**Doctoral School of
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THESIS SUMMARY

Andrea Tabi

Embracing the role of societal factors in the low-carbon transition

Ph.D. Dissertation

Supervisors:

Dr. Maria Csutora
associate professor

Prof. Dr. Rolf Wüstenhagen
professor

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Department of Environmental Economics and Technology

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I.   Research background

Due to the energy- and resource-intensive lifestyle pursued in developed countries during the last century, humankind has to face serious environmental issues in the future. To avoid the threatening consequences of climate change triggered by the rising CO_2 emission worldwide, policy makers come up with ambitious CO_2 emission abatements targeting reductions in production and consumption. Besides the promise of technological solutions we need to turn the searchlight on societal factors that play a prominent role in engaging in environmental actions.

The central topic of this thesis is the transition to a low-carbon economy and society. Various definitions of a low-carbon economy exist from international organizations and practitioners. Lately, it stands in the center of sustainability research as a more focused interpretation of the sustainable development concept, introduced by the Brundtland Commission (WCED, 1987)[1]. According to the definition of the UK's National Strategy for Climate and Energy, low-carbon economy *ensures that energy supplies remain secure, new economic opportunities are maximised, costs are minimised and the most vulnerable are protected* (HM Government, 2009, p. 6.). Low-carbon societies aim at reducing their greenhouse gas (GHG) emissions without significantly affecting their economic growth, i.e. minimal use of intensive energy while shifting towards resource-efficiency including renewable energy concepts and also societal changes in consumer behavior such as transport, heating activities or electricity use, etc. (Ali et al., 2013). Since energy conversion is the main source of GHG emissions, we need to elaborate on more efficient energy strategies including the reconsideration of the current energy systems with low-carbon and renewable energy technologies and adoption of new consumption patterns (e.g. Nakata et al., 2011). Skea and Nishioka (2008) suggested the following framework which could provide a basis for research and action: "*A low carbon society should: (1) take actions that are compatible with the principles of sustainable development, ensuring that the development needs of all groups within society are met; (2) make an equitable contribution towards the global effort to*

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[1] Sustainable development refers to "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).

stabilize the atmospheric concentration of CO_2 and other greenhouse gases at a level that will avoid dangerous climate change, through deep cuts in global emissions; (3) demonstrate a high level of energy efficiency and use low-carbon energy sources and production technologies; (4) adopt patterns of consumption and behaviour that are consistent with low levels of greenhouse gas emissions" (Skea and Nishioka, 2008, p. S6). In order to achieve the transition towards low-carbon economy the steps described below regarding low-carbon society need to be accomplished. This constitutes the theoretical basis of the present thesis that covers all aspects and features of low-carbon transition.

The scientific significance of this thesis is to present a comprehensive scrutiny and a summary of the most important societal barriers that could risk the implementation of curbing CO_2 emission. It aims at providing conclusions and implications to both scientific research and praxis. Building on the theoretical background and previous research experiences, this research broadens the scientific discussion on low-carbon transition. The thesis is built upon three research studies that revolve around possible decarbonisation pathways. Findings of each study make a contribution to designing more efficient environmental and climate policies.
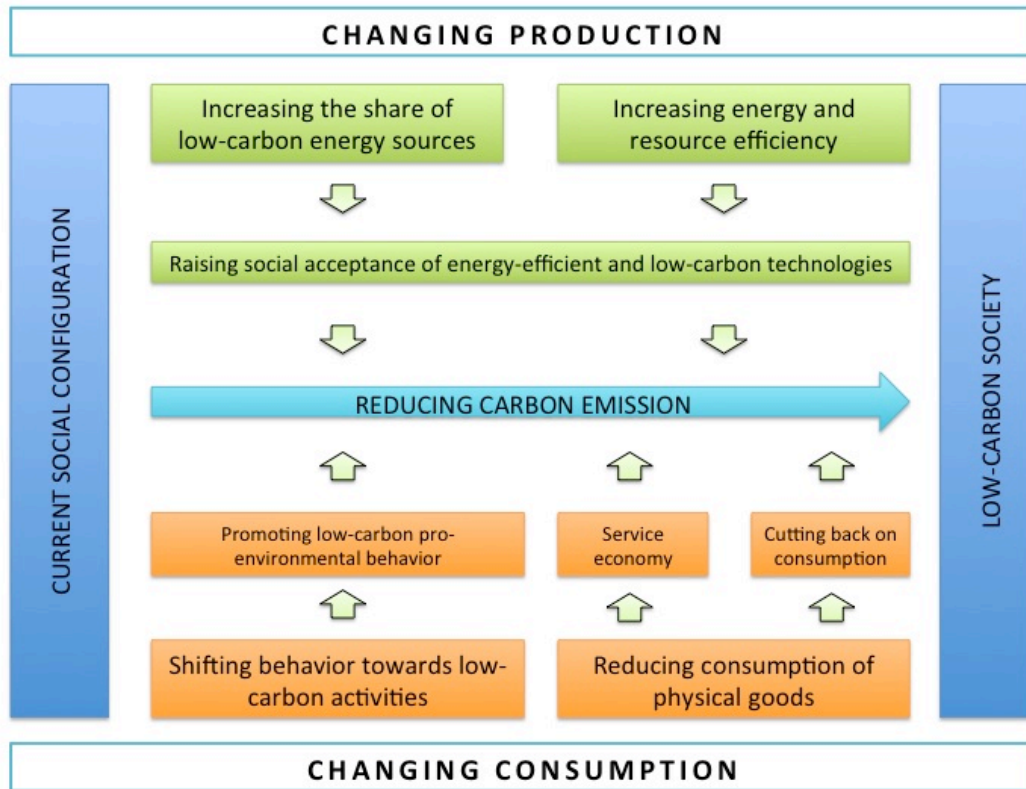
II.   Research methods

