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Assessing fairness of dynamic grid tariffs

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Abstract

The surge in the supply of intermittent renewable energy creates new challenges for electricity networks. The high variation in the supply either requires costly network extensions or the implementation of incentives that reduce peaks. One variant of the latter are dynamic tariffs. While dynamic pricing provides an efficient tariff scheme, people may perceive it as unfair. This paper examines to which extent such peak pricing is actually unfair and, if so, how this unfairness can be lessened by adapting the tariff design. We discuss the efficiency arguments for dynamic pricing and subsequently the acceptability and perceived fairness. In addition, we contrast these perceptions with fairness criteria derived from ethical theories. We conclude that dynamic pricing does not necessarily need to be unfair. In particular, the fairness depends to a significant extent on the concrete tariff implementation. The perceived fairness of dynamic pricing can be strengthened by using the revenues for measures related to the grid, providing clear common-language arguments, mediating adverse consequences for the least well-off, and minimizing unpredictability.

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1. Introduction

The surge of renewable energy 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 and thus possible congestions. Managing such congestions will either require network extensions or the implementation of incentives that reduce peaks. As the former option is more costly, we focus on the question how network tariffs can be used to give incentives to users to adapt the timing (i.e. peak shifting) and level of their network use (i.e. peak shedding) to the degree of overall network utilisation. The solution proposed is to implement a system of dynamic pricing and in particular tariffs that are significantly higher during periods of high network usage, namely peak pricing.

While the potential of dynamic network tariffs have been discussed extensively in economic literature, here we examine to which 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 (Jones and Mann, 2001; Muir, 2001). Fairness is seen as important because electricity network tariffs determine a significant proportion of the electricity bill[3] and access to electricity is considered as a basic need. Fairness is also related to the feasibility of 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 empirical research has shown that many people perceive peak pricing as unfair and unacceptable. This tension is the subject of our inquiry. In this paper, we analyse the exact content of this tension and how to deal with this tension in practice.

In Section 2, we introduce our method for examining the tension between efficiency and fairness of peak pricing. In Section 3, we discuss efficiency, acceptability (perceived fairness) and

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[2] The notions of fairness, justice and equity will be used interchangeably.

[3] In Australia network charges are responsible for about 43% ($720) of the average annual electricity bill (Wood and Carter, 2014, p. 13); in Belgium for about 40,5% (405€) (http://www.vreg.be/nl/energieprijs); in the Netherlands for about 17% (but partly compensated by higher taxes) (https://www.onlineenergievergelijker.nl/verwachting-energieprijzen).

fairness from an ethical perspective. Section 4 compares peak pricing with other ideal-type tariff structures. The final two sections discuss the results of this integration as well as the implications for policy.

2. Methodology

In order to grasp the tension at stake, we will discuss the efficiency arguments for and fairness perceptions of peak pricing. This is, however, not enough to understand fairness comprehensively and therefore they need to be contrasted with insights from ethics and theories of justice. Many psychologists and behavioural economists understand fairness perceptions as quick and intuitive reactions to a situation relevant for fairness, namely as cognitive shortcuts or as reflecting partly unconscious fairness heuristic (van den Bos et al., 2001). Such judgements can thus biased by available information. Therefore, we are in need of an unbiased reflection, which is what ethics aims at. Moreover, even if it concerns conscious and reflective judgments, 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. The fact that many people think a situation is fair is a good indicator of fairness but not enough to determine whether it actually is fair. What matters are the reasons: *why* is a particular situation 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.

A simplistic view of ‘applied ethics’ is that ethics provides the relevant, universal principles and these need to be applied to the case at stake, such as network tariffs. Most theories of justice, such as Rawls' (1971) and Dworkin's (2000), however, deal with 'distributive justice in the large', namely how the general institutions of a society (constitution, labour, inheritance, etc.) should distribute crucial goods (such as wealth, rights, jobs, education, property and health care). These theories do not engage with 'justice in the small', with 'concrete, everyday distributive problems such as how to adjudicate a property dispute, 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 across and within countries. The problem is not that local or small justice problems have not been examined yet, by applying general justice models, but rather that fairness is to a large extent a contextual notion, which requires understanding the context first in order to know what fairness can mean. ‘If we understand what it is, what it means to those for whom it is a good, we understand how, by whom, and for what reasons it ought to be distributed’ (Walzer, 1983, p. 9). This also holds for the literature on 'energy justice' (Heffron et al., 2015; Jones et al., 2015; Miller et al., 2013). While taking into account the specific features of energy provision, this literature does not provide specific fairness criteria for particular energy questions.

Therefore, our methodology consists of three moves: bottom-up, top-down and integration. The bottom-up starts from the case itself, namely the empirical results from behavioural economic studies. We need to understand *when* people think pricing is unfair and to provide a plausible interpretation of *why* they think this. Based on this, we are able to suggest plausible ways *how* to mediate unfairness perceptions. The top-down approach looks at theories of justice in order to deduce some general fairness criteria. These general fairness criteria will be combined with efficiency and acceptability criteria in order to make an integrated fairness assessment of peak pricing.

3. Three perspectives: economics, behavioural economics and ethics

3.1 Economic perspective: efficiency

3.1.1 Dynamic tariffs

One needs to distinguish two different problems with regard to the electricity network. First, total production and total consumption have to be in balance at any moment for the whole network. This balancing problem is dealt with at the level of the transmission grid. The second problem refers to the capacity of the grid to deal with the supply and usage of electricity in a particular part of the network. If there is a lack of capacity, the network is called to be congested. For such congestion problems there are broadly two solutions: local network extension or incentives to decrease use (either consumption or production). The latter incentives can be given through time-based (dynamic) network tariffs.

