Energy Use Caps under Scrutiny: An Ecological Economics Perspective[1]

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This paper highlights the need to limit resource use, especially energy resource use in the global economy. First, the scientific literature on capping resource use in light of three primary issues (sustainable scale, fair distribution, efficient allocation) is reviewed, as ecological economics suggests that these concerns must be addressed to move towards sustainability. Second, the paper examines how several tools proposed for capping energy use can or cannot deliver effective responses to the three primary concerns in ecological economics. Finally, recommendations are provided for future research on understanding and analysing energy capping tools to effectively achieve both environmental and social goals.

Keywords: energy use, cap, entitlement, social justice

JEL-codes: Q42, Q57

1. Introduction

Consumption behaviours are deeply embedded in the cultural, institutional and economic context in which people conduct their lives. However, limits to regional or global biocapacity[2] as well as the minimum material/ecological requirements for sustaining human life have determined biophysical constraints for consumption and, thus, resource use in absolute terms. Humanity uses more resources, including energy resources, than can be regenerated (EEA 2015). Although final energy and gross inland energy consumption have been slightly decreasing in the EU (European Commission 2016a; 2016b), the average global surface temperature continues to rise, as 2015 was the warmest year on record (European Commission 2016c). This can be attributed to the increasing amount of imported embedded energy (OECD 2015a), which primarily originates from China and India, and has led to China being the country with the single highest absolute emissions from consumption and production perspectives(Clark 2011a; 2011b). This is also underpinned by research investigating material and energy use in Iceland (Clarke et al. 2017) and Austria (Eisenmenger et al. 2017). As such, without global policy intervention, wealthy nations appear to slightly reduce emissions, whilst

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[2] Biocapacity refers to the capacity of a given biologically productive area to generate an on-going supply of renewable resources and to absorb its spillover wastes. Unsustainability occurs if the area's ecological footprint exceeds its biocapacity.

global emissions continue to rise (Barrett et al. 2013). Therefore, it is important to account for emissions that are embodied in products, particularly those traded internationally (Kanemoto et al. 2016).

Because unsustainable resource use driven by unlimited economic growth has not resulted in social justice, inequalities have been rising (OECD 2015b). However, public policies do not provide clear guidelines for changing these trends and finding new methods for sustainable transformations. This appears to be the case even though consumption trends since World War Two have not been coupled with an increase in subjective well-being or a reduction in inequality (Tóth 2013). The current dominant economic structure is responsible for driving these trends in unsustainable resource use and the unequal share of benefits that arise from resource use despite recent achievements in eco-efficiency. Therefore, there is a desirable and unavoidable need to re-adjust our economic model to our environmental space while accounting for social justice.

To solve this complex challenge, it is important to utilize a systems approach to address both unsustainable resource use and its unfair use. Without a guiding vision of sustainability, it is not possible to effectively target any single issue of global concern or to model this complex and interdependent array of ecological, economic, and societal issues (Luda 2013). As such, one of the founding fathers of ecological economics, Herman Daly (1992), conceptualized the three primary challenges that sustainability science in general and ecological economics in particular should be prepared to tackle: sustainable scale, fair distribution and efficient allocation. Ecological economics accepts all three challenges as individually significant and interrelated. From a systems approach, it appears clear that sustainable scale (living within planetary boundaries) is the primary challenge. A sustainable society and economy can be achieved only by respecting the ecological limits of planet Earth. Because all economic activities have meaning in specific social contexts, the economy should be institutionally designed to respect societal concerns, including social justice concepts. Consequently, the issue of fair distribution prevails over economic efficiency. In other words, there are social limits to growth (Hirsch 1973).

This systems approach has clear parallels with a Polanyian conceptualization of the economy as embedded within a socio-cultural system and a broad, natural system (Polányi 1944). As such, the biosphere is the larger system where the socio-cultural and economic systems, in hierarchical order, are embedded. Many other commentators(e.g. Gyulai 2010; Fleming – Chamberlin 2011) share this ecological economics perspective and have proposed specific policy tools to set an absolute limit for energy use to move towards an ecologically sustainable scale, fairer distribution, and a more efficient use of energy resources.

This paper assumes that there is evidence for the need to globally reduce absolute resource use. In addition, it is critical to account for the social justice consequences of such a reduction to move towards sustainability. As such, I review two policy tools proposed for capping energy capping: one created for the UK and the other for Hungary. I summarize the literature in relation to ecological economics (in which the references to the Hungarian proposal under scrutiny dominate). Then, I evaluate their potential for delivering integrated solutions that address the three aspects of ecological economics: sustainable scale, fair distribution, and efficient allocation of energy resources.

I chose two proposals aiming to set an absolute ceiling for energy use because energy is an overarching resource that affects the use of all other resources. In other words, if energy use is limited, practices that are based on intensive energy use, such as intensive agriculture or fossil energy use become less competitive. Therefore, these sectors would be forced to use less energy, apply more human labour and thus become more sustainable and extensive. At the same time, other sectors that use less energy automatically become more competitive.