Figure 1: The conceptual framework of the thesis (Source: Own compilation)

The way we produce and consume goods and services cause a constant rise in CO_2 level that current climate policies, for the time being, cannot stabilize efficiently. To face the low-carbon challenge, current production and consumption practices have to be revised and radically changed. Both sides require the active social participation. Figure 3 depicts a simplified framework that shows the most important societal factors playing a role in low-carbon transition. To reduce carbon emission from production activities, we need to adopt low-carbon and renewable energy technologies[2] and increase energy and resource efficiency at the same time. The implementation of such technologies is highly dependent on social acceptance with respect to socio-political, community and market dimensions. To change our

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[2] Though, nuclear power generation is indeed a low-carbon technology, but considering the low social acceptance (Siegrist and Visschers, 2013) due to its other substantially harmful characteristics such as radioactive and thermal pollution, nuclear power is not incorporated into the conceptual framework towards a low-carbon society.

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consumption patterns, the adoption of policies promoting low-carbon lifestyle and reducing the consumption of material goods are needed.

In this thesis the following three major social keystones of the framework are analysed in-depth: (1) social acceptance of renewable energy technologies, (2) promoting low-carbon pro-environmental behaviour, and (3) service economy. To investigate the societal factors of these keystones both empirical and non-empirical research are applied.

In the first study, consumer preferences for green electricity products are analysed and linked to socio-demographic, psychographic and behavioural characteristics. The aim of this study is to examine consumer acceptance towards renewable energies The emergence of green power, where residents get the opportunity to switch to renewable energy without being involved in the physical generation (Wüstenhagen et al., 2007), is an unexploited field in the literature. The research takes into account various factors that help to explain to what extent subscribers of green electricity tariff differ from potential adopters. Based on former research, the following hypothesis are developed regarding socio-demographic variables **(H1)**; Adopters of green electricity

- *are better educated (H1a)*
- *have higher income (H1b)*
- *live in smaller households (H1c),*

than Potential Adopters of green electricity. As for psychographic and behavioral variables **(H2)** we hypothesize that Adopters…

- *are more sensitive to environmental issues (H2a)*
- *perceive the price differential between green and conventional energy to be lower (H2b),*

than Potential Adopters. For measuring consumer preferences choice-based conjoint analysis and latent class model is applied using a representative survey that was conducted among 414 German households in 2009.

In the second study, the focus is on low-carbon behavioral patterns. The goal of this research is to explore the connection between pro-environmental behaviour and CO_2 impacts with respect to residential energy consumption. To achieve this, an empirical research has been carried out using a representative survey among 1012 Hungarian households in 2010 focusing on residential energy use. In this study it is

hypothesized that *people who consciously act in a pro-environmental way (green consumers) are responsible for a similar level of CO_2 emissions to those created by people who do not undertake environmental activities (brown consumers)* **(H3)**. To measure the impact of energy use, the carbon emission was calculated at individual level. A latent cluster analysis was conducted that allows us to explore the connection between stated pro-environmental behaviour and carbon emission and to investigate, furthermore, the influence of related socio-demographic and structural characteristics.