Dynamic pricing is not a new idea and is probably more well-known in the case of road-pricing. Nowadays most economists agree that highway congestion can be solved by pricing; notwithstanding that there is considerable disagreement about the concrete implementation (Lindsey, 2006, p. 296). In dynamic pricing, prices are allowed to react to fluctuations in demand and supply. William Vickrey (1971) argued to apply such responsive pricing to public utilities such as telephone, water, roads and electricity. While still uncommon in Vickrey's days, this is increasingly becoming a normal practice, such as for instance for airlines, cruise ships and hotels (Elmaghrab and Keskinocak, 2003). The cost of networks, such as highways, railroads and electricity grids, is primarily determined by its peak capacity. This peak capacity is only required on the peak moments and thus the peak demand determines the need for future network expansion. If one is able to decrease these peaks, less investments in network extension are needed and, as a result, the network costs could be substantially reduced. For instance, between 2009 and 2013 $17,6 billion was invested in the expansion of the Australian power network, but estimates say that $7,8 billion of this $17,6 billion investment could have been avoided by reducing the peaks through peak pricing (Wood and Carter, 2014, pp. 25–26). In the electricity wholesale market, such system already exists for many years, which is called peak-load pricing: users in off-peak period pay no more than the variable costs, while users in peak periods pay a price far above that level. The peak price is determined by the scarcity of capacity (supply) and the sensitivity of demand to prices. Peak-pricing moves the burden of the cost to those who use the network on the moment of maximum capacity. It also creates an incentive to decrease peak use and thus decreases the need for future investments in network expansion. Finally a peak-pricing system gives incentives for the optimal level of investments in network extension. While such a system already exists for the wholesale electricity market, the discussion is now whether such a system can be used for users of distribution grids.

3.1.2 Designing tariff schemes for electricity grids

The electricity network is a natural monopoly because it is characterised by economies of scale, namely high (initial) fixed cost and consequently declining average costs (Duffy, 2004, p. 40). If the monopolist would be allowed to set its price, this price would be higher than the competitive price, which causes a deadweight loss. One important strategy for dealing with this deadweight loss is tariff regulation. Here we briefly discuss some main design options for network tariffs, which will be used later for making an evaluative comparison.

A first straightforward option is charging a flat tariff to everyone. There is, however, a pricing dilemma for the regulator: if the price is equal to average costs then there remains a deadweight loss, but if price equals marginal cost, then there is a financial loss for the monopolist. Hotelling proposed in 1938 to set prices equal to marginal costs while the fixed costs should be funded by the government through subsidies: *costs partly socialised through taxes* (Hotelling, 1938, p. 242). Coase (1946), however, argues that there are at least two important problems with this strategy. First, it leads to a misallocation of resources. Second, if the fixed cost is paid by the taxpayers then there is an unjustified redistribution from those who do not consume the good to those who actually consume the good. Coase (1946) proposed two-part pricing in which one part of the price covers the fixed costs and a second part the variable, marginal costs. He assumes, however, that we could know which consumers are responsible for which costs – as in the case of transport: some people travel further distances than others. This is however more complex for the electricity network: it is not that clear which consumer causes which cost. This is the problem of common costs, namely costs that are common to a group of consumers. If we would charge everyone equally for the common costs, we arrive again at the same problems as with Hotelling's solution: misallocating resources and unjustified redistribution. The alternative for a single common cost price is price discrimination between groups or products, such as the difference between business and economy class in airplanes.

Another solution to the above pricing dilemma was proposed by Frank Ramsey in 1927 and consequently called *Ramsey pricing* (Train, 1991, pp. 115–145). Ramsey pricing uses an inverse elasticity rule: the price should be inversely related to their respective elasticity of consumers. Business travellers for instance can be charged a higher transport price because they are less sensitive for price changes. The second option for price discrimination is the tariff system we are examining here, namely time-based *peak pricing*, where peak-users are charged a higher rate. Hence, this is price discrimination over time. The most common tariff options are however not based on consumer preferences, but are meant to reflect the costs induced by the network user. First, there can be a transport charge, based on the amount of energy consumed (€/kWh). Second, there can be a capacity (or demand) charge, namely based on the maximum capacity of one's connection (€/kWmax). This could also be based on the actual peak use over a year, namely the capacity actually used, which is seen as good performing with regard to cost reflectivity (Brown et al., 2015; Wood and Carter, 2014).

In order to assess the fairness of tariff designs, we compare the dynamic (peak) tariff design to the above mentioned types: a) a flat rate, which may be partly socialised through taxes, b) transport and capacity charges, and c) Ramsey pricing.

3.2 Behavioral-economic perspective: community standards of fairness

3.2.1 Fairness attitudes towards (peak) pricing

Peak pricing seems to be a straightforward way to deal with possible congestion problems in electricity grids. However, the fact that it is an optimal strategy according to economic theory, does not necessarily imply people think of it as desirable or fair. Studies in behavioural economics have shown that different types of prices are evaluated differently with regard to fairness ('community standards of fairness') (Frey and Pommerehne, 1993; Kahneman et al., 1986; Xia et al., 2004)..

If a good becomes scarce and it is thus not available for everyone, for instance because of exceptional weather conditions, people in general conceive pricing as an unfair way to deal with such excess demand.[4] This might be in line with observed protests against pricing based on excess demand (Frey and Pommerehne, 1993, p. 299), for instance recent protests against Uber's higher prices for peak use (Surowiecki, 2014) and Amazon's higher prices for less price-sensitive consumers (Krugman, 2000). Such negative reactions are even stronger when it concerns a public provider rather than a private one (Frey and Pommerehne, 1993, p. 299). Moreover, if pricing is compared with other allocation mechanisms (e.g. lottery, queuing, administrative decision), people rank pricing in general among the least fair methods. For instance, Frey and Pommerehne (1993, pp. 299–302) found that 'first come, first served' (queuing) was judged most fair,[5] a procedure with public officials as secondly fair, and pricing and random allocation as least fair.

Behavioural economists offer the following explanation. People evaluate changes as gains or losses relative to a reference point, which is a price (or something) accepted as normal. This makes that fairness judgements primarily concern relative changes rather than absolute levels and, therefore, it is no surprise that people are particularly sensitive for losses (Kahneman et al., 1986, p. 739). This reference point determines the perceived legitimate claims of both sellers and buyers: firms are entitled to their reference profit and buyers have an entitlement to a particular price (principle of dual entitlement). Consequently, a firm cannot arbitrarily raise the price in order to increase profits; this is seen as unfair, because it violates the reference entitlements of the consumer. On the other hand, if reference profits of the firm are threatened, a price raise is seen as fair or acceptable, because the reference entitlement of the firm is threatened (Kahneman et al., 1986, p. 730).

