

# Advancing ESD in Ukraine: From awareness to orientation towards long-term thinking and societal needs

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## Abstract

This paper reflects on experiences of integrating sustainability in engineering education in Ukraine and discusses the personal contribution of Prof. Leo Jansen to this process.

The authors argue that Ukrainian engineering universities are progressing in incorporating sustainability in their curricula. Major efforts are still needed to shift the focus of educational programs from awareness rising by teaching about sustainability challenges to discussions on how engineers can meet those challenges and how sustainability is coupled to students' main disciplines. The paper identifies several features of Ukrainian society that affect SD programs and that shall be taken into consideration while designing pedagogical approaches in engineering universities of the country. Among those factors are:

- Civil society is in an infant stage of development in Ukraine;
- Short-term planning is prevailing in the country;
- There is scepticism among the wider public towards expert-focused strategic development.

The paper describes and reflects on a series of intensive courses and seminars developed in cooperation between colleagues from several universities from Ukraine and EU (2007-2012) that addressed the need for long-term thinking and interaction with society. Those courses introduced the concepts of sustainable technology and sustainable innovations and included various foresighting exercises.

Finally, the paper discusses the impact of Prof. Leo Jansen's teaching activities in Ukraine: the inspirational public lecture on Strategic Sustainable Development and the workshop on participatory backcasting that took place in the Kiev Polytechnic Institute in spring 2012.

The paper concludes with recommendations on the next steps towards advancing ESD in Ukrainian engineering universities.

## 1 Introduction

Education for Sustainable Development (ESD) is defined by UNESCO (UNESCO, 2003) as a process of learning how to make decisions that consider the long-term future of the economy, ecology and equity of all communities. Building the capacity for such future-oriented action is a key task of education. Since 2005 Ukraine has a noticeable progress in implementing ESD. As the UN Decade of Education for Sustainable Development (DESD, 2005-2014) approaches its end in 2014, it's high time to reflect on achieved results and update strategies for resolving obstacles on the way towards fulfilment of DESD goals in Ukraine.

Engineers play a central role for sustainable development as they represent a main capacity in developing and implementing sustainable technologies and system innovations. Therefore among the first supporters of DESD in Ukraine was the National Technical University of Ukraine "Kyiv Polytechnic Institute" (KPI). This paper provides an example of the evolution of ESD in Ukraine based on the experience of long-acting collaboration between KPI and European partner universities.

During the last decade a noticeable progress has been made towards integration of the sustainable development concept in Ukrainian education: a number of teachers have been trained, curricula have been changed, and new study programmes have been established. Existing SD courses are more or less successful in achieving basic learning outcomes focused on broad understanding. Students get to know about the environmental, economic, and social issues related to sustainability; they can explain global trends and interrelations between systems in the scope of SD; and they are aware of sustainability challenges.

However, development of skills necessary for further engagement and effective involvement of graduates in creating systematic changes towards sustainability is left beyond the study process in the vast majority of cases in Ukraine. Svanström *et al.*(2006) argue for the need to progress from recognizing the importance of change agent skills to comprehensive incorporation of these skills into all degrees. Several EU universities (Mulder *et al.*, forthcoming) have positive experience of dealing with this problem through introduction of participatory methods in their curricula, e.g. Quist *et al.* (2008) provides a detailed case of implementing a participatory backcasting course within TU Delft.

Yet there are several reasons why such experience is not easy to transfer to Ukraine:

- A weak civil society, with no tradition of public participation;
- Short-term thinking is prevailing in decision-making, long term planning is suspect the country's history;
- Lack of trust in expert-based strategic developments, more or less for the same reason;
- A gap between academia and society. Universities do not have a tradition of cooperation with industry, public authorities, or NGOs.

Despite these problems, Ukrainian Universities need to meet the task of enhancing the content and teaching methods for introducing SD in their engineering curricula. The current experience of ESD in Ukraine shows that while a dogmatic style of SD education improves students' awareness about existing challenges, it does not strengthen them with methods and tools for dealing with these challenges. Furthermore, the current SD learning styles do not support students' self-identification as problem-solvers or important actors who have a possibility to influence sustainable development of the country.

This paper describes and analyses experiences of introducing backcasting in Ukraine as a method for training engineering students in SD. Further, the paper discusses Prof. Leo Jansen's role in introducing participatory backcasting at NTUU KPI and the impact of his activities on development of ESD in Ukraine.