The third study challenges the theory of service economy that has been highly promoted because of its putative environmentally-friendliness, i.e. the servitization of economy is assumed to bring along less energy- and resource-intensity. The goal of this study is to elaborate on the real carbon impacts of different types of services and to provide environmental policy recommendations. Based on previous research and the observed trends, it is hypothesized that *the service sector is the major driver of total CO_2 emission* **(H4)** *and the largest share of CO_2 emission generated by service sector can be attributed to the pull effect on non-service industries* **(H5)**. These hypotheses are tested and analysed using the dataset of the Hungarian industries. In order to come to a deeper understanding of the (de)carbonisation effect of services, an environmentally extended input–output (EEIO) and a structural decomposition analysis are conducted. For the empirical application a symmetric Input-Output (IO) table for Hungary has been used for 2008 at current and basic prices provided by EUROSTAT database. Data for 2008 and 2000 has been chosen to investigate the temporal carbon effects of servitization and to avoid the distortion of economic crisis. Data of sectorial carbon emissions are extracted from the Hungarian Central Statistical Office (KSH) database.

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III. Results

3.1. Consumer acceptance of green electricity – Segmentation analysis based on choice experiment in Germany

Many customers exhibit positive attitudes towards renewable electricity mixes, but only a small percentage of them have already opted for green electricity tariffs. The research described in this study was designed to reveal what characteristics distinguish subscribers of green electricity tariffs from potential green electricity adopters in order to provide marketers and policy makers with important information, which might encourage potential adopters to walk the talk. Based on the 4968 experimental choices of a representative sample of 414 German consumers, different consumer segments were identified based on their preferences for different electricity product attributes. Results suggest that the majority of respondents (80%) clearly have a preference for electricity mixes derived from renewable energy sources but only 7% of the sample had already translated their preferences into the purchase of green electricity. The main goal of the research was, correspondingly, to highlight how Adopters differ from those who show interest in renewables but have not subscribed to a green electricity product yet (i.e. Potential Adopters).

Demographic variables were found to play a marginal role in explaining the difference between Adopters and Potential Adopters, which corresponds to findings that emerged from former research (Kotchen and Moore, 2007). With regard to the hypotheses regarding socio-demographic characteristics, the subhypotheses concerning the higher income (H1a) and smaller households (H1c) of Adopters cannot be confirmed by the analysis. On the other hand, results of this study show that Adopters can be characterized by a significantly higher average level of education (i.e. H1b can be confirmed). We can also highlight that gender and age show an equal distribution across the sample.

Results suggest that psychographic and behavioral factors have great explanatory power when it comes to understanding why consumers who evince strong preferences

towards electricity produced from renewable energy sources do not act according to their preferences by opting to purchase green power. As for the subhypothesis on the perceived price differential between electricity tariffs, Adopters estimate that the price difference between green and standard electricity tariffs is lower than Potential Adopters (H2b). The subhypothesis regarding Adopters' higher sensitivity to environmental issues is only partly underpinned by the findings since these characteristics are proven to be similar when compared to Truly Greens, but significantly different when compared to the other segments (H2a). Similarly, Adopters show higher awareness of green electricity labels than other segments except for Truly Greens. Adopters also change their place of residence significantly more often than two segments of Potential Adopters and have recently switched more often their electricity tariffs. Adopters can be further characterized by their higher level of perceived consumer effectiveness compared to all other segments of Potential adopters. Regarding price-related variables, Adopters, in contrast to the other segments of Potential adopters, tend to be willing to pay significantly more for eco-friendly products.

3.2. Measuring the carbon impacts of residential energy use linked to pro-environmental behavior

In the second study the CO_2 emission of residential energy consumption is measured with survey method. A latent class analysis was conducted and four main profiles were identified on the basis of stated environmental actions undertaken by respondents (Browns, Beginners, Energy savers and Supergreeens). The following two clusters describe people who undertake energy-saving behaviour; Energy savers and Supergreens. Respondents from the latter cluster undertake a range of environmental activities, including reducing their energy consumption and travelling in more environmentally friendly ways instead of using cars. In accordance with these statements, this cluster has the lowest carbon emissions for car use. However, their

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emissions due to energy consumption for heating and electricity are, on average, similar to those of Browns. Moreover, in some cases they exceed them.

