [22]. The Ecodesign Directive [23] has been extended in 2009 to all energy-related products, the use of which has an impact on energy consumption, including:

- **Energy-using products** (EUPs) which use, generate, transfer or measure energy (e.g. electricity, gas, fossil fuel), including consumer goods such as boilers, computers, TVs, washing machines, light bulbs, as well as industrial products such as transformers, industrial pumps and fans, and industrial furnaces.
- **Other energy related products** (ERPs) which do not necessarily use energy but have an impact on energy consumption (direct or indirect) and can, therefore, contribute to saving energy, such as windows, insulation material, or bathroom devices (e.g. shower heads, taps) [24].

5. Recommendations for the Course Structure and Content

The eco-efficiency course for VET students shall be applied to different levels of regular education and training, as well as for lifelong learning students. Vertical structure of the course will, therefore, be used for students from the 2-years duration of upper secondary education to the postsecondary one – having the same contents (chapters) but using different levels and times (credits by using the European Credit Transfer and Accumulation System, ECTS) devoted to them. The horizontal structure will enable the school and its teachers to decide which chapters and what breadth to take e.g. for electricians, chemists, nurses, etc.

Practical and home work including laboratory and field work, problem solving, and quizes is proposed. A list of textbooks, PowerPoint presentations, videos, guides, and/or manuals will be presented together with a list of suggestion for developing the teaching aids still missing.

The course is designed to contain the following chapters: introduction, historical development, energy and material efficiencies, methods, management, and organizations. Pratical and home work, textbooks, guides, manuals, PowerPoint Presentations are suggested to be prepared in a near future.

5. 1 Introduction to the Course

Motivation of the course includes human needs and externalities (life cycle costs) indicating the main greenhouse gas contributing sectors: transport (20 %), industry (18 %), households (17 %), etc. Regulations (laws and directives, national and EU) is to be discussed together with European directives, the Roadmap to resource efficiency, ISO and CEN standards. The importance of the policy – how to make the things happen – has to be stressed.

Challenges of the course include: climate change, extinction of fossil fuels, resource scarcity, biodiversity (species extinction), elimination of toxic substances, etc. The triple bottom line topics – environmental, economic, and social are included:

- Environmental issues: definition of sustainable development, and sustainable production: recycling, heat integration, and process optimisation, etc.
- Economic issues: Green Economy Initiative, Investing in the transition, Green Public Procurement, etc.
- Social issues: health and safety, consumer behaviour and sustainable consumption:
    - **Re**charge, reconstruct, recover, recycle, reduce, refill, reforest, renew, renovate, repair, retrofit, reuse, rework
    - Better information on the environmental footprints of products (labelling, declarations), etc.

A brief history of the eco-efficiency concept with its milestones shall be presented:

- 1961 – Silent Spring
- 1972 – Limits to Growth, UN Conference on Human Environment; book by Meadows et all
- 1975 – Pollution Prevention (Monsanto: PP Pays)
- 1980s – Environmental movement (following the Bhopal accident)
- 1984 – Best Available Technology (BAT)
- 1987 – The Brundland Report: Our Common Future
- 1989 – Cleaner Production
- 1990s – Setting eco-efficiency targets
- 1992 – United Nations Conference on the Human Environment, Agenda 21, Rio de Janeiro
- 1994 – UNIDO, National Cleaner Production Center Programme
- 1997 – Kyoto Protocol, entering into force on 16 February 2005
- 1996 – European Union, Integrated Pollution Prevention and Control (IPPC) directive
- 1998 – Factor Four and Ten, The Factor Ten Club
- 2000 – The Earth Charter, declaration of fundamental ethical principles
- 2002 – World Summit Johannesburg
- 2003 – Marrakech Process on sustainable consumption and production
- 2004 – 1st International Conferences on Eco-Efficiency, Leiden, Netherlands
- 2005 – United Nations World Summit: Millenium Development Goals
- 2006 – 2nd International Conferences on Eco-Efficiency, Egmond aan Zeem, Netherlands
- 2009 – Copenhagen Summit, United Nations Climate Change Conference
- 2010 – 3rd International Conferences on Eco-Efficiency, Egmond aan Zeem, Netherlands
- 2012 – Rio+20, United Nations Conference on Sustainable Development

More information about the above topics can be found at the websites http://en.wikipedia.org, and http://www.prepare-net.com/sites/default/files/history_and_definition_of_eco-efficiency.pdf

5.2 Core chapters of the course

The chapter on **energy** is including two subchapters:

- Renewable energy sources (RES): hydro, solar, wind, geothermal, thermo-solar, photovoltaics, biomass (wood, lignocellulosics, and waste), etc.

- Energy efficiency: Green buildings, innovation in lighting; heat and power (co- and poly-generation), and heat pumps; waste-to-energy (thermal treatment, incineration); green technology and process intensification; heat integration (Pinch Analysis); mobility (public transportation, walking, and cycling).

Modern approach will deal with: energy balances, low-carbon technologies and societies, passive and active (energy producing) buildings, product groups (lighting, air conditioning, etc.), system functions (overall optimization), Integrated Pollution Prevention and Control (IPPC, Best Available Techniques (BAT), and strategies on transportation and mobilities.

Material efficiency will also start with material balances and proceed with water minimisation and purification, raw materials **re**cycling, **re**covering, **re**using, **re**pairing, and similar methods; 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; and system functions – Lego principle in buildings.

Special attention has to be devoted to decoupling resource use (materials and energy) and environmental impact from the economic growth (dematerialization). Better eco-efficiency is giving more value per impact. Psychological effects shall switch the attention of people from Gross Domestic Product (GDP) to Gross National Happiness (GNH).