The current analysis suggests that the environmental impacts of the schemes, if they are implemented, could contribute to achieving a sustainable scale, as defined by ecological economics. At the same time, I question the extent to which the schemes have profound implications for social justice by delivering varied distributional impacts to different groups in society.

Although this topic is visionary, it provides a direction for public policy for tackling threats such as global climate change or the worldwide loss of biological diversity, which are challenging all members of human societies. Moreover, my analysis is underscored by scientific research on the UK scheme (Chamberlin et al. 2015), as both schemes have been politically debated in the Hungarian and British Parliaments respectively. Therefore, my analysis provides valuable insight into these political debates for moving towards implementing the proposed schemes.

The structure of the paper is the following: first I analyze how the concept of resource use capping has emerged in ecological economics and its related debates. Then I introduce the two policy proposals, the Hungarian Climate Bill Proposal and the Tradable Energy Quotas from the UK, both aiming to cap resource use, especially energy use in absolute terms. After their introduction, I evaluate the two proposed schemes, based on to what extent they contribute to the three aspects of ecological economics: sustainable scale, effective allocation and fair distribution. Following the evaluation, I discuss the outcomes for fair distribution, since the contribution of the schemes to enhance fair distribution is unclear. The article finishes with some concluding remarks on how the two schemes can be further elaborated in order to contribute more effectively to fair distribution.

2. Resource Use Capping in Ecological Economics

The three challenges that ecological economics targets are sustainable scale, fair distribution and efficient allocation. Sustainable scale refers to the amount of resources extracted and traded in total, due to the global reach of economic activities. The physical limits of our globe, which have already been exceeded (Rockström et al. 2009), define the scale of sustainable resource use and constitute an absolute limit to any kind of physical growth. In this sense, ecological economics follows the Malthusian (Malthus 1798) logic of absolute scarcity rather than a Ricardian relative scarcity approach (Ricardo 1911). This clearly separates ecological economics from environmental economics, as the latter is an applied microeconomics that operates within the realm of relative scarcity. Sustainable scale eventually demonstrates concern for the future for non-human living beings as well. Thus, it has both temporal (inter-generational) and non-anthropocentric aspects.

The second issue is the intra-generational distribution of resources. The benefits deriving from natural resource use also require ecological-economic analysis and management because fair distribution and a shared notion of social justice are constitutive elements of sustainability. Obviously, there are competing conceptions of social justice, and it is not clear which concept of social justice prevails or should prevail in each societal context when deliberated by citizens.

The third issue of ecological economics acknowledges the importance of free markets in delivering efficient economic outcomes, as is argued for and modelled in mainstream economics. In the cases of market failures and missing markets, mainstream economics proposes several forms of collective intervention to correct failures and/or create markets that operate efficiently. Unsurprisingly, proposals for resource use, including energy use, capping involve, to some extent, applying market mechanisms to ensure resource-efficient outcomes.

However, the three challenges may not be entirely independent, as Daly originally claimed (Daly 1992). In contrast, other researchers (Prakash – Grupta 1994) suggest that it is important to first set the scale, let the market achieve effective allocation through the price mechanism, and then call for a form of collective intervention to correct or compensate for any undesirable distributional outcomes through public policy tools (including fiscal instruments). Because scale is the first step and because the scientific literature has frequently addressed this concern, the following paragraphs summarize papers that discuss the issue of sustainable scale.

To identify a critical sustainable scale, it is important to account for intra-generational (space) and inter-generational (time) issues of scale. The former includes spatial scarcity and the heterogeneity of allocation and distribution (Jordan – Fortin 2002). The other is a temporal scale with respect to ecological turnover times and the rate at which humanity uses resources and disposes of waste, combined with how future generations will be affected by the environmental degradation that today’s activities cause. Therefore, these two concerns of space and time need to be considered when trying to identify sustainable scale.

Others have focused on methods through which the desired economic scale could be achieved. Both the Ehrlich’s equation (I = PAT) (Ehrlich – Holdren 1971; Pogutz – Micale 2011) and the ET = I equation based on the Global Welfare Curve (Wetzel – Wetzel 1995) show that all economic activity requires throughput that implies environmental impacts, which can be mitigated by appropriate technology but can never be completely eliminated. Similarly, Alcott classifies strategies for reducing environmental impacts according to the I = PAT formula (Alcott 2009). The research argues for giving preference to direct, left-sided strategies over indirect right-sided strategies for reducing I(mpact), such as resource depletion and environmental pollution. This would avoid a rebound effect and reduce the impact. In contrast, decreasing any of the factors found on the right side of the concerned equation (P: population, A: Affluence, T: Technology) causes, or at least enables, the other two to rise or ‘rebound’.

Another approach towards meeting the challenge of scale is to distinguish between maximum and optimal scale (Lawn 2001). The maximum sustainable scale is the largest macroeconomic scale that can be sustained with a throughput of matter and energy that is within the ecosphere’s regenerative and waste assimilative capacities, which reflects its biophysical reference. The optimal scale maximizes the net benefits of economic activity but rarely includes all expenditures, especially social and environmental externalities. Thus, it has macroeconomic relevance. These two scales should be harmonized so that the optimal does not exceed the maximum sustainable scale. Consistent with the optimal and maximum scale dilemma, others (Wetzel – Wetzel 1995) distinguish between ecological and economic carrying capacity. Ecological carrying capacity considers how many people live on Earth, while economic capacity determines the resource demands for the standard of living that they maintain.