From this starting point some reasons for a price change are seen as (un)acceptable or (un)fair. (i) A price increase is acceptable if the underlying costs for that product have increased. At the same time, people deem it acceptable that the price stays the same if costs decrease. Both refer to the entitlements of the seller: changing costs should not decrease the firm's reference profits. (ii) Using excess demand (e.g. scarcity because of weather conditions,) or an increase in monopoly power (e.g. single seller in a particular community) for raising prices is perceived as strongly unfair, contrary to increases based on increased costs. Rather than deserving a higher price (better product, higher costs), such reasons are perceived as just exploiting one's market power. (iii) Price discrimination based on

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[4] For instance, people were asked the following question: 'A hardware store has been selling snow shovels for $15. The morning after a large snow storm, the store raises the price to $20? Please rate this action as: completely fair/acceptable/unfair/very unfair' (Frey and Pommerehne, 1993; Kahneman et al., 1986, p. 729). Around 80% of the respondents considers the price increase as at least unfair and even 69% judged the situation as "very unfair" – a result confirmed in studies in different countries.

[5] This is partly confirmed by the resistance against road pricing, the current system is a kind of first-comes first-served and while disadvantageous might still be preferred to road pricing (Oberholzer-Gee and Weck-Hannemann, 2002, p. 361).

willingness to pay is also valued very negatively. For instance, a landlord who raises the rent because he learns that the tenant has taken a job close to the house and thus is less willing to move (decrease in price elasticity) is valued as very unfair (Kahneman et al., 1986, p. 735). (iv) Raising prices in a unique and unpredictable situation is seen as strongly unfair – people attach a lot of value to predictability and stability of prices (and this also applies to regulated tariffs (Biggar, 2010, p. 16)). Possibly because of this, consumers have so far been little interested in buying electricity at wholesale spot prices (Littlechild, 2000). Conversely, if something occurs often and is predictable, the acceptability of a price raise in response to excess demand increases, because consumers can adapt their behaviour in advance (Frey and Pommerehne, 1993, p. 303; Konow, 2003, p. 1220).

Recent research has provided more insights in attitudes towards peak pricing. Raux *et al*. (2009) examined people's reactions to situations of excess demand (both exceptional and recurring), such as allocating seats on a high speed train and parking places in a private company car park. Other mechanisms than peak pricing, such as a moral rule (priority to people with reduced mobility), queuing, and compensation were perceived as fairer than peak pricing. Only random mechanisms, such as a lottery and random allocation ('unknown administrative rule') were perceived as less fair than pricing. The study of Raux *et al*. provide additional insights with regard to fairness and peak pricing. (i) First, conform with the results discussed earlier, peak pricing is seen as (a bit) more acceptable if it applies to recurring situations, rather than to an exceptional situation. (ii) Second, it seems crucial what happens with the revenues of peak pricing. If the revenues are used to provide (at the same time) additional supply, this increases acceptability – for instance, if the revenues are used for extra trains, parking spaces or driving lanes (Raux et al., 2009). Along the same lines, increased investments in roads are the most popular variant for road pricing schemes; more popular than a general tax reductions (Verhoef et al., 1997, pp. 270–271). An important criterion seems that revenues should stay within the same dimension: revenues should be allocated to the problem the pricing scheme is supposed to solve. If pricing is aimed at solving congestion, use revenues for increasing road capacity; if aimed at environmental quality, use revenues for environmental measures (Oberholzer-Gee and Weck-Hannemann, 2002, p. 263). On the other hand, if one has more trust in the agency controlling the revenues this also increases fairness perception. Table 1 summarises the empirical results.

Table 1. Summary fairness perceptions towards (peak) pricing

When: unfairness perception if price rise/discrimination is:

- not based on a change in underlying costs;
- based on excess demand, price elasticity or willingness-to-pay (market exploitation); or
- if it is unpredictable.

How to mediate: unfairness perception of peak pricing can be lessened if:

- it concerns reoccurring, predictable situations ;
- revenues are used to address problems at stake by e.g. additional supply ; or
- there is more trust in the pricing agency.

3.2.2 Understanding fairness attitudes

Knowing *when* people perceive pricing as unfair and *how* to mediate such unfairness perception, however, does not provide an explanation of *why* people think so. Such an explanation is for two reasons important. First, an explanation allows predicting the when and the how. Second, the arguments provide the connection with ethics: arguments about fairness is what ethics deals with. Here, the empirical results potentially reveal which ethical ideas people do think are relevant in this context. Philosophers arguing for a contextual approach of justice often mention four central distributive principles, namely equality, need, desert (contribution) and efficiency (free exchange, welfare) (Elster, 1991a, p. 279; Miller, 1999, p. 18; Walzer, 1983, pp. 21–26). While efficiency and equality play a central role in economic and political theory, need and desert seem to play a rather important role in popular thinking about justice and fairness. Both the idea of needs (O'Neill et al., 2008, pp. 192–195; Wiggins, 1987) and desert are complex concepts but here we use two rather simple definitions. Needs can be defined as 'those conditions that allowed people to lead a minimally decent life in their society' (Miller, 1999, p. 210). Desert refers to the link between undertaking a valuable activity and a received benefit – for instance, 'because of outstanding academic research she deserves the Nobel prize' (Miller, 1999, pp. 131–155).

Fairness attitudes can relate to desert. For example, a seller raises the price for drinks on a hot day (*excess demand*). He has however not put any extra effort in In other words, the seller is not seen as 'deserving' this extra income. Another example, a seller raises prices because he learnt his consumers will not go elsewhere because of increased transport costs (changed *price elasticity*). Also here the seller earns extra money without extra effort, which can be perceived as 'undeserved' and thus unfair. Something similar applies to the element of *willingness to pay* at the consumer-side. For instance, because of a snow storm, half of the speed trains had to be cancelled (Raux et al., 2009) and one option is to allocate scarce seats by pricing, but this was perceived as unfair. The underlying question people ask themselves is probably why someone with more money should get access while other do not (willingness-to-pay). More income is not seen as a good basis to deserve this exceptionally scarce good. Therefore, a plausible explanation of the perceived unfairness of pricing is that people think earning money by just using market features (excess demand, price elasticity, willingness-to-pay) is undeserving and thus unfair. The cost-based argument relates to this: if a seller is confronted with higher costs, a price rise is acceptable – he does not 'deserve' a loss because of increased cost and, conversely, if costs do not increase, he does not 'deserve' a higher price.

