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Public Values in Power:

an exploratory framework applied to the case of The Netherlands[#]

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ABSTRACT

Artificial intelligence is increasingly applied in electricity systems. This development results in opportunities and pressures for incorporating public values. Public governments can steer the implementation of AI to safeguard certain values. To understand what values might be pressing to cover, this paper maps the visions of various actors in the Dutch electricity system regarding which public values should be safeguarded. For this analysis, actors in different elements of the electricity system were interviewed, and a narrative analysis of grey material published by several of these actors was conducted. Multiple actors within the electricity system identified sustainability, reliability, affordability, equity and equality, and balances of power as important values to prioritize. This does not mean other values can be disregarded. At its core, identification and non-identification indicate which public values are present and absent in the current debate about the future Dutch electricity system.

Keywords: energy systems, governance, artificial intelligence, public values, electricity system, the Netherlands

NONMENCLATURE

Abbreviations	
AI	Artificial intelligence
DSO	Distribution system operator
ICT	Information and Communication Technology
TSO	Transmission system operator
DER	Distributed energy resource

1. INTRODUCTION

Electricity systems are in transition [1–5]. This transition includes various electricity system actors implementing artificial intelligence (AI). AI can gather and process data, act on this data and learn from the results of these actions without human intervention [6–9]. With these capabilities, AI can support the integration and coordination of distributed energy sources (DERs), predict electricity production and consumption, and support grid improvements [4,10,11]. The implementation of this technology is predicted to have a major impact on the electricity system. This impact is not merely technological, but also social. Questions are emerging regarding how AI should be implemented, what regulations are required and how the implementation of AI could be guided in a way that it results in a more sustainable and just system.

Public governance plays a role in this. Governments steer developments by prioritizing those values deemed most important to safeguard for the future (more sustainable and more just) electricity system [12,13]. These values are then institutionalized in regulations, procedures or support mechanisms [14].

This prioritization of public values by public governments is, however, not a simple task. Such a prioritization affects various actors in the electricity system, as they may face new support mechanisms and regulations. Therefore, these actors, their interests and visions should be included in the debates surrounding the prioritization of public values in the electricity system. A first step of this (re-)prioritization process should thus be mapping the visions of various electricity system actors regarding public values. This paper covers such a mapping process for the Dutch electricity system, by identifying which values are (more frequently) recognized by various electricity system actors. These frequently identified public values could then be considered as important for the prioritization by the public government. At the same time, the public values not mentioned by the electricity system actors should not be disregarded. Rather, it should be explored why these values are not actively considered by the different

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actors and are therefore also less likely to come up in debates regarding the future electricity system.

This paper is structured as follows. In section 2, a description is given on how the visions of various electricity actors regarding public values is mapped. This is followed in section 3 by a further exploration of the link between governance and public values is further explored. Additionally, background is provided regarding the public value framework. In section 4, the results of the mapping process are discussed. Section 5 explores how the results can be used for public governments and how to deal with omitted public values. In the conclusion in section 6, the most important results and advice are revisited.

2. MATERIAL AND METHODS

For this study, various actors in the Dutch electricity system were asked about their perception of AI in the (Dutch) electricity system and the effect of the application thereof on the public values from the public value framework. Nine in-depth interviews were held with experts working for the Dutch Transmission Operator (TSO) [24,25], Distribution System Operators (DSOs) [26], government advisory groups [27], electricity retailers [28], Information and Communication Technology (ICT) providers [29,30], researchers [31] and local energy communities [32]. These interviewees were invited, as they represent a broad variety of the different aspects, tasks, and responsibilities in the Dutch electricity system. The TSO and DSOs are government institutions responsible for electricity system operation (e.g. national and regional electricity infrastructure, including electricity markets). Electricity retailers are private, commercial parties focused on the sales of electricity. They often also hold large scale electricity production in their portfolios. ICT providers give a slightly different perspective on the electricity system, as they are more focused on the ICT instruments which are applied in the system. Local energy communities and government advisory groups can give insight in the local community and consumer perspectives, as they are closer to consumers or research consumer perspectives, respectively.

Additional information was gathered from publicly available documents from the TSO [11,33], DSOs [34], the major electricity retailers in the Netherlands [35–37], advisory groups [38–43] and several energy communities and energy platforms [44–59]. This additional information was added to put the narratives of the interviewees into the broader perspective of the institutions they represent. The information from energy platforms was added to include the perspective of an emerging facet of the Dutch electricity system, which occurs often between the electricity retailer and the electricity consumer layer.

From these interviews and documents, it can be analyzed which public values were emphasized by the various actors as most relevant or in need of further governance measures, and which public values were identified significantly less. This indicates what values also arise in debates surrounding the future Dutch electricity system and the governance thereof. For this, a qualitative approach to the research is chosen to ensure emphasis (for example, by the use of strong language) and conceptualizations are taken into account correctly.

3. THEORY

Public values are “abstract principles and general convictions that people should hold paramount if society is to be good” [15]. These public values are shaped by democratic processes, but also embedded in institutions, regulations, laws and policies [16–21]. Governance measures can be taken to safeguard certain public values.