Degrowth scientists (Martinez-Alier 2009) argue that economic growth is not compatible with environmental sustainability; thus, mainstream economists need to recognize the importance of scale in economic theory. There does not appear to be another way of modifying the internal structures of a profit driven market economy to an economy which does not grow at all. This is where resource capping assumes a vital role: it provides an opportunity to set an absolute limit for resource use (external to the market), and institutionalizes a maximum physical size of the economy (Spangenberg 2013a). Even when the need for applying resource use capping tools is accepted, others (Ropke 2015) argue that it is critical to address implementation challenges. These challenges include the difficulties of implementing completely new and complicated policy tools, the lack of proper technical infrastructures as well as institutions, cultural expectations, and entrenched everyday practices. These challenges have evolved through long historical processes that favour the substitution of labour with fossil energy.

Despite the scientific findings and references listed above (for additional examples see Malghan 2010; Pelletier 2010), the three challenges, especially the issue of fair distribution as raised by Daly (1992), have not received significant attention among ecological economists in the last 20 years.

Experts from NGOs and scientific think tanks developed policy tools that were independent from the main scientific and policy trends in the past decade that targeted sustainable scale and fair distribution as defined by ecological economics through the energy resource capped economy. One of the tools has been attempted in Hungary (Gyulai 2010) and the other in the UK (Fleming – Chamberlin 2011). Both proposals aim to set an absolute limit for energy consumption.

The systems approach aims to prevent a shift from one type of environmental pressure to another. Furthermore, the systems approach for both schemes aims to prevent shifting environmental pressures in space and time (in an attempt to solve the dilemma of intra- and intergenerational space of Jordan and Fortin 2002) and thus also avoids the rebound effect (Alcott 2009).

Energy use caps influence the size of the economy and thus contribute to sustainable scale and, combined with allocation/distribution mechanisms, may also facilitate or hinder the needed transformation towards a fairer distribution of resources (Spangenberg 2013a). However, in the scientific arena, there are pros and cons for cap and trade systems compared to their most popular competitor, environmental taxes. Although both are market-based instruments that provide price signals for internalizing environmental damage (Crals – Vereeck 2005), they have several differences. Inter alia cap and trade (C&T) systems behave progressively, as poorer consumers are often 'winners', while taxes are primarily regressive (Li et al. 2014). In other words, placing the tax burden on electric bills can disproportionately affect poor households (Bouzarovski – Petrova 2015), which suggests that taxes tend to create diffuse benefits and concentrated costs (Levin et al. 2012). However, grandfathering in C&T systems can be regressive and can also concentrate wealth in high-income groups (Blonz et al. 2010; Archer 2015; Waxman 2009).Additional pros for C&T systems are that they usually result in lower emissions than their tax counterparts (Levin et al. 2012), and because they allow people to choose how to consume less, C&T systems are more preferable (Perrels 2010). In addition, in C&T systems, consumers are obliged to reduce their original consumption by a certain proportion, and therefore, cost efficiency is automatically attained in these schemes (Colt 2015; Bye – Bruvoll 2008). For their attained costs, taxes pose more information as well as transaction costs, while C&T systems require more set-up costs (Crals – Vereeck 2005).

3. Policy Tools for Energy Use Capping

This section introduces two proposals for capping energy use. Both were proposed for European states: one was developed for Hungary, while the other was developed for the UK. These schemes seek to account for the differential economic impacts of resource use capping policies on households in different income brackets and on their varied capacities to invest in energy efficiency (Lorek – Vadovics 2016). Both schemes aim to reduce energy use by setting an absolute ceiling for use and allocating energy entitlements. Energy consuming entities (individuals, companies, etc.) can trade energy units or quotas among themselves. Figure 1 illustrates the flow of quotas in the Hungarian Climate Bill Proposal.

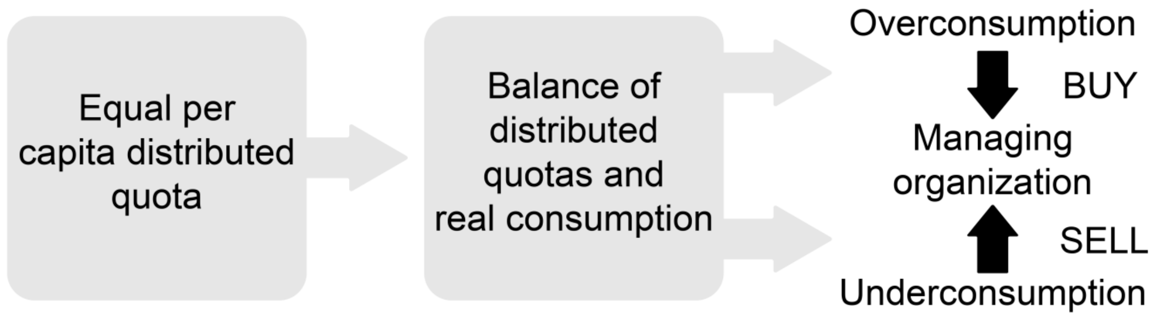

Figure1. The flow of quotas (entitlements) in the system
Source: Gyulai (2010))

I will describe the development of and support for both proposals, their elements, the required institutional and administration background for implementation and will demonstrate their benefits through concrete examples. Later, I examine how the schemes contribute to solving the three concerns in ecological economics. Social aspects will be extensively highlighted and discussed due to their typical marginalization in sustainability science.