Second, fairness attitudes can relate to 'needs'. Needs do not only refer to 'basic goods', but also to a broader category of dependency; 'I need this' often means that there are little alternatives. This is for instance clear in the difference between reoccurring and exceptional situations. If the train cancellation is exceptional, one might have little alternatives. An allocation mechanism based on willingness-to-pay, and thus partly on ability-to-pay, may infuriate people. Since everyone needs to get at his destination, people do not see why someone with more money should get easier access to, for instance, trains. Richer people are not seen as deserving it or as having special needs, contrary to, for instance, pregnant women or elderly. It is therefore no surprise that people tend to prefer other allocation methods above pricing in such situations, such as lotteries, queuing and moral rules (e.g. priority for pregnant women, elderly and disabled people). Also all the forms of so-called market exploitation discussed above relate to needs: excess demand might be an indicator for needs (e.g. drinks on an exceptional hot day), low price elasticity could indicate needs (e.g. needing electricity for basic lightning), and low willingness-to-pay might relate to low ability to pay (e.g. someone poor and ill who needs medication). Implementing peak price implies that peak use will become less accessible to some users, also some could be more in need of it, which will appear unfair to many people. This is probably harder to remedy, but it could for instance require a way of compensating those who lose (Lindsey, 2006; Oberholzer-Gee and Weck-Hannemann, 2002). Also the desire for predictability refers to need and dependency. If something is unpredictable, one is unable to look for alternatives. Indignation about pricing probably increases if it concerns exceptional situations or real (basic) needs, such as drinking water or basic energy provision.

Given these unfairness perceptions, the arguments given by the provider for pricing are crucial. Economic arguments for peak pricing or reducing use do not seem to convince people. An important part of the argument concerns not only the reason but also the use of the revenues. In particular, peak pricing for road, rail or parking becomes more acceptable if the revenues are used for creating extra supply. Here, acceptance increases because pricing is not just perceived as exploitation (extra profit), but as a way to address a significant problem. The trustworthiness of such an argument relates also to the trust people have in the agent himself (Raux et al., 2009, p. 235).

Table 2. Overview fairness attitudes and peak pricing: reasons, interpretations and mediation

Reason *Peak pricing is perceived as unfair if it is …*	**Interpretation** *The explanation that people see peak pricing as unfair is that …*	**Mediation** *Possible ways of moderating unfairness perception:*
not cost-based	if one is not confronted with higher costs, the producer does not ***deserve*** a higher price	▪ relate price to costs ▪ clarify relation with costs
market exploitation (using market features just to increase profit)	excess demand, people's price elasticity and higher ability to pay (part of WTP) are not seen as a good reason for ***deserving*** more profit excess demand, low price elasticity and low ability to pay (part of WTP) might be indicators of **needs** (dependency)	▪ use revenues to address problems at stake (e.g. additional supply) ▪ increase trust in agency (e.g. by consultation and participation) ▪ consider compensatory measures ▪ guarantee minimal provision
unpredictable	unpredictable events allow for little alternatives (dependency)	▪ apply to reoccurring situation rather than to exceptional ones ▪ provide more information about when and how

3.3 Ethical perspective: Normative criteria for distributing common costs

The previous section provides an interpretation of fairness attitudes, but we also need to look at a more 'objective' account of fairness. What matters is not only people's opinions, but rather which are the best arguments about what constitutes fairness. These arguments are the subject of ethics and theories of justices, such as those of Rawls (Rawls, 1971), Miller (1999), Dworkin (2000) and Nozick (1974). Here, given our interest in practical issues, we just need the rather *general* principles.

Besides general and well-supported, the list of principles should, secondly, also be *encompassing,* meaning that they should encompass all the relevant dimensions. Fairness can relate to almost all dimensions of life, ranging from lying to distributing environmental bads. The question at stake here is how to distribute a common cost. What could be the ideal-type options for a fair distribution of a common cost? Imagine the following example where a common cost has to be split: a common path in the neighbourhood leads to some common allotment gardens: how should the costs for the laying of the path be divided? To divide the common costs, one can distinguish five alternative ideal-type options: a) *equal allocation*, b) allocation based on *costs*, c) allocation based on *ability to pay*, d) allocation based on *benefits* derived from the good and e) allocation according to the *desire* to have the good. Whether a particular option is more fair will depend to a large extent on the particular good that has to be allocated.

These five options express also to a certain extent the different dimension of the fairness problem at stake. Equality can refer to strict (outcome) equality – such as a flat tariff – but it can also be interpreted more minimally, namely as referring to *formal equal treatment* (Elster, 1991b), namely people from the same class or group should be treated equally, conform Aristotle's principle (Gosepath, 2011) 'equals should be treated equally and unequals unequally, in proportion to their relevant similarities and differences' (Isaac et al., 1991, p. 333).

The design option 'ability to pay' can refer to two related but different ideas in theories of justice, namely basic needs and distributive justice, in common language often referred to as poverty and inequality. Without *basic needs being met* people are not able to participate to society and without the possibility of participation people cannot contribute to society (Shue, 1980). Access to electricity and a basic level of electricity provision seem to fall under the label of basic needs in our societies; both are a precondition for participation. With regard to electricity, this is often discussed under the label 'energy poverty':[6] energy should be affordable. Fulfilling basic needs is different from realising a just distribution. A common strategy in normative theorizing about distributive justice is to imagine an

[6] There are different definitions of energy poverty: fuel poverty ratio (more than 10 % income on heating) (Hills, 2011, p. 29); 'low income-high cost' ratio (Hills, 2012, 2011); subjective measures; or having arrears on utility bills (Bouzarovski, 2014, pp. 282–283).

equal starting point[7] and subsequently examine the acceptable reasons to depart from equality – such as efficiency, liberty, need and desert (Dworkin, 2000; Nozick, 1974; Rawls, 1999). Rather than looking for a principle for an optimal or perfectly just distribution, here we just need a minimal, non-ideal distributive justice criterion. We can assume that (a) actual levels of inequality are probably unjustified[8] and (b) the level of electricity consumption is not related to 'deserving' more income.[9] A minimal and relevant distributive justice criterion can be the following: the provision of electricity as such should *not increase of inequality*.[10] If not realised by the tariff itself, then the criterion serves to see whether additional, compensatory social-policy measures are required.