It is notable that there is a trade-off between using natural gas and firewood for heating in Hungary. Since wood is a relatively inexpensive form of heating and has been promoted by EU Directives as a renewable source of energy it has become more and more popular over the last decade and now constitutes an important heating source, which may substitute for natural gas. In some cases respondents reported that they owned mixed-fuel boilers which can combine wood burning with gas heating systems. Energy savers use the most firewood in their heating mix. The use of coal and LP-gas no longer prevails in Hungary. District heating is the only form of heating which creates indirect CO_2 emissions, since combustion occurs in heat and CHP plants and not at the location of the end user. Having this form of heating means that a customer is locked-in from an infrastructural perspective (i.e. these consumers are not usually able to switch to using other energy sources, regardless of their wishes).

Energy-saving behaviour is one of the most popular environmental activities although it is difficult to specify the reasons for this; is it driven by environmental concern or a desire to reduce costs. This survey indicated that Energy savers generally have lower incomes. It is also remarkable that Energy savers appear willing to cut back on direct consumption of energy but they pollute significantly more through their use of passenger cars.

The central hypothesis of this research (H3), that people who consciously act in a pro-environmental way do not necessarily impact CO_2 emissions more than those who do not undertake environmental activities is partly confirmed; there were no significant differences found between groups in terms of electricity use or heating activities - only with transport activities.

3.3. CO_2 impacts of servitization – a structural decomposition analysis of the Hungarian economy

The third study examines the concept of service economy. It has been a common belief that changing consumption patterns towards a bigger share of income spent on services could help to reduce consumption-related CO_2 emissions. In order to come to a deeper understanding of the (de)carbonisation effect of services, an environmentally extended input–output model and a structural decomposition analysis are conducted on the Hungarian industries between 2000 and 2008. The EEIO revealed the total (direct and embedded) emissions of different sectorial activities. The total emissions from non-service industries are characterized by the dominance of direct emission. In case of services the ratio is reversed, their direct emission has only a marginal share (except for electricity generation and transportation). In order to obtain a more detailed picture of the variety of carbon impacts across different type of services, six groups of services are defined based on possible channels of policy intervention; (1) Electricity, gas, steam and air conditioning supply (2) Basic supply services, (3) Transportation and trade, (4) Recreation and entertainment, (5) Knowledge-based services and (6) Other services. The structural decomposition of the EEIO model is applied to identify the major drivers of CO_2 emissions across intersectoral relationships. Six main components are taken into account during the calculations: Own demand, Final demand, Electricity demand, Service Supply, Non-service Supply (pull effect) and Feedback components. The changes in components over time are dissected into technological and demand elements. A substantial pull effect is found among some industries such as Wholesale and retail trade, Accommodation and food services, and Public administration and defence services. The overall pulling effect of services accounts for 11% in total emission and 16% of total service sector emission. Looking at the structural changes over time, we can conclude that the aggregated technological efficiency improvements (apart from the impacts of the greening electricity generation) at national level are much slower than the growth of demand.

To sum up, the findings of this research do not underpin the concept that a service economy comes necessarily with lower carbon emission. The hypothesis regarding the major role in total CO_2 emission (**H4**) can be confirmed. The pulling effect of services on productive sectors covers the largest part only in case of some services, therefore the hypothesis concerning the leading role of the pull effect among services (**H5**) can partly be confirmed.

The mitigation of climate change requires reduction of CO_2 emissions in absolute terms, which the present structure of economy cannot ensure. Currently, we can experience a growing demand in services with high embeddedness that contributes to the rise in emission of productive activities. Real transition can only be achieved if services become independent from CO_2-intensive products.

IV. Policy implications

This thesis also aims at providing policy recommendations based on the findings of the presented studies. For decision-makers and practitioners the following three major policy implications can be highlighted:

1) Green electricity adoption, as the most accessible way of supporting renewable energy production for the public, seems to be hampered more by psychographic factors such as the lack of awareness and information than socio-demographic factors

2) Even though consumers undertake a number of pro-environmental behaviors, the actual CO_2 impact of these actions is marginal, which can be attributed to the structural lock-in that can offset the positive effects of motivational-driven actions

3) Service sector shows high CO_2 embeddedness and pull effect on productive activities that suggests overlooked CO_2 reduction potentials