3.1. The Hungarian Climate Bill Proposal

The scheme developed in Hungary aimed to reduce national non-renewable energy consumption while simultaneously facilitating a shift towards renewable energy sources and higher efficiency. The proposal was developed by Iván Gyulai, an expert working for different nature conservation NGOs (Friends of the Earth Hungary; Ecological Institute for Sustainable Development). It gained the support of Friends of the Earth Hungary, which is the largest nature conservation NGO network in the country. The NGO engaged in a communication campaign between 2008 and 2010 to increase public and political awareness about the scheme. The National Council for Sustainable Development placed the scheme on its agenda for 2008-2009. The Hungarian National Assembly (HNA) passed a resolution to draft the act in May 2009, and it was debated in February 2010. However, the scheme failed to become law due to two amendment proposals being technically blocked, the end of the mandate of the HNA, and a lack of political will, and since 2010, the Hungarian atmosphere has not favoured implementing this tool.

The proposed regulatory system is based on 3 + 1 pillars (Gyulai 2010). The first pillar is Energy Entitlement, which would set an absolute ceiling for non-renewable energy consumption that would be decreased every year. Energy consumption entitlements in annually decreasing quantities would be allocated among individual consumers (on an equal per capita basis for adults and a varying percentage for children depending on whether the individual is the first, second, etc., child in the household) and public and private consumer groups. Those who save a portion of their allocated entitlements could sell their remaining entitlements through an entitlement management organization to those who consume more than their allocated consumption entitlements. This management organization would sell the entitlement in the national currency and would purchase the remaining quota in "quota money". This currency is parallel to the national currency, or the currency of the region in which the scheme is implemented. The national currency shall serve as a collateral for quota money, based on specific legislation. Those who do not consume their entitlements receive quota money, which can be spent in the Green Market (See the second pillar).

The second pillar is the Green Market, which aims to spread sustainably produced products with high labour contents (e.g., meat produced in extensive agriculture, organic food, insulation of buildings for energy saving, renewable energy investments), which operate according to pre-defined environmental and ethical rules, such as aspects of sustainability and market considerations. This pillar encourages consumers and businesses to purchase from locally owned, independent businesses rather than transnational corporations, which have grown rapidly in the past decade (Kurland – McCaffrey 2013).

The third pillar is the Revolving Fund, which aims to provide opportunities for everyone, both the rich and poor, to obtain savings through energy efficiency and renewable energy investments. It is especially important because 40% of the final energy consumption in the EU stems from the residential and commercial building sector. Although the EU targets this challenge through regulations, several corrections are still required from an ecological perspective (Bányai 2014). One necessary condition may be this institution. The Revolving Fund would provide interest-free loans in "quota money" with a payback period that is adjusted to the energy savings or income generation that occur through the investment.

The last pillar is the Support Service, which aims to provide everyday advice to citizens on how they can benefit from the system if it is implemented. Advisors should be fully aware of the system's benefits as well as the challenges faced by people from each income decile, and should provide specific suggestions for changing lifestyles towards greater sustainably as well as advice on household investments for reducing energy consumption.

One can easily notice that the scheme appears very inspiring but that it involves several implementation challenges in reality. For proper implementation, the system requires proposing and implementing new laws, establishing new governmental bodies as well as developing electronic systems for the energy allocation card. First and foremost, the Hungarian Parliament would need to define the provisional energy reduction target for the next ten years in accordance with domestic and international expectations and opportunities. The rate of reduction is stipulated by government decree, which should be promulgated 30 days prior to the start of the financial year, while the final regulatory rate for the reduction must be published by 15 January.

The system prescribes the development of an electronic system for the energy allocation card, which has a running account that indicates the available amount of non-renewable energy for the consumer for yearly use. Furthermore, it simultaneously registers consumption at fuelling stations and settles the account. The energy providers register the consumed non-renewable energy quantities on the card when the service is accounted for on the books, while card owners can check their balance at any time. Payment in the green market in quota currency occurs with these cards owned by all consumers.

A quota managing authority needs to be established to allocate and monitor energy consumption entitlements. This body would maintain parallel accounts for both customers and providers. Parallel accounting is designed to insure data security, to allow for the replacement of lost cards and to manage the day-to-day traceability of all the accounts. It marks the consumption entitlements on an individual electronic energy allocation card with a personalized PIN code by 31 January of each year. Furthermore, the quota managing authority observes confidentiality regulations related to personal data management and does not divulge individual consumption data.