There are many public values but for digitalizing electricity systems we have established a framework in which we identified nine overarching, relevant public values [22]. This framework is shown in Table 1. These public values can be supported or pressured by the introduction of AI in the electricity system.

Governments have the complex task to decide which value to prioritize. Prioritizing all public values equally is impossible, as some government measures to support one public value, negatively impact other public values [22]. For example, measures to automate the electricity system to increase its efficiency and thereby its sustainability, can decrease consumer autonomy. Therefore, careful consideration of which values to prioritize, is much needed to ensure a more sustainable and just future electricity system.

It depends, however, on the electricity system aspect and the electricity system actor how these values are (expected to be) impacted by the implementation of AI. Applications of the framework have shown that implementations of AI have the potential to both pressure and support public values [22,23]. Therefore, a broad debate including various actors of the electricity system regarding the prioritization of public values is a useful first step for governments. Such a mapping of visions regarding public values can give governments insight into what public values are deemed most relevant to include in future governance measures, regulations, and policies and which public values are less recognized in current debates.

Table 1: Public values and description. Source: Niet et al. [22].

Public values	Description
Sustainability	Development meeting the needs of the present without compromising the ability of future generations to meet their own needs. This includes life of dignity for all within the planet's limits, reconciling economic efficiency, and environmental responsibility.
Reliability	Security of supply; relative independence and diversification of energy fuels and services and stability of the energy system.
Affordability	People can afford energy services, prices are stable and there is equitable access to energy services. It includes lack of energy poverty and fuel poverty and has been one of the reasons to encourage liberalization and privatization of the energy market.
Security	Information security, identity fraud prevention, physical safety, and cybersecurity.
Privacy	Data protection, mental privacy, spatial privacy, surveillance, and function creep including using data for other purposes.
Balances of power	Shifting relations between government, consumers and businesses including fairness of competition (a fair market), non-discriminatory access and terminating exploitation.
Equity and equality	Preventing discrimination and exclusion, ensuring equal treatment, preventing unfair bias and stigmatization, aiming for due process and inclusiveness.
Control over technology	Control and transparency of algorithms, clear accountability, predictability, and giving both consumers and other market actors enough information.
Autonomy	Freedom of choice, freedom of expression, preventing manipulation and paternalism, and self-direction. This is also related to self-enhancement, such as building individual and community skills and capacity, and enhancing pride.

4. RESULTS

In the interviews and documents, several public values were frequently mentioned. All values from the public value framework were asked about or searched in the additional documentation. A handful of public values were deemed as most important by various electricity system actors, were identified naturally during the conversations, or were mentioned multiple times. These public values are sustainability, reliability, affordability, equity and equality, and balances of power.

First, all actors view sustainability as an important value to imbed in the future electricity system and use AI to make their part of the electricity system more sustainable. Actors are able to accelerate the integration of DERs with AI [11,24,25,34–36,44,47]. This includes renewable energy generators (e.g. wind turbines) and flexibility assets (e.g. batteries). With AI, the management and coordination of DERs can be automated, rendering integration less complicated. Integrating DERs results in an influx of renewably generated electricity, as well as greater flexibility capabilities, which can increase the electricity grid efficiency.

This increase in flexibility could also improve electricity affordability and grid reliability, two other public values deemed important by various electricity system actors. For the TSO and DSOs, reliability is their main priority; for electricity retailers and local energy communities it is often a requirement [24,25,28,31]. These actors implement AI to predict upcoming imbalances, and coordinate available flexibility assets accordingly, preventing blackouts [24–26].

The effect of the implementation of AI on electricity affordability is less certain. DER integration has the potential to increase electricity affordability for consumers, as they can benefit from the low renewable energy electricity prices and diversity in electricity suppliers [24,26,47,48]. Alternatively, AI could be used to drive up prices on the electricity market or use smart pricing and profiling to set individual, dynamic prices [29,49,50]. This could lead to consumers not paying the lowest prices, but the highest price they can afford. The TSO and DSOs do not identify this as a possible future problem [24,26].

Two other public values the various electricity system actors deemed important, were equity and equality and balances of power. These values were often mentioned together. Some electricity system actors (e.g. local energy communities and small energy platforms) rely on AI programs to be an active participant in the electricity system [29–33,49]. These programs coordinate and manage assets and electricity market biddings; activities these actors would otherwise have to employ people for. AI programs are often more affordable and therefore a better option for these smaller actors. The use of AI could thus increase equality and the balance of powers, as more actors are able to be active in the electricity system. At the same time, the use of AI could also decrease equity and equality and the balance of powers in the electricity system. Consumers often need flexibility assets to join electricity system AI programs, which excludes consumers without such financial means [51]. Additionally, larger digital energy platforms often have a competitive advantage over smaller energy platforms in the electricity system, as they are able to acquire more technical expertise and flexibility assets, and therewith can outprice smaller platforms [49,52–54]. Various actors express their concern over these uses of AI which could negatively impact the equity and equality and balances of power in the electricity system, but a solution which does not affect other public values (e.g. reliability of the grid, affordability of electricity) is perceived as difficult to find and implement [24].