## 2 Participatory Backcasting

### 2.1 Long-term thinking, crucial for sustainability

Sustainable Development requires leaps in the efficiency of the systems that provide the basic products and services that we need. Mere improvement is not sufficient. One can easily calculate that a growing world population, rapidly adopting the Western style of living/consumption everywhere, while already now depleting various resources, needs drastic improvement (Weaver et al., 2000). Changing systems requires new technology, but also requires changing patterns of behaviour of many stakeholders. The history of technology shows that more radical technological change never means mere substitution, but it means rearrangement of actors, institutions and hardware. (Bijker, Hughes et al. 1987). This implies that in order to create radical change, stakeholders need to cooperate. Hence, creating joint visions is a way to attune the actions of stakeholders and have them work towards the same goal. A well-known example of such an influential future vision was president Kennedy's famous address to US Congress "*Before the end of this decade we will put a man on the moon .....*" which guided a giant technological program. But also in a more social political context, visions have strong influence. Martin Luther Kings' "*I have a dream*" has been guiding the US civil rights movement for decades.

Hence joint visions can be powerful tools to work to a common goal. Also in SD, visions are needed to align actors in working for a common goal. Stockholm's eco district Hammarby Sjöstad had its "Hammarby model" as a common vision and even a more daily rule of thumb "twice as good" to evaluate actions. (Pandis Iveroth et al., 2013) Backcasting is a strong tool to create future visions, and to design a set of coherent actions to work towards that vision (Robinson 1982). It can be used in a participatory way (Weaver 2000), which allows and facilitates interaction of stakeholders. This is required as SD does not necessarily lead to a single future vision (Mulder 2011). Backcasting has proven to be an effective means to initiate SD action (Quist, 2007) and to learn Sustainability competences (Segalas et al., 2012)

### 2.2 Methodology

Backcasting has been described as "looking back from the future". A more comprehensive definition of backcasting is envisaging a desirable future first, before looking back to how that future may be achieved, and defining what steps need to be taken to bring about the envisaged future. The following five steps have been defined:

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|--------|---|
| STEP 1 | Strategic Problem Orientation (including defining normative assumptions & goals)    |
| STEP 2 | Construction of sustainable future visions or scenarios                             |
| STEP 3 | Backcasting stage (backwards-looking analysis)                                      |
| STEP 4 | Elaboration (design & analysis) and defining follow-up activities and action agenda |
| STEP 5 | Embedding of action agenda, activities and generating follow-up & implementation    |
- (Quist, forthcoming)

### 2.3 *Strategy and Participation in Engineering Education*

Sustainable development requires transitions in various societal systems. Transitions take a longer term: sometimes it can take long preparation, and then suddenly take off rapidly. Backcasting is a successful tool for working at transitions. However, in engineering, there are still few examples of courses that train students for long term thinking (e.g. Lucena et al., 2010) and even less that offer some comprehensive framework for developing and implementing a sustainability strategy. (e.g. Robert, 2010, Quist et al., 2006, Segalàs and Tejedor, 2012)

## 3 **Implementation**

### 3.1 *Evolution of ESD at NTUU KPI*

ESD has been set as a priority in KPI since 2007 as one of the results of an EU-financed Tempus UKRBRIDGE project, which aimed at bridging the gap between education, research and business in Ukraine. First initiatives towards implementation of ESD were pilot courses on SD in cooperation with three partner universities – KTH (Stockholm, Sweden), TU Delft (Delft, the Netherlands) and UPC (Barcelona, Spain) (Segalàs *et al.*, 2008) during the Erasmus-Mundus SDPROMO project. Later, based on the outcomes of these initiatives, in particular the trained lecturers and developed study materials, KPI introduced a compulsory course “Basics of Sustainable Development” for all MSc students of the university. Furthermore, a joint MSc&PhD program “Sustainable Development and Governance: Global and Regional contexts” has been developed in 2008. This programme provides SD specialisation to students of different engineering areas (Zgurovsky & Statyukha, 2008).

Main idea of these first educational activities was to bring general understanding and awareness of sustainability challenges to Ukrainian Universities. This goal was achieved by 2008-2009, therefore, our following activities were focused on enhancing quality of ESD and developing more advanced courses in scope of sustainability education. The methods of future studies have been gradually introduced since that time.