The system defines issuing a new currency, so-called quota money, which can be received when possessing an energy quota surplus that is returned to the managing authority. It can be spent in the green market. The quota currency can be converted to national currency; its price is pegged to the respective value of non-renewable energy. A 20% commission shall be paid at the exchange, which will be used by the quota manager. Furthermore, the system would establish a council to verify the products and services that enter the green market and to establish product certifications and the branding rules of the market.

The Revolving Fund is established by law, and its basic accounting instrument is the quota currency. Its operational costs are covered by a transaction charge that amounts to 1.5% of credit transactions, which is paid back by the debtors from their savings as part of the loan. The state ensures the assets of the fund from public funds set aside for the energy sector, and contributes to carbon-trade revenues. The funds provided by the state secure collateral for the quota currency in national currency. However, the state may capitalize on that collateral, e.g., by depositing it at the central bank at a certain interest rate.

In addition to the abovementioned system requirements, specific regulation needs to be developed to govern opportunities and limitations for buying fuel abroad, as well as energy and fuel allocations for foreign individuals. The operating costs for the entire system, including the costs for the quota management organization and the advisory service, need be covered by 0.5% of the amount of each purchase transaction.

In a region where this scheme is implemented, those who use more energy than their received entitlement can choose different options based on their income. When wealthy people want to use less energy, they can either change their lifestyle to consume less energy or invest in energy reduction. When poor people use more energy than their fair share due to low-quality installation in their houses or to the large size of their houses, they can approach the Support Service staff to ask for advice on how to benefit from the system. These marginalized people would potentially have an opportunity to apply for interest-free loans through the Revolving Fund if the Support Service is appropriately established. They could pay the loan back during a payback period adjusted to the energy savings or income generation realised through the investment. People who use less energy than their entitlements could sell their remaining entitlements to the management organization, which would in turn provide quota money to be spent on sustainable product and services. Therefore, those who consume less energy could enhance their well-being through freely accessing healthier and sustainable products.

3.2. Tradable Energy Quotas from the UK

The Tradable Energy Quotas (TEQs) scheme was developed by David Fleming, an independent thinker and writer on environmental issues. It was first published by the Fleming Policy Center in 1996. In 2004, it resulted in a Ten Minute Rule Bill. The government funded research into it in 2006, and a feasibility study was conducted in 2008. Unfortunately, one of the four reports included in this study explicitly reviewed a Personal Carbon Allowances (PCA) scheme without a hard cap on emissions, rather than TEQs. Based on this analysis, the report concluded that the cost would outweigh the benefit and shaped the UK government's conclusion that TEQs are "ahead of their time" and their decision was not to fund additional research. At the time, the UK press claimed that the UK Treasury had banned continued work on the idea, although the government did commit to continue to "monitor the wealth of research focusing on this area" (Chamberlin et al. 2014).

The decision not to fund further research was widely criticized by the UK government's Sustainable Development Commission and the House of Commons Environmental Audit Committee. In 2011, an All Party Parliamentary Report emerged that highlighted several methodological errors in the 2008 study and argued in favour of funding a new and properly specified feasibility research programme. This report received high-profile political endorsements and international media attention, but was ignored by the UK's new government, which eventually confirmed that despite the previous government's commitment to monitor ongoing research, it had no staff committed to this task. In the absence of government funding and widespread popular support to contest this decision, work on TEQs has slowed (Chamberlin et al. 2014).

Similar to its Hungarian counterpart, Tradable Energy Quotas (TEQs) set an absolute limit on energy consumption that also pushes energy users towards using the limited energy as effectively as possible (Fleming – Chamberlin 2011; Chamberlin et al. 2014).The total number of units that are available in the country would be determined in advance in the so-called TEQ

Budget. The size of the budget would decrease year by year and step by step. This would provide long-term clarity for the economy and investors. The budget in the UK would be set by the Committee on Climate Change, which is independent of the government. The government would be bound by the TEQ scheme, which would support the country in thriving on the available carbon/energy.

TEQs would be measured in units. Every adult would receive an equal free entitlement of TEQ units each week. Other energy users (state, industry, etc.) would bid for their units at a weekly auction (tender). When individuals purchase fuel or energy, such as petrol for their car, units corresponding to the amount of energy they have bought would be deducted from their TEQ account, in addition to their money payment. This is the only time they would need TEQ units, and transactions would generally be automatic using credit-card or direct-debit technology.

All fuel and electricity supplies would carry a “carbon rating” in TEQ units; one unit would represent one kilogram of carbon dioxide – or the equivalent in other greenhouse gases – that is released in the fuel’s production and use. This aims to determine how many units are needed to make a purchase (thus giving a competitive advantage to low-carbon energy). If someone uses less than the entitlement of units, the surplus can be sold. If more is needed, the consumer could buy them until the set ceiling is not obtained and entitlements are on the market. All trading would occur at a single national price, which would rise and fall in line with demand. Buying and selling would be as easy as topping up credit on a mobile phone.