Water efficiency will be one of the most important materials in future. Water stress is already causing drinking and irrigation water shortage, droughts, desertification, and lower crop yields. Water and waste water minimisation are important tasks to release the stress. Water Pinch Analysis encompasing water re-use, regeneration, recycling, and combinations of them are important methods used for this purpose [25]. Water pollution shall be described, and its purification as well as effluent treatment methods explained. Hosted and led by UNESCO, the United Nations World Water Assessment Programme (WWAP) coordinates the work of 28 UN-Water members and partners in the World Water Development Report (WWDR).

The United Nations World Water Development Report [26], released every three years in conjunction with the World Water Forum, is the UN's flagship report on water. It is a comprehensive review that gives an overall picture of the state of the world's freshwater resources and aims to provide decision-makers with the tools to implement sustainable use of our water. Through a series of assessments, the Reports provide a mechanism for monitoring changes in the resource and its management and tracking progress towards achieving targets, particularly those of the Millennium Development Goals (MDGs) and the World Summit on Sustainable Development. The Reports also offer best practices as well as in-depth theoretical analysis.

Methods to achieve sustainable development are very important: Life Cycle Assessment, LCA, and other life cycle approaches (LC management, LCM, LC inventory, LCI, LC impact assessment, LCIA, energy efficiency assessment, EEA), Pollution Prevention, Cleaner Production, Zero waste, UNIDO's Resource Efficient and Cleaner Production (RECP) and UNESCO's Technical and Vocational Education and Training (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 chapter is planned to include: Corporate (Environmental &) Social Responsibility (CSR, ISO 26000), Environmental Management System (EMS, EMAS), Eco-Management and Audit Scheme (EMAS), eco-industrial parks, voluntary approaches (e.g. Responsible Care in chemical industry), ecological economics (e.g. Environmental Accounting (EA), environmental reporting (Global Reporting Initative, GRI), environmental law, and environmental policy. It contains public and investors' involvement, user engagement, sustainable consumption, triple helix (business, academia and society), TRIZ – Theory of Inventive Problem Solving (TIPS), operational management, and also some case studies.

Organisations dealing with resource efficiency will be discussed and their web-sites studied: professional organizations (national, European, and global ones), retail organizations, non-governmental organizations (NGOs), consumer organizations, trade unions, forums, round tables,

panels, chambers of industry and commerce. Examples of them: UN Environment Programme (UNEP), Intergovernmental Panel on Climate Change (IPCC), UNIDO's National Cleaner Production Center Programme (NCPC) and UNEP's Resource Efficient and Cleaner Production (RECP), World Business Council for Sustainable Development (WBCSD), Environmental Agencies (European EEA, US EPA, national ones), International Organization for Standardisation (ISO), UN University Institute of Advanced Studies (UNU-IAS), Sustainable and Socially Responsible Universities, Preventive Environmental Protective Approaches in Europe (PREPARE) Network. Professional organizations (national, European, global), Chambers of industry and commerce, retail organizations, non-governmental organizations (NGOs), consumer organizations, trade unions, forums, round tables, panels are active in the field.

Teaching methods shall use problem the based approach with many examples and case studies. The teacher shall start with an experiment, or video to raise awareness and motivation, explain the topic in a simple way and let the students enjoy hands-on experience in laboratory, or use field experiments. Students shall be active in browsing literature using internet (Google, Wikipedia, etc.). The teachers shall use life long learning opportunities at universities; the recommended university education courses are e.g. Integrated environmental protection, Rational use of energy, Environmental engineering, Sustainable development.

5.3 Additional material

Auxilliary material is including an Anex with Definitions and a Glossary, Practical and Home Work instructions, Quizes, Textbooks, Guides, Manuals, PowerPoint presentations, videos, and Literature, including Proceedings of the three Eco-efficiency conferences and Proceedings of the ERSCPs – past and the last.

Practical and homework may give additional information on: Carbon Footprint calculation, energy use and emissions with different ways of transportation (airplane, car, railway, bike), energy consumption and emissions in electric appliancies (energy classes, life cycle analysis), energy and water efficiencies in buildings, food and biofuels (bio-diesel, bio-gas, bio-ethanol) dilemma, calculation of energy and resource efficiency factor calculations, etc.

Several **textbooks**, guides, and manuals for the resource efficiency exist, but they are written for the students of tertiary education [27–31] – they need to be simplified to the VET level ones. There is a need to write suitable textbooks, guides and manuals for VET students.

7. Conclusions

We have tried to study the needs for an European training course on eco-efficiency which is a brand name for the course on resurce efficiency as it is formulated in contemporary documents. The work in the TRUST IN project group is presented in four areas of major concern: building and construction, food, mobility, and energy related products. Partners have collected the eco-efficiency course curricula in their own countries (and some nonparticipating ones) in order to improve the proposal presented above. Examples of practical and homework problems with solutions have been developed.

Recommandations for Future Projects are including development of teaching aids for VET course on Eco-efficiency (textbooks, manuals, and guides in national languages, specialized for different profiles), videos, PowerPoint presentations for different chapters, excursion manuals, practical and home work problems and quizzes, solution manual for problem solving and quiz answering. Transfer and exploitation of the VET course on Eco-efficiency is requiring another Leonardo da Vinci project, too.

Dissemination action plan will produce articles and presentations at national professional meetings. The proposal will be sent to vocational schools, Chambers of industry and commerce, Ministries for education of the participating countries in order to speed up the introduction of the course, echo the content, and stimulate further work regarding the contents, methods, teaching aids, and networking of teachers.

The partners are ready to discuss any suggestions from the outside world.

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Annexes:

1. Definitions
2. Glossary
3. Practical and Home Work, Quizzes
4. Textbooks, Guides, Manuals, Ppts, Videos
5. Literature and standards