#### *Joint Ukrainian-Swedish PhD course on scenario methods for energy planning*

A PhD Summer course on scenario methods was organized in two parts during summer 2009: one week in Stockholm and one week in Odessa. PhD students from Ukrainian universities and from KTH (Sweden) participated in the course. The course program consisted of lectures and project work in international groups targeted at development of explorative scenarios for energy systems of Ukraine and Sweden. During the Stockholm part of the course a study visit to Hammarby Sjostad was organized to demonstrate implementation of sustainability principles in a real-life project. A number of KTH lecturers and researchers supported students learning of energy related issues and scenario methods. The second part of the course in Odessa was devoted to elaboration of visions for energy system of Ukraine and Sweden by 2050. The developed scenarios included a ‘business as usual’ (BAU) scenario that was compared with alternatives proposed by each group. Such approach allowed students to better understand possible consequences of current energy policy and to compare the current energy system with more sustainable alternatives.

This course became an important step on the way of scenario methods implementation for ESD in Ukraine. It has shown the potential of the scenario approach as a tool that stimulates long-term thinking, provides better understanding of the current situation and points out how the current systems may be changed towards a more sustainable future.

### *SD stream at Summer School 2010*

One of the main successes of the first SD course in KPI in 2007 and the following ESD activities during 2008-2009 became the formation of a highly motivated student group at KPI. The students gathered because of their shared interest in SD and in order to initiate and support ESD related activities. The students designed and introduced an SD stream in the program of the Summer School “Achievements and Applications of Contemporary Informatics, Mathematics and Physics”, which is organized in KPI since 2006 by the Student Science Association. This Summer school is a two-week educational event, which consists of three or four simultaneous streams (about 50 h of courses on a chosen topic in each stream). Because of the students initiative Sustainable Development was chosen as a topic for a stream in 2010. Ten lecturers from European and Ukrainian universities and research institutions provided sessions on approaches to measuring sustainability; social aspects of SD; models for SD; scenario methods for SD; energy technology for sustainability; renewable energy and etc. About twenty participants from all around the world joined the stream. The stream’s program consisted of lectures, seminars and group work. Informal and friendly atmosphere of the summer school allowed students to communicate a lot with tutors during the study program as well as during the social program. The final evaluation of the stream by students showed that it was successful. The students concluded that the two-week stream provided them with a good overview of the current sustainability challenges and the related research fields, and thereby the summer school supported the students in identification of interesting directions for their further research.

### *3.2 Introducing Backcasting to ESD*

#### *ERAIHM backcasting workshop*

The backcasting method was introduced in KPI during the FP7 ERAIHM project “Advancing Research and Cooperation Capacities of IHM NASU (Institute of Hydromechanics of the National Academy of Sciences of Ukraine) towards European Research Area”. The project team from KTH and TU Delft implemented capacity building activities among Ukrainian researchers, teachers, PhD and Master students using a learning-by-doing approach through conducting a full-scale participatory backcasting exercise. The exercise started with a training workshop on participatory backcasting in January 2012. Partners from TU Delft and KTH provided lectures and organized group work for Ukrainian participants to foster understanding of future studies and to ensure their ability to implement participatory backcasting projects as a tool for stakeholder involvement, identification of societal needs and improvement decision-making for sustainability.

#### *Intensive course on Strategic Sustainable Development*

Following the ERAIHM backcasting workshop, an intensive course on Strategic Sustainable Development was organized for students, PhD students and young scientists in KPI in May 2012. The course consisted of two parts. The first part included lectures on strategic sustainable development, technology for sustainability and participatory backcasting. The second part contained a workshop on participatory backcasting. About fifty participants joined the lecture-part and thirty participants were admitted to the workshop part. Prof. Leo Jansen delivered a keynote lecture on sustainable development and a lecture on participatory backcasting. Leo has also designed and conducted the workshop.

There were several points in the lecture on SD by Leo Jansen that distinguished it from the SD-related lectures that have been provided at KPI so far. Firstly, Leo introduced sustainability as a constant fulfilment of societal needs through implementation of different functions. Thus, when thinking about sustainability, the engineers should rather adhere to needs than to functions. Secondly, it was shown

that options for technology optimization are generally limited and and that this level of innovation is not enough to meet the contemporary challenges of SD. Therefore, in general the only approach that can provide necessary effect is system level innovation. Thirdly, Leo talked about the importance of future visioning for enabling such renewals and backcasting was presented as an effective tool for developing visions for orientation in solving the complex problems of sustainability. Finally, Leo presented the participatory approach as a key factor for success in developing the needs-orientated solutions. The importance of stakeholders' involvement in the visioning and decision-making processes was discussed. It should be mentioned here that Prof. Jansen had a great experience in policy-making and leading STD initiatives at TU Delft. Leo's lecture has been valued by participants as very motivating and full of strong and convincing examples.

