Public Values in Power:

an exploratory framework applied to the case of The Netherlands#

Irene Niet[1]

1 Eindhoven University of Technology, Eindhoven, The Netherlands (Corresponding Author)

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

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.

REFERENCE

[1] European Commission. "Fit for 55": delivering the EU's 2030 Climate Target on the way to climate neutrality 2021.

[2] European Commission. A Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy 2018.

[3] Kern F, Smith A. Restructuring energy systems for sustainability? Energy transition policy in the Netherlands. Energy Policy 2008;36:4093–103. https://doi.org/10.1016/j.enpol.2008.06.018.

[4] MIT. Utility of the Future. An MIT Energy Initiative response to an industry in transition. Massachusetts: MIT; 2016.

[5] Markard J. The next phase of the energy transition and its implications for research and policy. Nat Energy 2018;3:628–33. https://doi.org/10.1038/s41560-018-0171-7.

[6] Johnston J. The Allure of Machinic Life: Cybernetics, Artificial Life, and the New AI. MIT Press; 2008.

[7] Poole D, Mackworth A. Artificial Intelligence and Agents. Artificial Intelligence: Foundations of Computational Agents, Cambridge: Cambridge University Press; 2010, p. 3–42.

[8] Kalogirou SA. Introduction to Artificial Intelligence Technology. In: Kalogirou SA, editor. Artificial Intelligence in Energy and Renewable Energy Systems, New York: Nova Science Publishers; 2007, p. 1–46.

[9] Royakkers L, Est R van. Royakkers, L: Just Ordinary Robots: Automation from Love to War. Boca Raton, Florida: 2015.

[10] Summeren LFM van, Wieczorek AJ, Bombaerts GJT, Verbong GPJ. Community energy meets smart grids: Reviewing goals, structure, and roles in Virtual Power Plants in Ireland, Belgium and the Netherlands. Energy Research & Social Science 2020;63:101415. https://doi.org/10.1016/j.erss.2019.101415.

[11] TenneT. Integrated Annual Report 2021. Arnhem: TenneT; 2022.

[12] Grin J, Rotmans J, Schot J. Transitions to sustainable development: new directions in the study of long term transformative change. New York: Routledge; 2010.

[13] Meadowcroft J. Who is in Charge here? Governance for Sustainable Development in a Complex World*. Journal of Environmental Policy & Planning 2007;9:299–314. https://doi.org/10.1080/15239080701631544.

[14] Charles MB, Martin de Jong W, Ryan N. Public Values in Western Europe: A Temporal Perspective. The American Review of Public Administration 2011;41:75–91. https://doi.org/10.1177/0275074010361529.

[15] Milchram C, Kaa G van de, Doorn N, Künneke R. Moral Values as Factors for Social Acceptance of Smart Grid Technologies. Sustainability 2018;10. https://doi.org/10.3390/su10082703.

[16] Dahl RA. On Democracy. 2nd ed. London: Yale University Press; 2015.

[17] Moore MH. Creating Public Value: Strategic Management in Government. Cambridge: Harvard University Press; 1995.

[18] Susskind J. Future Politics. 1st ed. Oxford: Oxford University Press; 2020.

[19] Dekker R, Est R van. The convergence of electricity and digitalization in the Netherlands. TATuP 2020;29:31–7. https://doi.org/10.14512/tatup.29.2.3.

[20] Royakkers L, Timmer J, Kool L, Est R van. Societal and ethical issues of digitization. Ethics and Information Technology 2018;20:127–42. https://doi.org/10.1007/s10676-018-9452-x.

[21] Werff E van der, Steg L. The psychology of participation and interest in smart energy systems: Comparing the value-belief-norm theory and the value-identity-personal norm model. Energy Research & Social Science 2016;22:107–14. https://doi.org/10.1016/j.erss.2016.08.022.

[22] Niet IA, Dekker R, van Est R. Seeking Public Values of Digital Energy Platforms. Science, Technology, & Human Values 2021;47:380–403. https://doi.org/10.1177/01622439211054430.

[23] Niet IA, Van den Berghe L, Est R van. Emerging AI-based electricity markets: ways to safeguard public values. TBD TBD.

[24] Wismeyer L. Interview with TenneT 2021.

[25] Kop S. Interview with TenneT 2022.

[26] Fonteijn R. Interview with Enexis 2021.

[27] WRR. Interview with WRR 2021.

[28] Kaus S, Dubucq P. Interview with Vattenfall 2021.

[29] Wieringen R van. Interview with Florijn 2021.

[30] Wieren H van. Interview with OrangeNXT 2022.

[31] Reijnders VMJJ. Interview with TU Twente 2022.

[32] Vliet R van. Interview with Flexlokaal 2021.

[33] TenneT. Equigy platform gives European consumers access to tomorrow's sustainable energy market. TenneT 2020. https://www.tennet.eu/news/detail/equigy-platform-gives-european-consumers-access-to-tomorrows-sustainable-energy-market/ (accessed August 25, 2020).

[34] Stedin. Jaarverslag 2020. Rotterdam: Stedin; 2021.

[35] Vattenfall. Annual and sustainability report 2020. Stockholm: Vattenfall; 2021.

[36] E.ON. Annual report 2020. Essen: E.ON Group; 2021.