The social acceptance, as pointed out by Wüstenhagen et al. (2007), is a keystone in promoting the technological change in energy sector. Results of the survey presented in the first study imply that consumers are usually ill-informed about the environmental significance of their actions. This is underpinned by the outstanding role of perceived consumer effectiveness among green electricity adopters and the low awareness of eco-labels among non-adopter segments. Eco-labelling is a well-designed policy tool to spread out information on environmentally friendly products among consumers. Recently, this policy instrument has received growing attention among academics, policy makers and industry professionals (e.g. Thogersen, 2000; Rubik et al., 2007). Whereas several eco-labels exist in the German market, there is still low awareness of energy labels detected among electricity consumers. *For policy makers, the enhancement of information channels on eco-labels and the development of their dissemination techniques are recommended to increase transparency and reliability.*

Furthermore, education seems to play an utmost important role in the purchasing decision and may also make a strong contribution to higher perceived consumer effectiveness. *This highlights the necessity of communicating better about the actual impacts of opting for green power.*

The second study concludes that there may actually be no significant difference between environmentally-conscious and environmentally indifferent individuals in terms of their energy-related CO_2 emissions. This implies that pro-environmental behaviors are limited in impact and might be dominated by structural factors. This statement applies to heating and electricity use but not to transportation activities. Besides the information gap between environmental actions and their carbon impacts the findings presented in the second study suggest that *subsidies and incentives targeting structural factors such as home size, type of house etc., can be efficient policy instruments to improve energy efficiency of heating activities and electricity use. Transportation activities can be targeted by awareness raising campaigns.* In line with the findings of the first study, the greenest consumers (Supergreens) have higher education level on average compared to other segments. *Therefore, we can conclude that a more efficient way of disseminating information on CO_2 impacts of environmental actions is also needed. Misleading or inaccurate information may lead to redundant efforts and in the long run to the demoralization of consumers.*

As it is demonstrated in the third study, the major part of CO_2 emission generated by service sector is embedded in the supply chain. Results of structural decomposition analysis show that the major share of CO_2 emission generated by services comes indirectly from the emission of non-service sector and electricity generation. The high embeddedness of services gives room for improvement in policies targeting curbing CO_2 emission. Sectors such as energy generation, paper and pulp industry, cement, etc. are mainly associated with carbon emission and stand in the focus of climate regulation, although downstream sectors – mainly services – are significantly affected as well (Csutora and Dobos, 2012). The findings of this study provide relevant inputs for improvements in the field of carbon accounting as well as carbon pricing. Along with carbon emission, carbon costs (e.g. taxes or market-based mechanisms such as emission trading schemes)

are accumulated in the supply chain. Downstream industries are affected by these policy regulations through purchasing carbon-intensive products such as energy, transportation and other intermediate products. Knowledge-based services and Recreational and entertainment activities, which have almost zero direct carbon emissions, purchase mainly electricity and products from non-service sectors for their activities. Due to the strong intersectorial dependency, these sectors might therefore be sensitive to changes in energy and carbon costs. *So it can be concluded that downstream service industries such as knowledge-based and recreational services are strongly affected by energy and carbon prices as well, which can provide a possible channel to regulate the indirect CO_2 impact of such industries.*

V.   Limitations and further research

The doctoral thesis also came across some limitations. Two studies presented are built upon survey results and as such those share some of the limitations that are common to stated preference methods.

A standard limitation for any stated preference method is that there might be a gap between stated and revealed preferences. In stated preference methods such as contingent valuation method and discrete choice experiment, the difference of hypothetical and actual statements of value is often wide and this phenomenon is known as hypothetical bias. In other words, that people tend to overstate their economic valuation especially in estimating the value of non-market goods and services. Stated preference methods are often the only technique available for estimating the value of ecosystem services or goods. Since these goods and services are hypothetical in provision, hypothetical bias may often occur e.g. when individuals express how much they would pay for them in a hypothetical market (Murphy et al., 2005). Schläpfer and Fischhoff (2012) found that hypothetical bias can be overcome and the results of stated preferences can be consistent with revealed preferences if the goods and the context are familiar for respondents. This bias can also limited by using indirect questioning techniques for preferences such as discrete choice experiment and designing the survey as close as possible to real purchase situations.

With regard to preferences for product attributes, there is inconsistency detected in people's choices that can be derived from the format of information. Evidences found that people choose what is offered to them as the default. In other words, people's preferences depend mostly on the context of the choice and way it is presented (Pichert and Katsikopoulos, 2008; Chassot et al., 2013).