After the lecture part of the course, a participatory backcasting workshop has been organised so that student groups have got a task to developed scenarios for sustainable housing in a city. During the workshop Prof. Leo Jansen introduced a number of techniques to enhance backcasting as a tool facilitating students learning.

From the experience of the ERA IHM workshop it has been already clear that it's not trivial to explain the importance, strengths and weaknesses of the participatory approach during the standard teaching activities such as lectures and group work. It is also quite problematic to involve real stakeholders into education process in Ukraine due to a lack of cooperation between academia and society and because of poor acceptance and understanding of such initiatives by stakeholders. To solve this problem, Leo designed the workshop as a role-play. In every student group each participant had to act as a key stakeholders, i.e. representative of consumers, industry, local government, NGOs or researchers. It was emphasized at the very beginning that group work should be consensus-oriented, thus it was requested that the final outputs had to be supported by all members of the group in the largest possible extent.

During the workshop all main stages of backcasting were trained. Groups identified system boundaries, elaborated set of criteria describing a vision of sustainable housing and performed analysis of driving forces, identifying trends and selecting two key uncertainties. Four scenarios were built, tested on robustness against selected uncertainties and evaluated according to the elaborated criteria. Finally, the student groups developed a pathway for one selected scenario by identifying necessary cultural, structural and technological changes to reach the desirable future.

At the end of the workshop the participants provided their feedback. Everybody agreed that the most challenging and at the same time instructive element of the exercise was discussions for reaching consensus in the points of collision of different stakeholders' interests on all stages of backcasting. After only few hours of the group work the students concluded that establishing and supporting constructive dialogue among different stakeholders is crucial for any projects based on the participatory approaches. In its turn, when successful, the participatory processes lead to a new level of awareness and perception of the problem, taking into account opinions of all involved stakeholders, which is important for the well-based and broadly supported decisions. From the educational point of view the course has been considered a success: the role-game approach made it possible to implement the 'learning-by-doing' principle and enabled high level of student activation, interest and learning.

## 4 Discussion

### 4.1 Expert vs participatory approach

The problem that we are facing today is not how to calculate the ideal sustainable world: it is to reach agreement on what would be an attractive and sustainable future for all of us. No doubt we can create an environmentally sustainable world by cutting consumption, limiting population and substituting most wasteful technologies. The issue is if we accept these measures and want to live in such a world. This question has often been regarded as an issue of experts but in fact it is not: it is at least also an ethical question (regarding responsibilities for others) a social question (how we deal with each other) and a pedagogical question (are we willing/able to learn from each other). The expert approach presupposes a consensus on these basic issues which is not there. The nuclear controversy showed that renewal and innovation of technological systems changes society, and affects any consensus.

Participation is a ‘must’ not just for smooth introduction of changes. Except for their expertise have something else in common; their appreciation of certain technologies. It is rather exceptional that the expert community is critical to its own technologies.<sup>1</sup>

The participatory approach giving more value to non-experts is also highlighted by the postnormal science community (Turnpenny et al., 2011). In a broad sense citizens are experts too: the application of a technology often requires specific skills and adjustments that can best be developed by involving the citizens.

### 4.2 Effect of stakeholder role game in learning the participatory backcasting

Teaching of participatory backcasting is a challenging task in Ukraine. It is hardly possible to find good examples of the broad stakeholder involvement in the decision-making processes in the country. Furthermore, there is no culture of interaction with society partners such as companies, authorities and NGOs during the educational process in Ukrainian Universities, with an exception of the practical placement of students during their degree projects. Even in the countries, where students have a good possibility to interact with various practitioners, it is barely feasible to introduce a real-scale workshop with different stakeholders in the framework of a course. Therefore, it is necessary to use innovative pedagogic methods to enable understanding of stakeholder dynamics and stakeholder learning during the participatory research and development projects targeting sustainability goals. An example of such a method – a role game was demonstrated by Leo Jansen during the intensive course on Strategic Sustainable Development in KPI. The approach when student group members have roles of different stakeholders within a backcasting exercise provided students with ideas on how such a group may interact in a real-life workshop and about possible impacts of this interaction.

One potential drawback of the role-playing games is that students might lack information or have prejudices about values and opinions of the stakeholders they represent. They might take the roles not seriously by, for example, exaggerating or making jokes on the opinions or the discussion style of their stakeholders. In order to meet this problem in the following courses, the authors are planning to ask students to interview the stakeholders prior to the role play and to evaluate whether the role-play is perceived as more realistic by the students after the interviews.