5. DISCUSSION

One side of the conclusion we can draw from the results described in Section 4 is clear. The public values sustainability, reliability, affordability, equity and equality, and balances of power are largely present in debates regarding the future Dutch electricity system. Therefore, these values should be considered and safeguarded in governance measures, given that they are the most acknowledged by various electricity system actors. Another side is, however, less clear: how to treat values which are much less or not acknowledged by the electricity system actors?

Although the quickest conclusion might be to disregard these values altogether, this might not be the most useful solution. When questioned about the values missing from their analysis, various actors gave reasons why these values did not come up in their conversation, much different from irrelevance. The two main reasons to focus on in this paper, were: coverage in current regulations and uncertainty about the value and the effect of AI thereon.

As for the first reason, some actors indicated that certain values were already implemented in current laws and regulations. One example of this is the public value of privacy. Electricity retailers, the TSO and DSOs do not focus on this value, as they emphasize this value is already safeguarded by the General Data Protection Regulations they adhere to [24,26,28]. This contrasts with (local) aggregators and ICT parties, who stress additional privacy measures (e.g. privacy by design or additional caution in the use of data) are necessary [29,30,45,55]. In short: none of the actors indicate privacy is irrelevant but some actors rely on existing regulation. Therefore, governments should ensure existing regulations are kept up to date and develop in parallel with technological developments.

The second reason to not focus on a certain public value is less straightforward. This is uncertainty about what a public value entails, how the implementation of AI in the electricity system could impact this value or what strategies for solving negative impacts could be followed. An example of this is the public value of autonomy. Many electricity system actors believe that as long as electricity is available, households hold full autonomy in their electricity use [24,26,27]. With the implementation of AI, however, more has become possible. Consumers could use the smart home systems to automatically adjust their electricity consumption to make more use of renewable energy [56–58]. This could increase their autonomy. In practice, however, consumers rarely act on these opportunities [30,31,46,59]. The implementation of AI could also decrease consumer autonomy, as other electricity system actors could create personal profiles to curtail electricity use. Personal profiling is currently used for client contact purposes, but could also be applied for electricity consumption intervention [29,37,43]. Various electricity system actors are unsure about how realistic this scenario is in the near future [24,26]. This uncertainty makes it difficult to prioritize this public value but makes disregarding the public value too presumptuous.

These reasons indicate what could be termed a public value lock-in. similar to a moral lock-in [60], a public value lock-in transpires when actors are focused on certain values and continue to prioritize these values over other values, even when this leads, in this case, to a less sustainable or less just future system. The various electricity system actors all recognized sustainability and reliability as core values for the electricity system; privacy, too, was viewed as a requirement when working with data. Sustainability, reliability and (data) privacy have been at the core of electricity system and ICT system governance for decades. In contrast, autonomy was omitted as a value by the various electricity system actors, and the possibility of increasing or decreasing autonomy is relatively new, as it only emerged with the introduction of smart meters and smart home systems [22,61]. Additionally, some value tensions have emerged, in which case it is difficult to prioritize one value and still support a sustainable and just future electricity system. This is, for example, the case between reliability and equity and equality. This, too, results in a locked-in satiation for debates.

6. CONCLUSIONS

AI is increasingly implemented in the transitioning electricity systems. Public governments are in the position to steer this development towards a more sustainable and just electricity system. in this process, public governments prioritize some public values over others. As a first step in this (re-)prioritization process, this paper mapped how various actors in the Dutch electricity system perceive the importance of the public values from the public value framework, using in-depth interviews and grey literature (see Table 1)[1]. Five values were identified as highly relevant by various actors. Sustainability and reliability are both perceived as vital values for the future electricity system and are perceived to be supported by the implementation of AI. Actors also agree on the importance of affordability but disagree on how the implementation of AI would affect this. Some actors expect AI to make the electricity system more affordable for consumers; other actors are less positive about the effect of AI. Various actors are most critical regarding equity and equality and balances of power. AI could support inclusion of a larger group of actors as active participants in the electricity system. this opportunity is, however, only available for those with the financial capacity and technical expertise to join.

This does not mean that only these five values should be safeguarded by future governance measures. At its core, this mapping shows which values are prominent in current debates amongst different electricity system actors in the Netherlands. Further research could analyze whether similar values are identified by other electricity system actors throughout the European Union. If this is the case, governance at a European Union level could be preferred over national governance measures to safeguard certain public values. Furthermore, additional research is needed to understand why some values remained non-identified and if the debate on the future electricity system experiences a value lock-in. lastly, research could be conducted on what governance measures could effectively safeguard public measures or deal with the potential value lock-in. Such research would allow governments to integrate public values in the electricity system which are regarded as vital for the future power system, putting the public values in power.

[1] For this research, a qualitative approach was followed. Further research could consider a quantitative approach, which might allow including a broader set of documents.

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