The idea of costs is related to a central distinction with regard to justice, already made by Aristotle, namely between distributive and corrective justice: distributive justice deals with a just distribution of goods and bads, while corrective (or restorative or retributive) justice deals with a violation of an accepted entitlement. In a very general way, retributive justice requires that harm should be prevented, or, if caused, that costs should be compensated. For electricity this can mean two things. First, Society should not bear the costs of non-basic preference satisfaction and therefore the consumer should pay for the costs made for making the electricity provision possible. In tariff setting this is the so-called *cost causation principle*. Second, electricity provision can also create costs which are not priced by the market, namely negative externalities, such as carbon emissions.[11] A justice principle would require the prevention of such externalities or the *full internalisation of externalities*. While important, we will leave this principle aside here because carbon emissions are primarily a consequence of production and not of the network.

The benefit-based option relates to so-called cross-subsidies: while all groups pay the same, some groups derive more benefits from it (e.g. football stadium paid by tax budget). This goes against a kind of impartiality: why should one group get more benefits? The assumption is often that different cross-subsidies level out if taken together, but for large investments, such as an electricity network, it might be relevant to look at the particular cross-subsidies. Based on Wicksell's view on taxation,

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[7] For instance Rawls' veil of ignorance (Rawls, 1971), Dworkin's shipwreck survivors island (Dworkin, 1981) and Nozick's Wilt Chamberlain example (Nozick, 1974).

[8] For instance, in 2014 for the Netherlands: the richest decile had 61% of the total wealth, while the first six deciles (0-60%) had 1% of the total wealth (negative wealth included); and the ratio between the first and tenth decile with regard to the standardised gross income exceeded a factor of 160 (Kremer et al., 2014, pp. 48, 83).

[9] Of course, it is possible that what one does *with* the electricity gives desert-based reasons for inequality, but this relates to the activity made possible by energy provision rather than its provision itself and its price or tariff.

[10] Several indicators of equality are possible: Gini coefficient, relative or nominal differences, etc.

[11] Other negative externalities are more local, such as landscape changes and electromagnetic fields. The externality of network congestion is not mentioned here because the topic here is exactly the internalisation of the congestion costs.

David Miller argues in the case of public goods for a principle of *equalising net benefits* as far as possible (Miller, 2004, p. 143) – the net benefits are the individual benefits (e.g. WTP) minus the individual costs (e.g. tax). For the example of the football stadium this would imply that football spectators pay a higher contribution (tax) than non-football spectators. This relates to a common view in network regulation: 'Tariffs should be designed to recover class revenues in proportion to the cost-of-service of each class' (Brown and Faruqui, 2014, p. 4).

The idea of desire-based is more complex here. With regard to electricity consumption it seems hard to distinguish desires from benefits and thus the normative principle underlying is probably the same, namely the cost-causation principle.

While all these principles refer to the justice literature, they are also present in economics. The economic theory of taxation distinguishes two main principles to distribute the tax burden. The first is the ability to pay or *(equal) sacrifice principle*, associated with authors such as John S. Mill, Arthur C. Pigou and Francis E. Edgeworth. The principle states that individuals should contribute according to their capacity to bear it.[12] The idea of not increasing current inequalities is related to the idea of ability to pay. If contributions are made according to ability to pay, current inequalities should ideally not increase. The second one is the *benefit principle*, associated with Knut Wicksell and Erik Lindahl, namely that taxes should be proportional to the benefits individuals derive from public goods (Musgrave, 2008; Neumark and McLure, 2016; O'Neill, 2000). The benefit principle is obviously related to the idea of equalising net benefits. These evaluative criteria can now be used to look at peak pricing and to contrast peak pricing with the other tariff schemes discussed in Section 3.1 (see Table 3).

[12] Further distinctions are made between equal absolute, equal proportional and equal marginal sacrifice.

Table 3. Ethical assessment of network tariffs

		Tariff design options			
Ideal type	**Distributive principle**	**Flat rate (possibly partly socialised)**	**Transport & capacity charge**	**Ramsey pricing**	**Peak pricing**
1. Equality	*Formal equal treatment*	+	+	− (price elasticity is morally arbitrary criterion)	+
2. Ability to pay	*(a) Meeting basic needs*	− / + (+ if socialised through progressive taxes)	− / + (requires study on relation use levels and income levels)	− (low-use probably low elasticity and thus high prices)	− (peak use probably less accessible to less well-off)
	(b) No increase of inequality	− / + (+ if socialised through progressive taxes)	− / + (requires study on relation use levels and income levels)	− (low-use probably low elasticity and thus high prices)	− / + (requires study on relation peak use and income levels)
3. Costs	*Cost causation*	− (no relation with costs)	+ (kWh & kW are proxies for cost for network)	− (no relation with costs)	+ (higher price if network faces congestion costs)
4. Benefits	*Equalise net benefits*	− (everyone pays the same, independent of benefits)	+ (those who use/benefit more, contribute more)	? (because of mix preference intensity and ability to pay are benefits unclear)	+ (− / +) (those benefitting from peak use contribute more/requires study on relation peak and non-peak use)

Legend. − : the tariff design scores negatively on this criterion; + : the tariff design scores positively on this criterion; − / + : whether the tariff scores negatively or positively depends on empirical relations or on implementation choices; ? : assessment is unclear

* For all tariff options it is assumed they are sufficient to cover the costs.