[37] Eneco. Jaarverslag 2020. Rotterdam: Eneco Groep N.V.; 2021.

[38] ACM. Goedkeuring specifiek product mFRR balanceringscapaciteit. vol. 2021. 2021.

[39] ACM. Goedkeuring specifiek product aFRR balanceringscapaciteit. vol. 2021. 2021.

[40] Bakker S, Korsten P. Artificiële intelligentie als een general purpose technology. Den Haag: Wetenschappelijke Raad voor het Regeringsbeleid; 2021.

[41] Faber A, Goede PD, Weijnen M. Klimaatbeleid voor de lange termijn: van vrijblijvend naar verankerd - Policy Brief. Den Haag: WRR; 2016. https://doi.org/10/13/klimaatbeleid-voor-de-lange-termijn-van-vrijblijvend-naar-verankerd.

[42] Weijnen M, Correlje A, de Vries L. Infrastructuren als wegbereiders van duurzaamheid. Den Haag: WRR; 2015.

[43] WRR. Opgave AI. De nieuwe systeemtechnologie. Den Haag: Wetenschappelijke Raad voor het Regeringsbeleid; 2021.

[44] Gridflex Heeten. Duurzamer dan duurzaam. Gridflex Heeten 2020. https://gridflex.nl/ (accessed July 19, 2020).

[45] Gridflex Heeten. Privacy by Design predikaat voor Gridflex. Gridflex Heeten 2018. https://gridflex.nl/privacy-by-design-predikaat-voor-gridflex/ (accessed July 27, 2020).

[46] Gridflex Heeten. Samen energie steken in de buurt. Gridflex Heeten 2020. https://gridflex.nl/deelnemers/ (accessed July 27, 2020).

[47] Tesla. Autobidder. Tesla 2019. https://www.tesla.com/nl_NL/support/autobidder (accessed August 25, 2020).

[48] Nhede N. Vermont utility uses consumer batteries to balance regional grid with Tesla. Smart Energy International 2021. https://www.smart-energy.com/industry-sectors/storage/vermont-utility-balances-regional-grid-with-consumers-tesla-batteries/ (accessed July 15, 2021).

[49] Poplavskaya K, Vries L de. Chapter 5 - Aggregators today and tomorrow: from intermediaries to local orchestrators? In: Sioshansi FP, editor. Behind and Beyond the Meter, San Francisco: Academic Press; 2020, p. 105–35. https://doi.org/10.1016/B978-0-12-819951-0.00005-0.

[50] Vries L de. De problemen rondom netcapaciteit 2019.

[51] Powells G, Fell MJ. Flexibility capital and flexibility justice in smart energy systems. Energy Research and Social Science 2019;54:56–9. https://doi.org/10.1016/j.erss.2019.03.015.

[52] Dijck J van, Poell T, Waal M de. De Platformsamenleving: Strijd om publieke waarden in een online wereld. Amsterdam: Amsterdam University Press; 2016.

[53] Langley P, Leyshon A. Platform capitalism: The intermediation and capitalization of digital economic circulation. Finance and Society 2017;3:11–31. https://doi.org/10.2218/finsoc.v3i1.1936.

[54] Kloppenburg S, Boekelo M. Digital platforms and the future of energy provisioning: Promises and perils for the next phase of the energy transition. Energy Research and Social Science 2019;49:68–73. https://doi.org/10.1016/j.erss.2018.10.016.

[55] Aubel P van, Colesky M, Hoepman J, Poll E, Montes Portela C. Privacy by Design for Local Energy Communities. CIRED Workshop - Ljubljana, 7-8 June 2018 2018;Paper No 0319.

[56] Reijnders VMJJ, Laan MD van der, Dijkstra R. Energy communities: a Dutch case study. In: Sioshansi FP, editor.

Behind and beyond the meter. Digitalization, aggregation, optimization, monetization, San Francisco: Academic Press; 2020, p. 137–56.

[57] Verkade N, Höffken J. Collective Energy Practices: A Practice-Based Approach to Civic Energy Communities and the Energy System. Sustainability 2019;11:1–15. https://doi.org/10.3390/su11113230.

[58] Cossy L, Goodson T. Empowering electricity consumers to lower their carbon footprint. International Energy Agency 2020. https://www.iea.org/commentaries/empowering-electricity-consumers-to-lower-their-carbon-footprint (accessed January 27, 2020).

[59] Smale R, Kloppenburg S. Platforms in Power: Householder Perspectives on the Social, Environmental and Economic Challenges of Energy Platforms. Sustainability 2020;12:692. https://doi.org/10.3390/su12020692.

[60] Bruijnis MRN, Blok V, Stassen EN, Gremmen HGJ. Moral "Lock-In" in Responsible Innovation: The Ethical and Social Aspects of Killing Day-Old Chicks and Its Alternatives. J Agric Environ Ethics 2015;28:939–60. https://doi.org/10.1007/s10806-015-9566-7.

[61] Sovacool BK, Furszyfer Del Rio DD. Smart home technologies in Europe: A critical review of concepts, benefits, risks and policies. Renewable and Sustainable Energy Reviews 2020;120:109663. https://doi.org/10.1016/j.rser.2019.109663.