Finally, it can also be noted that to the fact that this work does not consider that a certain action (e. g. green electricity adoption) could potentially influence other behaviors in different contexts. For instance, participating in green electricity programs could have a knock-on or spill-over effect on other pro-environmental behavior and lead to a generally wider behavior or attitude change. In a similar vein, the first study did not consider the link between adopters' a priori and

posteriori psychographic and behavioral characteristics e.g. adoption itself may have a transformative effect. It would be worth investigating this phenomenon in a longitudinal study, where the attitude change during the process could be analyzed over time.

VI. Related publications

1. Journal articles in English

Tabi, A., Hille, S., Wüstenhagen, R., 2014. What makes people seal the green power deal? - Customer segmentation based on choice experiment in Germany. (accepted for publication in *Ecological Economics*)

Tabi, A., 2013. Does pro-environmental behavior affect CO_2 emissions? *Energy Policy*, Volume 63, Pages 972-981.

Tabi, A., 2013. Using the stated preference method for the calculation of social discount rate. *Society and Economy*. DOI: 10.1556/SocEc.2013.0003

Mozner, Z., **Tabi, A**., Csutora, M., 2012. Modifying the yield factor based on more efficient use of fertilizer—The environmental impacts of intensive and extensive agricultural practices. *Ecological Indicators* 16(2012) 58–66.

Tabi, A., Csutora, M., 2011. Representing forest management dilemmas in ecological footprint indicator. *Applied Ecology and Environmental Research* 10(1): 65-73.

2. Book chapters in Hungarian

Tabi, A., Csutora, M. 2012. A temporális diszkontálási szokások vizsgálata - a társadalmi diszkontráta és a társadalmi preferenciák kapcsolata. In: Kerekes Sándor, Csutora Mária (edited) Fenntartható fogyasztás?: Trendek és lehetőségek Magyarországon. Budapest: Aula Kiadó, 2012. pp. 173-197.(ISBN:978 963 339 042 9)

Tabi, A., Csutora, M., Benedek, Z., Ásványi, K., Marjainé Szerényi, Z., Molnár, A., Szabó, Z., Eszlári, N., Kardos, M., Kozma, Z., Derts Z. 2011. Gazdasági számítások alapjai a modellezett vízkészlet-változások mentén. In: Koncsos László (szerk.). Jövőképtöl a vízkészlet-kockázatig. Budapest: BME Építőmérnöki Kar Vízi Közmű és Környezetmérnöki Tanszék, 2011. pp. 95-137. (ISBN:978 963 313 060 5)

Tabi, A., 2011. A magyar háztartások energia lábnyomának vizsgálata lakossági felmérése alapján (In: Az ökológiai lábnyom ökonómiája, 2011, ISBN 978-963-339-028-3, 75-88 pp.)

3. Book chapters in English

Schaltegger, S., Harms, D., Hörisch, J., Windolph, S., Burrit, R., Carter, A., Truran, S., Crutzen, N., Rhouma, A., Csutora, M., **Tabi, A**., Kokubu, K., Kitada, H., Badrul Haider, M., Dae Kim, J., Lee, K., Moneva, J., Ortas, E., Alvarez-Etxeberria, I., Daub, C., Schmidt, J., Herzig, C., Morelli, J. 2013. International corporate sustainability barometer: A comparative analysis of 11 countries. Lüneburg: Center for Sustainability Management e.V., Leuphana University Lüneburg, 2013. 56 p. (ISBN:978-3-942638-38-8)

4. Conference proceedings in English

Csutora, M., Mózner, Z., **Tabi, A**. 2009. Sustainable consumption: From escape strategies towards real alternatives. In: Kerekes, S., Csutora, M., Székely, M. (edited) Sustainable Consumption 2009 Conference: Sustainable consumption, production and communication: Proceedings: Budapest,. 63-74. (ISBN:978-963-503-399-7)

5. Working papers in English

Tabi, A., del Saz-Salazar, S., 2014. Environmental damage evaluation and familiarity in a willingness-to-accept scenario: the case of Valencia Port, Spain (submitted to Ecological Economics)

VII.   References

Alcántara, V., Padilla, E., 2009. Input–output subsystems and pollution: An application to the service sector and CO2 emissions in Spain, Ecological Economics, Volume 68, Issue 3, 15 January 2009, Pages 905-914. DOI: 10.1016/j.ecolecon.2008.07.010

