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Assessing fairness of dynamic grid tariffs

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ABSTRACT

The increase in the supply of intermittent renewable energy and the higher electricity use lead to stronger variation in network usage, which either requires costly network extensions or the implementation of incentives to reduce peaks. This paper focuses on the latter, namely dynamic tariffs. However, a tension may exist between economic arguments for dynamic pricing and people perceiving such pricing as unfair. This paper seeks to assess the fairness of dynamic tariffs through a combination of theoretical and empirical research. Fairness is defined broader than inequality; it is understood more objectively than just people's perceptions and thus requires engagement with ethical theory; and the fairness analysis is not only based on abstract ethical reflection but also on analysing the underlying arguments for people's perceptions. Both the theoretical fairness assessment and the survey among Dutch households reveal that dynamic tariffs are less fair than transport and capacity tariffs and fairer than Ramsey pricing. The fairness of dynamic tariffs depends on implementation conditions such as: clear, non-economic arguments as justification, guarantying basic-needs fulfilment, decreasing perception that 'peak use is only for the rich', and increasing predictability.

1. Introduction

The surge of renewable energy sources combined with the increase in the demand for electricity creates new challenges for electricity networks. Because of the intermittent character of the supply of renewable energy, the grids have to deal with high variation in flows. The increased demand for electricity, for instance to charge electric cars, also enlarge the variation in the network usage. These increases in the peak usage of the network may result in higher risks for congestions. Managing such congestions will either require network extensions or the implementation of incentives that reduce peaks (see e.g. Gils (2014), Jeon et al. (2015)). In this paper we focus on the question how network tariffs can be used to give incentives to network users to adapt the timing (i.e. peak shifting) and level off their network use (i.e. peak shedding) to keep network utilisation within capacity constraints. Such incentives can be given through a system of dynamic pricing and in particular through tariffs that are significantly higher during periods of high network usage, which is called peak pricing.

While the potential of dynamic network tariffs has been discussed extensively in economic literature, here we examine to what extent such dynamic pricing is fair.[2] Fairness has always been an important consideration of electricity-network regulators. While there has been an increasing focus on incentive regulation fostering efficiency in the last decades, regulators almost always state that they see fairness as an important goal as well (Jones and Mann, 2001; Muir, 2001). Fairness is seen as important because electricity network tariffs determine a significant proportion of the electricity bill[3] while access to electricity is considered as a basic need. Fairness is also related to the feasibility of policy implementation. If people perceive certain policies to be unfair, they will consider them as unacceptable and possibly they will not support or even protest against them (Steg and Vlek, 2009, p. 314). Many experiments in behavioural economics and psychology have shown that fairness is an important motivational force (Bowles and Gintis, 2013, 2002). However, there appears to be a fundamental tension here. On the one hand, efficient network tariffs such as based on peak pricing are seen as important, while on the other hand empirical research has shown that many people perceive peak pricing as unfair and unacceptable. This tension is the starting point of our inquiry. In this paper, we analyse the exact content of this tension and how we can go beyond this tension to say something about the fairness of dynamic tariffs.

In Section 2, the methodology for constructing a fairness assess-

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[2] The notions of fairness, justice and equity are used interchangeably here.
[3] Network charges as a proportion of the average annual electricity bill: 43% ($720) in Australia (Wood and Carter, 2014, p. 13); 40,5% (405€) in Belgium (http://www.vreg.be/nl/energieprijs); and 17% in the Netherlands (but partly compensated by higher taxes) (https://www.onlineenergievergelijker.nl/verwachting-energieprijzen).

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ment is explained. Section 3 discusses the literature on the tension between efficiency arguments and fairness perceptions with regard to dynamic pricing. Section 4 introduces the ethical approach in order to construct a framework for fairness assessment. In Section 5, different approaches are integrated into one framework which allow for making a fairness assessment of different tariff schemes. In order to test the validity of the framework, we will contrast this assessment with the empirical results from a survey which we conducted among a sample of Dutch households. The final section formulates the conclusion as well as some implications for policy.

2. Methodology

In order to grasp the tension between efficiency and fairness, we will discuss the efficiency arguments for dynamic and other tariff schemes (§3.1). Subsequently, we need to contrast this with the existing behavioural research on fairness perceptions concerning dynamic pricing in general (§3.2). However, discussing these two, just places efficiency and fairness against each other. It does not tell us what fairness is, neither how to transcend the tension between fairness and efficiency.

Much of the literature dealing with 'energy justice' discusses either general issues about energy and justice (Heffron et al., 2015; Jones et al., 2015; Miller et al., 2013) or discusses the decision-making process of new power infrastructure (Knudsen et al., 2015; Ottinger et al., 2014; Visschers and Siegrist, 2012). If research is focused on network tariffs (Muir, 2001; Wood and Carter, 2014), it often uses a narrow notion of fairness, focussing on perceptions, impact on inequality and poverty or energy needs. However, if consumers, companies and policy-makers talk about fairness, this often refers to a much broader spectrum of fairness meanings. Focusing on one element, such as impact on poverty, could therefore be set aside by some groups as being just a particular view.