Two tariff schemes score relatively badly in this table, namely the flat rate and Ramsey pricing. The bad scoring of a flat rate should not come as a surprise, since it is by definition insensitive for all types of criteria (costs, income, benefits). That does not necessarily imply that this tariff is very unfair. Not only might a flat rate embody a symbolic equality – the same rate for everyone – it is possible that the negative judgments balance each other out overall.

Ramsey pricing (inverse elasticity rule) depends on estimates about price elasticity. According to Brown and Faruqui (2014, pp. 5, 30), two assumptions are commonly made: first, it is assumed that households are less price elastic than industrial users and, second, that within the class of households low-use electricity customers are less price elastic than high-use costumers. The argument for the latter is that high-use consumers use more electricity for luxuries, which can be more easily reduced, while low-use, less-off consumers use electricity mainly for essential services, which cannot be so easily reduced. Therefore, Ramsey suggests a higher tariff for households than for industrial users and a declining tariff for household: more use implies a proportionally lower tariff (Brown and Faruqui, 2014, pp. 5, 30). (Such assumptions are, however, an empirical matter and different data could put forward different assumptions.[13]) Ramsey pricing is therefore controversial with regard to fairness. For instance, Kenneth Train calculated what Ramsey pricing would mean if applied to public transport in San Francisco Bay: it 'would require that low-income riders of the bus subsidize the higher-income riders (…) From an equity perspective, this arrangement would be unsuitable' (Train, 1991, p. 144). Ramsey pricing is also the only scheme that is not realising the first criterion, namely formal equal treatment. The problem is that price elasticity is both morally arbitrary – it does not say anything about needs, capacities or merits – and average numbers are applied to individuals. Therefore, it is perhaps no surprise that Ramsey pricing has not really been used for grid tariffs. 'Ramsey pricing has rarely been applied, at least not explicitly, for price discrimination across customers in the same class. The main reason is that equity considerations have stood in the way' (Brown and Faruqui, 2014, p. 5).

The cost-based tariff-design options (transport and capacity charge) and the income-based design option (socialised through taxes) are successful in correspondence with their design concept, namely as either a way to represent costs or in being income-sensitive, but the downside is that they both score worse on the criteria of the other dimension: if income-sensitive, then less cost-sensitive, and conversely. Peak pricing, our subject here, represents an interesting case. While peak pricing is valued rather negative if we look at people's fairness perceptions, the judgement is more complex if we look at evaluative criteria put forward from an ethical perspective. Contrary to people's attitudes

[13] For instance, a study examining electricity consumption in California found that the price elasticity was lower for high levels of electricity use. The explanation is that a significant group was dependent on electric space heating. Nonetheless, the price sensitivity of higher incomes was a bit lower than this of lower incomes, probably because households replace their electric heating as income rises and become less dependent of electricity prices (Reiss and White, 2005).

towards peak pricing, there is a link between this tariff scheme and costs and/or benefits: people using peak capacity create a cost for the network and they also benefit by using this scarce capacity. Nonetheless, the relation with affordability and inequality is less straightforward, especially the fact that it may exclude some people from peak use for essential activities.

4. Integrated overview and discussion

We now bring the three perspectives together in the integrated overview table below. Just as before, we use a dichotomous scale ('+' ; '–'), with a third item ('– / +') indicating uncertainty or dependence. While limited, for the purposes here such a dichotomous scale suffices and reduces discretionary judgments.

Table 4. Integrated assessment: 3-perspectives' multi-criteria and comparison with other tariff options

		Policy options			
Perspective	**Evaluative criterion**	**Flat rate (socialised)**	**Transport & capacity charge**	**Ramsey pricing**	**Peak pricing**
Economic	*Allocative efficiency*	–	– / +	+	+
Behavioural-economic	*Cost-based*	–	+	–	– / +
	Non-exploitation	+	+	– [5]	– [6]
	Predictability	+	+	+	–
Ethical	*Formal equal treatment*	+	+	–	+
	Meeting basic needs	– / +	– / +	–	–
	No increase inequality	– / +	– / +	–	– / +
	Cost causation	–	+	–	+
	Equalise net benefits	–	+	?	+ (– / +)

Legend. – : the tariff scores negatively on this criterion; + : the tariff scores positively on this criterion; – / + : whether the tariff scores negatively or positively depends on empirical relations or on implementation choices; ? : the assessment is unclear.

If one looks at the tariffs from such an integrated fairness perspective, the relatively positive scoring of transport and capacity charges stands out. It is their relation to costs, both actually and perceived, that makes them attractive. Moreover, the relation with capacity to pay (judged as 'depends' in table) is contingent: it depends on the relation between use levels and income levels. In order words, while it is possible that there is relatively higher burden for the least well-off, this is not necessarily the case.

Moving away from such cost-based tariff, the regulator has two options. Either one moves to a less efficient tariff that possibly takes more equality considerations into account, or one moves to a more efficient tariff structure. The first option refers to a more flat tariff, possibly partly socialised. Such a tariff is neither very efficient nor cost sensitive, but at the other hand, it is very predictable, expresses a strong formal and symbolic equality and allows room – in the case of progressive taxes – for adjustments with regard to income inequality.

The alternative implies moving towards a tariff aimed at more efficiency. A theoretically attractive option for dividing common costs is Ramsey pricing, which allows maximising efficiency (without allowing financial loss for grid operators). However, as we have seen in our ethical discussion on tariffs, this tariff scores the worst with regard to fairness criteria, both from an ethical and behavioural-economic perspective. And, as mentioned before, this seems to be confirmed by reality, since it is rarely used in practice for grid tariffs.

This brings us to peak pricing. From an integrated perspective, peak-pricing design presents the most ambiguous result: positive for efficiency, negative with regard to fairness perceptions and nuanced from an ethical perspective. This ambiguous nature makes that the fairness perception and evaluation depends to a greater extent on the concrete implementation.

5. Policy implications

The fact that the fairness of peak pricing depends on the modalities of its implementation, gives significant room for incorporating fairness into the design of peak pricing. While the ethical perspective allows to make an overall judgement of the different tariff schemes, for the conditions for mediating we also need to look backwards at the behavioural-economic findings about which conditions effectively change fairness and its perception.