Because the national TEQ price would be determined by national demand, it would strive for transparently and thus encourage everyone to help each other to reduce energy demand and work together, establishing a sense of common purpose.

Similar to the Hungarian Climate Bill Proposal, TEQs also require some institutional change. First and foremost, the total number of TEQ units issued into the economy would be determined by the national carbon budget, which is currently recommended to the government by the Committee on Climate Change in the UK. A so-called registrar would issue a full year’s supply of TEQ units via both entitlement and tender on the first day of the scheme. From then on, the regular weekly issue of new units would commence. All sectors buy and sell TEQ units at a single national price, and because the supply of the units is fixed by the hard cap, the fluctuations in this price are solely determined by national demand for (carbon-rated) energy.

TEQs also establish an electronic system for the process of buying and selling TEQ units, which would be comparable to topping up a mobile phone or travel smart card. In this system, TEQ units travel in the opposite direction of money flow. Namely, TEQ pass from consumers to energy retailers at the point of energy purchase, and those same units would then pass from the retailers to wholesalers as the retailers purchase their own energy supplies. They would continue to flow up the energy supply chain until ultimately reaching the country’s primary energy providers and importers. Finally, these organizations would surrender the units back to the registrar in exchange for the right to produce or import energy into the economy, which is consistent with the national carbon budget.

TEQs would also require establishing new regulations, including import tariffs for protecting domestic producers. Until recently, such tariffs were deemed politically unrealistic, but the World Trade Organization has now admitted that their rules are not prohibitive of such tariffs.

In a region where this scheme is implemented, those who use more energy than their entitlement (usually rich people) could choose different options. When these people want to use less energy, they could either their change their lifestyles to consume less energy or invest in energy reduction. Marginalized people who use less energy would have the opportunity to sell their remaining entitlements to those who consume more and thus could potentially benefit directly from the scheme.

4. Evaluation of the Two Schemes

This section evaluates the two proposed schemes, the Hungarian Climate Bill Proposal and the Tradable Energy Quotas from the UK, based on what extent they contribute to the three aspects of ecological economics. The summary of this evaluation is illustrated in Table 1.

Table 1. How do the proposed energy use caps contribute to addressing the challenges in ecological economics?

Three challenges in ecological economics	**Contribution of the proposed energy use caps to addressing the challenge**
Sustainable scale	• Aims to reduce the size of the economy • Sets an absolute ceiling of energy resource use, which would be decreased every year
Fair distribution	• Modifies distribution patterns through distributing equal per capita units of energy use • Rewards marginalized people, under-consumers • Reduces household energy costs • Creates jobs • Enhances motivation, ensures freedom of choice
Effective allocation	• Encourages all stakeholders to use their allocated units as effectively as possible • Allows stakeholders to choose from different options (buying, investing, reducing) according to what is the most effective for them

Source: author

Of the three aspects of ecological economics, the evaluation of fair distribution is dominant because limiting energy use has hidden benefits to this aspect of ecological economics. Thus, I detail below the social consequences of limiting energy use.

4.1. Sustainable scale

The scheme’s adequacy is underscored because the slight decrease in energy consumption in developed states is due to a growing amount of imported embedded energy and to the wealthy people who can afford energy efficiency investments. However, this slight decrease is far from the needed extent, and it is also important to ensure that not only the wealthy people can afford energy efficiency investments. The transition towards a low-carbon society should result in significant reductions in energy consumption that also includes marginalized populations through proper support systems, as was highlighted in the two analysed proposals. Without adequate promoter schemes, climate crises could seriously affect the marginalized, or place a high financial burden on state budgets.

Both schemes consider the biophysical limits of the Earth. They aim to reduce energy resource use to stay within the thresholds of our globe. They contribute to obtaining sustainable scale through striving to reduce energy consumption and, thus, the size of the economy. The proposals would obtain their goal through setting an absolute ceiling for energy resource use, which would decrease each year. The continuous ceiling reduction would ensure that energy use gradually decreases until it obtains sustainable levels.

Due to the set ceilings, companies should also adapt. Companies that have developed high-level environmental management systems and strong sustainability policies and reports in theory (Csutora 2011) would have to implement them in practice.

4.2. Effective allocation

The set limit of energy use would encourage all stakeholders impacted by the system to use their allocated units as effectively as possible. However, the proposals allow stakeholders to decide how to use those units by allowing them to choose from different options (buying extra quotas, investing in energy reduction or changing energy use patterns) according to what the most effective is for them.

Furthermore, the schemes provide an alternative to the casual and popular 'rationing by price' approach that is currently in effect. While the energy cap tools incorporate a market mechanism to do what markets do best – finding a price for scarce goods and facilitating exchange – they would not be market-based frameworks. The recent financial crises clearly demonstrate that markets are not good at regulating their own appetites. Rather, they create a framework in which the market would be constrained, which is consistent with the set energy use ceiling. Through the Green Market, there could be an increase in the demand for circular, sustainable products and services, which would also contribute to positive economic performance.

4.3. Fair distribution

The social benefits that the resource use capping tools would deliver are often forgotten. The public, as well as scientific perceptions are dominated by the perspective that they primarily target the challenge of unsustainable resource use and thus aim to tackle environmental problems. A more thorough examination may suggest that they significantly contribute to human well-being, especially for the poor.