Ali, G., Abbas, S., Qamer, F. M., 2013. How effectively low carbon society development models contribute to climate change mitigation and adaptation action plans in Asia, Renewable and Sustainable Energy Reviews, Volume 26, October 2013, Pages 632-638. DOI: 10.1016/j.rser.2013.05.042

Butnar, I., Llop, M., 2011. Structural decomposition analysis and input–output subsystems: Changes in CO2 emissions of Spanish service sectors (2000–2005), Ecological Economics, Volume 70, Issue 11, 15 September 2011, Pages 2012-2019. DOI: 10.1016/j.ecolecon.2011.05.017

Chassot, S., Wüstenhagen, R., Fahr, N., Graf, P. 2013. Wenn das grüne Produkt zum Standard wird: Wie ein Energieversorger seinen Kunden die Verhaltensänderung einfach macht. Organisationsentwicklung, 2013(3), 80-87.

Csutora, M., Dobos, I., 2012. Calculating carbon cost sensitivity of companies using hybrid   accounting. 15th EMAN Conference on Environmental and Sustainability Management Accounting in collaboration with the CSEAR International Congress on S ocial and Environmental Accounting Research, SBN 978-952-93-1238-2, ., Helsinki

Hartikainen, H., Roininen, T., Katajajuuri, JM., Pulkkinen, H., 2013. Finnish consumer perceptions of carbon footprints and carbon labelling of food products, Journal of Cleaner Production, Available online 24 September 2013, DOI: 10.1016/j.jclepro.2013.09.018

Heinzle, S., Wüstenhagen, R., 2012. Dynamic Adjustment of Eco-labeling Schemes and Consumer Choice – the Revision of the EU Energy Label as a Missed Opportunity?, Business Strategy and the Environment, 21(1), 60-70, DOI:10.1002/bse.722.

HM Government, 2009. The UK Low Carbon Transition Plan, ISBN: 9780108508394

Kotchen, M. J., Moore, M. R., 2007. Private provision of environmental public goods: Household participation in green-electricity programs, Journal of Environmental Economics and Management, Volume 53, Issue 1, Pages 1-16. DOI: 10.1016/j.jeem.2006.06.003

Murphy, J. J., Allen, P. G., Stevens, T. H., Weatherhead, D., 2005. A Meta-analysis of Hypothetical Bias in Stated Preference Valuation, Environmental and Resource Economics, March 2005, Volume 30, Issue 3, pp 313-325. DOI: 10.1007/s10640-004-3332-z

Nakata, T., Silva, D., Rodionov, M., 2011. Application of energy system models for designing a low-carbon society, Progress in Energy and Combustion Science, Volume 37, Issue 4, August 2011, Pages 462-502. DOI: 10.1016/j.pecs.2010.08.001

Pichert, D., Katsikopoulos, K.V., 2008. Green defaults: Information presentation and pro-environmental behavior. Journal of Environmental Psychology, 28 (1), pp. 63-73. DOI: 10.1016/j.jenvp.2007.09.004

Rubik F, Frankl P, Pietroni L, Scheer D. 2007. Eco-labelling and consumers: towards a re-focus and integrated approaches. International Journal of Innovation and Sustainable Development 2(2): 175–191. DOI: 10.1504/IJISD.2007.016932

Schläpfer, F., Fischhoff, B., 2012. Task familiarity and contextual cues predict hypothetical bias in a meta-analysis of stated preference studies, Ecological Economics, Volume 81, September 2012, Pages 44-47. DOI: 10.1016/j.ecolecon.2012.06.016

Siegrist, M., Visschers, V. H. M., 2013. Acceptance of nuclear power: The Fukushima effect, Energy Policy, Volume 59, August 2013, Pages 112-119. DOI: 10.1016/j.enpol.2012.07.051

Skea, J., Nishioka, S., 2008. Policies and practices for a low carbon society, Climate Policy, 8, s5-s16. doi:10.3763/cpol.2008.0487

Thogersen J. 2000. Psychological determinants of paying attention to eco-labels in purchase decisions: model development and multinational validation. Journal of Consumer Policy 23(3): 285–313. DOI: 10.1023/A:1007122319675

WCED (World Commission on Environment and Development), 1987. Our Common Future, Oxford University Press, Oxford.

Wüstenhagen, R., Wolsink, M., Bürer, M. J., 2007. Social acceptance of renewable energyinnovation: An introduction to the concept. Energy Policy 35 (5): 2683-2691. DOI: 10.1016/j.enpol.2006.12.001