First, making peak pricing acceptable requires explaining the arguments for peak pricing in common language. Allocative efficiency is an important economic notion, but does not necessarily appeal to common language. People might see peak pricing as more acceptable if, for instance, the revenues are used for something related to what peak pricing is supposed to address (e.g. network capacity, provide batteries, stimulate domestic energy efficiency, etc.).

Second, a major problem with peak pricing is that it could exclude the least well-off from (minimal) peak use; people deem this unfair because it hinders people from fulfilling certain needs. Increasing fairness requires attention for basic needs.

Third, peak pricing conflicts with many desert-based ways of reasoning, such as why do higher income groups deserve easier access to peak use or why does the network provider deserve the extra income from peak pricing? The acceptability can be raised by changing the use of the revenues, adding compensatory measures; changing the reference point in the pricing (e.g. non-peak users earn credits to reward them for their non-use:) or selling (peak) capacity access in advance (Doorman, 2005))

Fourth, the empirical research on fairness attitudes also revealed that predictability is important. This is a challenge for peak pricing, but since most peaks are somewhat predictable in advance, consumers could be given notice sufficiently in advance. One could also think of formulating a cap on the maximum amount of peak periods.

6. Conclusion

This paper aims at assessing network tariffs from a fairness perspective. 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, such as nuclear plants (Visschers and Siegrist, 2012) wind farms (Ottinger et al., 2014) or grid lines (Knudsen et al., 2015). If research is focused on network tariffs (Muir, 2001; Wood and Carter, 2014), it often does not clarify the meaning of fairness and neither does it provide a method to assess the fairness of particular tariffs. This article departs from the perceived tension between efficiency and acceptability. One can only go beyond this tension by using an *integrated approach* that combines insights from efficiency, acceptability and fairness. It is particularly the ethical perspective that allows transcending the impasse: understanding the underlying normative arguments and contrasting perceptions with insights from ethics makes it possible to formulate conclusions beyond that tension, and in addition this allows clarifying the notion of fairness.

Looking through the lens of this integrated approach at peak pricing allows us to assess its consequences for fairness. While other tariff schemes are less (e.g. transport and capacity charges) or more (e.g. Ramsey pricing) controversial with regard to fairness, the fairness of peak pricing is more ambiguous and contingent upon the concrete implementation design. We identified four possible implementation conditions for improving the fairness of peak pricing. The arguments used to explain peak pricing should appeal to common language and common normative notions. Moreover, one should guarantee the satisfaction of basic needs if they would be threatened by peak pricing. The worry that peak use is only for the rich or only for the enrichment of the provider should be addressed as well. Some possibilities for making peak prices more fair are related to the use of revenues, the existence of compensatory measures and the choice of the reference point. Finally, people attach much value to predictability and this should thus be maximised as much as possible. If one takes such conditions into account, the acceptability and fairness of peak pricing will be fostered.

References

Biggar, D., 2010. Fairness in Public-utility Regulation: A Theory. Agenda A J. Policy Anal. Reform 17, 5–29.

Bouzarovski, S., 2014. Energy poverty in the European Union: landscapes of vulnerability. WIREs Energy Environ. 3, 276–289.

Bowles, S., Gintis, H., 2013. A Cooperative Species: Human Reciprocity and Its Evolution. Princeton University Press, Princeton.

Bowles, S., Gintis, H., 2002. Behavioural science: Homo reciprocans. Nature 415, 125–128.

Brown, T., Faruqui, A., 2014. Structure of Electricity Distribution Network Tariffs: Recovery of Residual Costs. Report prepared for the Australian Energy Market Commission.

Brown, T., Faruqui, A., Grausz, L., 2015. Efficient tariff structures for distribution network services. Econ. Anal. Policy 48, 139–149.

Coase, R.H., 1946. The Marginal Cost Controversy. Economica 13, 169–182. doi:10.2307/2549764

Doorman, G., 2005. Capacity Subscription: Solving the Peak Demand Challenge in Electricity Markets. IEEE Trans. Power Syst. 20, 239–245.

Duffy, J.F., 2004. The Marginal Cost Controversy in Intellectual Property. Univ. Chicago Law Rev. 71, 37–56.

Dworkin, R., 2000. Sovereign Virtue: The Theory and Practice of Equality. Harvard University Press, Cambridge, MA.

Dworkin, R., 1981. What is Equality? Part 2: Equality of Resources. Philos. Public Aff. 10, 283–345.

Elmaghrab, W., Keskinocak, P., 2003. Dynamic Pricing in the Presence of Inventory Considerations: Research Overview, Current Practices, and Future Directions. Manage. Sci. 49, 1287–1309.

Elster, J., 1991a. Local justice. How institutions allocate scarce goods and necessary burdens. Eur. Econ. Rev. 35, 273–291.

Elster, J., 1991b. Local justice. Eur. Econ. Rev. 35, 273–291. doi:10.1016/0014-2921(91)90128-6

Frey, B.S., Pommerehne, W.W., 1993. On the fairness of pricing — An empirical survey among the general population. J. Econ. Behav. Organ. 20, 295–307.

Gosepath, S., 2011. Equality, in: Edward N. Zalta (Ed.), The Stanford Encyclopedia of Philosophy (Spring 2011 Edition).

Heffron, R.J., Mccauley, D., Sovacool, B.K., 2015. Resolving society's energy trilemma through the Energy Justice Metric. Energy Policy 87, 168–176.

Hills, J., 2012. Getting the measure of fuel poverty: final report of the Fuel Poverty Review. CASEreport, 72. London, UK.

Hills, J., 2011. Fuel poverty: the problem and its measurement. CASEreport, 69. London, UK.

Hotelling, H., 1938. The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates. Econometrica 6, 242–269. doi:10.2307/1907054

Isaac, R.M., Mathieu, D., Zajac, E.E., 1991. Institutional framing and perceptions of fairness. Const. Polit. Econ. 2, 329–370. doi:10.1007/BF02393135

Jones, B.R., Sovacool, B.K., Sidortsov, R. V., 2015. Making the Ethical and Philosophical Case for "Energy Justice." Environ. Ethics 37, 145–168.