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<sup>1</sup> Paul Berg’s efforts in regard to Recombinant DNA are most well-known: Paul Berg, David Baltimore, Sydney Brenner, Richard O. Roblin III, and Maxine F. Singer, 1975. “Summary Statement of the Asilomar Conference on Recombinant DNA Molecules”. Proc. Nat. Acad. Sci. Vol. 72, No. 6, pp. 1981-1984.

### *4.3 Leo Jansen approach to sustainability*

The Leo Jansen approach to sustainable development would not have been so successful if Leo had not been such an enthusiastic teacher. He was always enthusiast about teaching the lessons that he had learned in his long career. He was willing to share. His power point slides are among the most recycled ones, including the spelling error that has become a trademark that the slides were genuine Leo's.

Leo has participated actively in many international teaching scheme trainings, among them it is worth to highlight his implication in the definition, development and realization of the International Seminar in Sustainable Technology Development (STD) run at UPC-Barcelona Tech university. This link shows a video with his introduction to Backcasting methodologies in the framework of this STD program: <http://upcommons.upc.edu/video/handle/2099.2/3163>

### *4.4 Relevance for Ukraine*

Ukraine is a young state that faces many challenges because of the transitions in economy and society that keep going on. The SD paradigm can significantly improve this situation and boost Ukrainian development for a number of reasons. Firstly, it involves developing a culture of mutual respect leading to interactive and integrated policy- and decision-making. Through developing ESD, participatory democracy is also improved, as students are better equipped to resolve conflicts in society and achieve justice. Secondly, Ukrainian society is lacking the long term thinking approach. The projects with short-term effects are prevailing, which makes it difficult to realize the complex infrastructural developments and the actions that require system renewal. The projects targeting the sustainability goals require strategic planning and investments and therefore they are often postponed to the “better times”. Thus, introduction of the long-term thinking is crucial for enabling the SD projects in Ukraine.

One of the key points for implementation of the SD approach is multi-stakeholder cooperation and partnership. The main actors include government and local authorities, the education and scientific sectors, industry and agriculture, transport and communications, trade and labour unions, the mass media, non-governmental organizations, various communities and international organizations. However such inter-sectorial cooperation for the common benefit is not typical in Ukraine due to a weakly developed civil society. At the same time, the current SD study programs in the country do not include participatory methods as they require much more efforts from the teachers and organisers. Therefore, certain efforts should be performed to enable the shift of society perception of SD activities. i.e. bringing up different values and behavioural patterns.

Another challenge that significantly influences the perspectives of participatory methods to be implemented for ESD in Ukraine is the existing gap between universities and society. This gap causes the lack of the research and educational projects that meet the existing societal needs. At the same time, the societal actors hardly understand potential impacts from cooperation with academic institutions. The participatory methods have a good chance to change existing situation and to facilitate cooperation and mutual understanding between science and society in Ukraine.

### *4.5 After-effects and further developments*

The success of the pilot course in participatory backcasting in KPI has served as a strong impulse for further implementation and development of the teaching approaches introduced within this course in various educational activities in KPI. Furthermore, following the Leo Jansen's workshop the stakeholder role-play game method of teaching backcasting has been used in KTH and UPC



Barcelona-Tech. Another example of the recent implementation of the participatory backcasting exercise is the Spring Course on Innovations for Sustainable Development at KPI that was conducted in cooperation with TU Delft and KTH in March 2013. KPI is currently working on incorporation of participatory methods in its education and research projects on the regular base.

## Conclusion

KPI has implemented a number of successive educational projects aiming at introduction of ESD in the University. These projects were performed in cooperation with the colleagues from KTH, TU Delft and UPC in order to foster the further progress from awareness on sustainability challenges to understanding and ability to implement sustainable solutions by engineering students. Within these projects the participatory backcasting has evolved as an efficient tool for ESD because of its following features: (a) it cultivates long-term thinking; (b) it is societal needs-driven; (c) the participatory backcasting facilitates acceptance of the strategic decisions due to the broad stakeholder involvement and the consensus-focused procedure; and (d) it contributes to stakeholder learning.

Prof. Leo Jansen had made a distinctive impact on the ESD in KPI. Leo's public lecture has inspired the teachers and students of KPI to enhance the ESD activities at the University. Presented by Leo approach to the participatory methods and in particular the participatory backcasting has been adopted and used during the Master- and PhD-level courses in KPI, KTH and UPC.

Involvement of the real stakeholders for communication with students is still remaining to be a challenging task in Ukraine. Therefore, creating success stories and good practices for establishing collaboration between universities and society partners is an important goal for the future projects.

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