According to national surveys (Centre for Sustainable Energy 2008; Dresner – Ekins 2004) TEQs primarily reward marginalized people who use less energy. According to the Strategic Environmental Assessment (SEA) of the Hungarian Climate Bill proposal (Tombácz – Mozsgai 2009), the Hungarian proposal also benefits the poor. Over-consumers are wealthy in the UK but could choose whether they would start economizing, investing, or paying for the surplus quotas. Because savings can occur only to some extent without investments, the choice between investing and buying the surplus to satisfy their energy demands will narrow.

Among the social benefits, household expenses could be reduced if these types of schemes are implemented. Those who consume less energy than the equally distributed units under the energy cap would gain extra income from the systems by selling their received, unused units to those who consume more than their share. The systems would contain assistance (Fleming – Chamberlin 2011; White – Thumim 2009) for poor people who consume more energy due to cheap and inefficient appliances or a lack of control over home insulation. This would occur through providing either interest-free loans (in Hungary) or governmental support (in the UK). With these types of gained income, they could invest in energy reduction and thus lower their energy use and reduce their household costs.

According to the SEA of the Hungarian Climate Bill Proposal (Tombácz – Mozsgai 2009), this energy capping tool directly creates jobs in the construction, renewable energy and energy efficiency sectors. Specifically, in the construction sector, 40 000 new work places would be created. Due to the increased level of investment in these sectors, there would be additional demands for related products and human labour. Due to the newly created jobs, people would have an increased demand for vital goods, which would lead to further job creation. In addition, the stimulus from these sectors would have the potential to pose further increases in other related industrial and service provider sectors. Furthermore, new jobs would also be directly established in the Support System that would provide proper life-style-related recommendations for citizens who are affected by the schemes. Moreover, due to the spread of sustainable, labour-intensive practices and the income generation of the quota under-consumers, there would be increased access to environmentally friendly goods and services, which contributes to enhanced wellbeing. The increasing number of consumers on the Green Market would drive further job creation for satisfying the emerging demand for sustainable products. After each transaction that occurs in the market or the concerned energy sectors, tax would enrich the state budget. This tax would moderate the amount of loans provided from the central bank to the commercial banks to cover the initial expenditures of the revolving fund. Thus, the entire process results in added value for reusing currently unused productive capacities and idle human labour. Even though new jobs are created and people who could not afford consumption can now do so, the overall system would move towards sustainability due to the absolute consumption ceiling, which would be constantly decreasing.

Behavioural studies have consistently shown that intrinsic motivation drives us more than extrinsic motivation. This point can also be applied to environmental issues (Compton 2010) in terms of being more environmentally aware and consuming less in an environmentally friendly manner. As such, these schemes may contribute to the transformation of values and consumer behaviours by creating individual as well as common motivation with the set limit and the distributed units. This suggests that it is in everyone's best interest to assist each other and to cooperatively work to reduce energy demands and stay within the set caps on energy consumption. Sharing ownership of the problem across society encourages both active, engaged participation in creatively reducing energy demands and a sense of legitimacy around the tools' framework.

The energy resource use capping tools allow the energy consumer to have the freedom of choice, and as a citizen can decide how much to consume. This freedom would allow individuals, families and communities to both politically and practically decide for themselves what is essential and what is not.

5. Discussion on outcomes for fair distribution

5.1. Do poor people use less energy?

Unfortunately, in the UK (BBC news 2015) as well as in Hungary (Portfolio news 2014), there is an increasing number of people in hunger and below the poverty line. Therefore, both proposals would need to pay extra attention to those who are currently in poverty. These people already cannot afford environmentally friendly, energy-efficient solutions that are affordable for the wealthy, thus, they may easily and quickly consume their entitlements and thus require special attention. However, the Revolving Fund might have the potential to solve this problem by providing interest-free loans for these people.

In the UK, lower-income households (Centre for Sustainable Energy 2008; White – Thumim 2009) tend to use less energy and thus could sell surplus allowances to gain extra income. In Hungary, the picture is not that clear. There is no significant difference in the amount of energy used by the rich and the poor (Herpainé Márkus et al. 2009); in other words, energy does not correlate with level of income. Therefore, there are arguments as to whether the Hungarian proposal moderates the level of inequality. Furthermore, the Hungarian scheme aims for an increased level of access to energy resources, and, thus, enhanced living conditions through the Revolving Fund, which would be theoretically available to everyone regardless of their income. However, the level of inequality could stay the same because the information hub of the Support Service might not reach the most disadvantaged groups. In other words, absolute poverty might decrease, well-being could increase, and housing and energy poverty could be moderated, but relative poverty would remain due to the existing inequality. To address this contradiction, the Hungarian Climate Bill proposal would need to identify the potential shortcomings of the Support Service and consider the energy use patterns of the Hungarian population.