Our framework aims to transcend the tension between efficiency and fairness, and to employ a broad notion of fairness. The methodology consists of a number of steps (see Fig. 1) and is designed to deal with two challenges of applied ethics, which roughly correspond with the problems with internalist and externalist accounts (Beauchamp, 2005). First, ethical norms can be revealed by looking at a practice itself (such as sport, medicine, science) and analysing its own norms,

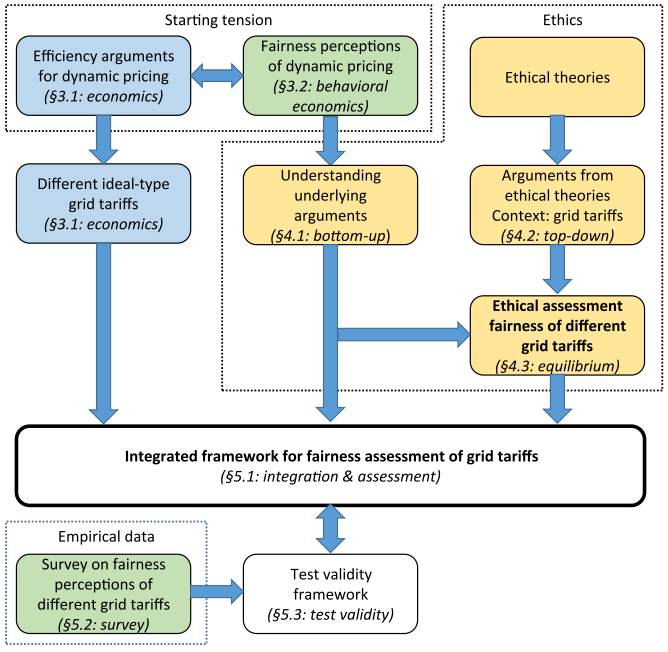

Fig. 1. Overview of methodological steps.

habits, perceptions, opinions, etc. (internalism). However, while these practices may store relevant information concerning fairness, they might be biased. Fairness perceptions are often understood as quick, intuitive and unconscious reactions, possibly biased by the particular context (van den Bos et al., 2001). Moreover, even when conscious and reflective, norms and opinions can be wrong. The moral rightness of an action is largely independent of whether someone thinks it is right or wrong. Acts such as killing or slavery are not wrong 'because' people think they are wrong. What matters are reasons: *why* is a particular situation right or fair? It are these arguments that are discussed in ethics and theories of justice: such theories represent the outcome of long-standing debates about which arguments are considered to be the strongest. Therefore, ethics requires a kind of *top-down approach*: look for general ethical principles that are applicable to the particular case. We will deduce a list of general evaluative principles that are applicable to our problem of common costs and network tariffs (§4.2: top-down).

The second challenge is, however, somewhat the opposite of the first. If the source of ethical reflection is not the practice itself, it is something external to that practice, namely ethical theory (externalism). The problem with ethical theories or theories of justice is, however, that they are too abstract to be applicable to all particular issues, such as network tariffs. Most theories of justice, such as Rawls' (1971) and Dworkin's (2000), deal with 'distributive justice in the large', namely how the general institutions (e.g. constitution and labour system) of a society should distribute crucial goods (e.g. wealth and rights) and they do not engage with 'justice in the small', with 'concrete, everyday distributive problems such as (…) who should get into medical school, or how much to charge for a subway ride' (Young, 1995, p. 6). Such 'local justice' problems (Elster, 1991a) are characterised by a plurality of principles that differs across spheres (e.g. medical versus educational) and countries. General theories of distributive justice in the large are therefore not usable for very specific problems, because for these cases the content of fairness depends on the particular context: what is fair on a sport field is not necessarily fair in a hospital or at a job place. Hence, we need to understand the good, its meaning and its context before we can know which principles are (Walzer, 1983, p. 9). So we are also in need of a *bottom-up approach*. Therefore, we look again at fairness perceptions about dynamic pricing and try to understand what the underlying principles for people are (§4.1: bottom-up). Such contextual, bottom-up approach is in our view mostly absent in the literature on 'energy justice' (Heffron et al., 2015; Jones et al., 2015; Miller et al., 2013). While sensitive for the energy context in general, it does not provide a way to think about particular issues such as grid tariffs.

In order to have a stable assessment framework for fairness, this top-down and bottom-up approach should be brought together. In ethics, one speaks of a reflective *equilibrium* (or coherentism) (Daniels, 1979; Rawls, 1999, pp. 40–45): through a series of readjustments one reaches a kind of equilibrium. Here, of course, our aim is rather limited, but follows nonetheless a similar idea, namely bringing the bottom-up and top-down in line with each other to establish a framework for ethical assessment of grid tariffs, namely a series of evaluative principles for ideal-type grid-tariffs (§4.3: equilibrium). Subsequently, we will *integrate* these ethical criteria with economic and behavioural criteria, encountered earlier in §§3.1–3.2, into one integrated assessment framework. Based on this framework, we will *assess* the fairness of dynamic grid tariffs, compared to other ideal-type grid tariffs (§5.1: integration & assessment).

While these steps may reflect good ethical practice, it is not evident that a framework starting from general observations and reflections about pricing, common cost and fairness, is actually applicable to the case of grid tariffs. This is a general challenge for ethical assessments. Beauchamp (2005, pp. 12–14) calls this the 'problem of specification': how to make abstract ethical principles applicable to particular situations. The previous method proposes exactly an attempt to such