Jones, D.N., Mann, P.C., 2001. The Fairness Criterion in Public Utility Regulation: Does Fairness Still Matter? J. Econ. Issues 35, 153–172. doi:10.1080/00213624.2001.11506345

Kahneman, D., Knetsch, J.L., Thaler, R., 1986. Fairness as a Constraint on Profit Seeking: Entitlements in the Market. Am. Econ. Rev. 76, 728–741.

Knudsen, J.K., Wold, L.C., Aas, Ø., Kielland Haug, J.J., Batel, S., Devine-Wright, P., Qvenild, M., Jacobsen, G.B., 2015. Local perceptions of opportunities for engagement and procedural justice in electricity transmission grid projects in Norway and the UK. Land use policy 48, 299–308. doi:http://dx.doi.org/10.1016/j.landusepol.2015.04.031

Konow, J., 2003. Which Is the Fairest One of All? A Positive Analysis of Justice Theories. J. Econ. Lit. 41, 1188–1239.

Kremer, M., Bovens, M., Schrijvers, E., Went, R., 2014. Hoe ongelijk is Nederland? Een verkenning van de ontwikkeling en gevolgen van economische ongelijkheid. AUP, Amsterdam.

Krugman, P., 2000. Reckonings; What Price Fairness? New York Times.

Lindsey, R., 2006. Do Economists Reach a Conclusion on Road Pricing?The intellectual history of an idea. Econ J. Watch 3, 292–379.

Littlechild, S.C., 2000. Why we need electricity retailers: A reply to Joskow on wholesale spot price pass-through, Judge Institute of Management Studies. Cambridge.

Miller, C.A., Iles, A., Jones, C.F., 2013. The Social Dimensions of Energy Transitions. Sci. Cult. (Lond). 22, 135–148.

Miller, D., 2004. Justice, Democracy and Public Goods, in: Dowding, K.M., Goodin, R.E., Pateman, C. (Eds.), Justice and Democracy: Essays for Brian Barry. Cambridge University Press, Cambridge, pp. 127–149.

Miller, D., 1999. Principles of Social Justice. Harvard University Press, Cambridge, MA.

Muir, J., 2001. Fair pricing regulation. Agenda 8, 3–18.

Musgrave, R.A., 2008. Public finance, in: Durlauf, S.N., Blume, L.E. (Eds.), The New Palgrave Dictionary of Economics. Palgrave Macmillan, Basingstoke.

Neumark, F., McLure, C.E., 2016. Taxation, in: Encyclopædia Britannica.

Nozick, R., 1974. Anarchy, State, and Utopia. Blackwell, Oxford.

O'Neill, J., Holland, A., Light, A., 2008. Environmental Values. Routledge, London.

O'Neill, J.R., 2000. The benefit and sacrifice principles of taxation: A synthesis. Soc. Choice Welfare 17, 117–124.

Oberholzer-Gee, F., Weck-Hannemann, H., 2002. Pricing road use: politico-economic and fairness considerations. Transp. Res. Part D Transp. Environ. 7, 357–371. doi:10.1016/S1361-9209(02)00005-6

Ottinger, G., Hargrave, T.J., Hopson, E., 2014. Procedural justice in wind facility siting: Recommendations for state-led siting processes. Energy Policy 65, 662–669. doi:http://dx.doi.org/10.1016/j.enpol.2013.09.066

Raux, C., Souche, S., Croissant, Y., 2009. How fair is pricing perceived to be? An empirical study. Public Choice 139, 227–240. doi:10.1007/s11127-008-9390-y

Rawls, J., 1999. A Theory of Justice. Revised Edition. Belknap Press of Harvard Univeristy Press, Cambridge, MA.

Rawls, J., 1971. A Theory of Justice, Revised. ed. Harvard University Press, Cambridge, Mass.

Reiss, P.C., White, M.W., 2005. Household Electricity Demand, Revisited. Rev. Econ. Stud. 72, 853–883. doi:10.1111/0034-6527.00354

Shue, H., 1980. Basic Rights: Subsistence, Affluence, and U.S. Foreign Policy. Princeton University Press, Princeton.

Steg, L., Vlek, C., 2009. Encouraging pro-environmental behaviour: An integrative review and research agenda. J. Environ. Psychol. 29, 309–317. doi:10.1016/j.jenvp.2008.10.004

Surowiecki, J., 2014. In Praise of Efficient Price Gouging. MIT Technol. Rev. September, 74–77.

Train, K.E., 1991. Optimal Regulation. The Economic Theory of Natural Monopolies. MIT Press, Cambridge, MA.

van den Bos, K., Lind, A.E., Wilke, H.A.M., 2001. The psychology of procedural and distributive justice viewed from the perspective of fairness heuristic theory, in: Cropanzano, R. (Ed.), Justice in the Workplace. From Theory to Practice. Volume 2. Laurence Erlbaum Associates, Mahwah, NJ, pp. 49–66.

Verhoef, E.T., Nijkamp, P., Rietveld, P., 1997. The social feasibility of road pricing: A case study for the Randstad area. J. Transp. Econ. Policy 31, 255–276.

Vickrey, W., 1971. Responsive Pricing of Public Utility Services. Bell J. Econ. Manag. Sci. 2, 337–346. doi:10.2307/3003171

Visschers, V.H.M., Siegrist, M., 2012. Fair play in energy policy decisions: Procedural fairness, outcome fairness and acceptance of the decision to rebuild nuclear power plants. Energy Policy 46, 292–300. doi:10.1016/j.enpol.2012.03.062

Walzer, M., 1983. Spheres of Justice. A Defense of Pluralism and Equality. Basic Books, New York.

Wiggins, D., 1987. Needs, Values, Truth. Essays in the Philosophy of Value. Blackwell, Oxford.

Wood, T., Carter, L., 2014. Fair pricing for power. Grattan Inst. Rep. 2014-8, 1–39.

Xia, L., Monroe, K.B., Cox, J.L., 2004. The Price Is Unfair! A Conceptual Framework of Price Fairness Perceptions. J. Mark. 68, 1–15. doi:10.1509/jmkg.68.4.1.42733

Young, H.P., 1995. Equity: in theory and practice. Princeton University Press, Princeton.

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