5.2. Different opportunities for rural and urban populations

There are also concerns as to whether the schemes would decrease household energy costs. Providing appropriate information and raising awareness have the potential to reduce energy use, but a study in Hungary (Hoffmeister-Tóth et al. 2011) on environmentally conscious behaviours found that this effect was limited and that reinforcement was needed to identify appropriate activity alternatives. Hungarian household's energy demands are primarily defined by the type, size and heating scheme of the house (Herpainé Márkus et al. 2009). Energy costs for households are almost the same throughout the country, independent of the numbers and incomes of people who reside in the house as well as the type of energy used. This is because urban households are usually smaller and have better conditions but are heated by the more expensive gas and often have district heating. In rural areas, households are larger and outdated and often have expensive electric boilers and insufficient insulation but with individual room heating methods with cheap wood. Given these facts, we could not assume that poor households consume significantly less energy than the wealthier households. Therefore, it is not clear whether the poor would have a surplus and would be able to sell their remaining entitlements to the rich due to the specific domestic household structure, the current insufficient energy efficiency of the households and the high rate of non-renewable energy use.

To moderate these challenges, there is a need for more focused and compensative mechanisms rather than an equal distribution of quotas. Even though the Revolving Fund could provide opportunities for marginalized people by providing interest-free loans and the Support Service could inform them that these funds are available and would provide professional advice on how to transform their energy consumptions, marginalized people might not be able to access the information and, thus, the opportunities. Therefore, the Revolving Fund and the Support Service should attend to those disadvantages households that consume more due to their outdated conditions and lack of information on investment choices. Additional research is needed to reveal these mechanisms and collect data on other energy consumptions, such as car use and other non-renewable energy resource use.

In the UK, the percentage of people who have low incomes is lower in rural areas than in urban areas; however, thousands of individuals living in rural areas are in households below the average income (Department for Environment, Food & Rural Affairs 2014). In Hungary, this is not the case. Because most poor and marginalized people in Hungary live in the countryside (Herpainé Márkus et al. 2009), access to information as well as rural energy poses a substantial issue to solve. Hungarian researchers are convinced that rural energy-related problems could be solved through energy efficiency improvements, which may be worth investing in (Rácz 2013). Furthermore, decentralized energy production and simple renewable energy technologies may provide an alternative solution (Renewable energies for eliminating poverty conference recommendations 2009). Decentralized energy systems would allow for the cheaper production of energy and the establishment of workplaces through solar energy and community-owned, low-performance biomass-related investments. The Revolving Fund would also contribute to solving rural energy-related problems by enhancing the livelihood of poor families through supporting the local, community-based use of renewable energy-related investments.

5.3. When freedom of choice can strike back

To determine the impact of the scheme on middle-class people, who can choose between investing in energy reduction or simply changing their way of living, there is a need for more research on their choices. Arguments would support choosing investing because it does not require any additional expenditure (in contrast to the entitlement purchase), it has added value and it avoids future quota shortage problems. On one hand, it would be very beneficial because it is assumed that implementing the scheme would result in a significant reduction of energy use. On the other hand, everyone would then choose to invest and not to purchase, which would result in a lack of utilization of the quotas saved by under-consumers. Solving this contradiction is a major challenge. A combination of setting the ceiling of investments cost might be needed following local practice in the UK (WarmFront 2010).

6. Conclusions

The two policy tools for energy capping that have been scrutinized in this paper would contribute to the first concern of ecological economics through an absolute limit on energy use. The sustainable scale would then be achieved through gradually decreasing the ceiling that is set for energy use. Under the limit, the level of allocation would become increasingly effective because every entity would be forced to reduce consumption. It is not clear how to ensure a fair distribution of resource use. We list the obvious social benefits, including favouring less consumption and job creation and supporting cooperation and the freedom of choice. Those who consume less or manage to change their consumption patterns so that they become energy unit savers financially benefit from the systems directly. Furthermore, due to the set energy caps, the schemes favour human labour-intensive practices and would thus create jobs in less energy-intensive sectors. As such, setting an absolute limit for energy consumption would enhance cooperation by forcing members of society to work together towards meeting the requirement appointed by the set limit. Moreover, both systems would allow consumers to choose whether they would continue to consume as before or change consumption habits either through changing behaviours or through energy reduction investments.

However, there is some concern about whether the schemes would result in fair distribution in practice. One challenge is how to address freedom of choice, which may lead to everyone being more environmentally and energy conscious, with no one using more energy than their share. This challenge needs additional research. Moreover, we need to distinguish between the social impacts of the Hungarian Climate Bill proposal and the UK TEQ scheme because energy consumption patterns in different income groups and access to information differ in these two countries. In Hungary, there is no significant difference in the amount of energy used between the poor and the wealthy, due to lower installation and more marginalized people residing in the countryside. Furthermore, these people might not fully be able to use the benefits of the Hungarian proposal due to a lack of information and their limited ability to access the information. The situation is different in the UK. Marginalized people use significantly less energy than wealthy people. Because the poor often live in urban areas, access to information might be easier, and they may be more easily informed about the benefits of the energy cap scheme. This challenge arises from the difference in energy use patterns and the way that information is distributed in the two countries, which is another area for further research.

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