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Smart grid development in Quebec: A review and policy approach

Maya Jegen[a,*], Xavier D. Philion[b]

[a] Département de Science Politique, Université du Québec à Montréal, CP 8888, succ. Centre-Ville, Montréal, QC, Canada H3C 3P8
[b] Department of Political Science, University of British Columbia,C425 – 1866 Main Mall, Vancouver, BC, V6T 1Z1, Canada

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ABSTRACT

What explains the inception, the scope and the political saliency of smart grid development? Illustrating the dynamics of non-agenda-setting, this study reviews the electricity sector in the Canadian province of Quebec. Drawing from Kingdon's multiple streams, we argue that the opening of a policy window that would put smart grid development on the policy agenda has proved elusive. In the problem stream, we show that key actors in Quebec's electricity sector do not link smart grid development to policy problems such as climate change or sustainability. In contrast to other jurisdictions, abundant renewable electricity removes the pressure to substitute fossil with renewable energy and the need for its integration via smart grid. In the policy stream, we show that despite the presence of different ideas about smart grid among experts, the state-owned electric utility dominates the policy monopoly and frames smart grid as a technological fix to upgrade the grid. In the political stream, we observe that the issue has very low salience. Based on media analysis, we show that the public mood is somewhat negative and focuses mostly on the health impacts of smart meters. Another factor is the lack of political entrepreneurs emerging either for or against smart grid deployment. As the three streams do not converge and no policy entrepreneur promotes a broad vision of smart grid that would require fundamental changes in the electricity sector, this review concludes that smart grid in Quebec has developed primarily in the form of a technological, security-focused upgrade.

1. Introduction

"Smart grid" is promoted as an innovative tool to change the way societies produce, distribute, and consume electricity. A smart grid is a network that connects generators and consumers to ensure electricity supply that is economically efficient, secure and sustainable. It comprises tangible information and communication technologies (ICT), but it is also used as a proxy for the way electricity demand and supply should be managed to meet different societal objectives. Smart grid is often considered as part of a sustainable energy transition which implies not only technical innovations, but also social, behavioural, institutional and policy adjustments. For its advocates, smart grid is a key element of the sustainable energy transition that aims to mitigate climate change, enhance energy security and prevent soaring energy prices.

While engineers and IT experts have been interested in smart grids for some time, smart grid development is relatively recent in Europe and North America. In Ontario, a rapid deployment strategy for smart meters was launched in 2004 and is considered to be "the furthest evolution of smart grid policy agenda-setting, formulation and implementation in Canada to date" [1]. In this Canadian province, smart grid has been put on the policy agenda as an ambitious strategy to upgrade the grid while mitigating climate change. By contrast, in the neighbouring province of Quebec, smart grid deployment came later, lacked political saliency, and has been limited in scope. In Quebec the primary goals of the smart grid initiative have been to address security and enhance electricity invoicing, with minimal ambitions for more fundamental change to the industry's operating model.

In this paper, we review smart grid development in Quebec by asking why the smart grid policy agenda in Quebec has been so limited, promoted almost exclusively as a security and technical issue. An obvious difference between Ontario and Quebec is that the latter has access to abundant and cheap electricity, while Ontario phased out coal, relies on nuclear and gas power and made important investments in intermittent renewable energy. In addition, Ontario's electricity sector is divided between different utilities while Quebec still has a state monopoly. This review of Quebec's narrower use of smart grid opportunities may help us better understand the mechanisms that explain paths of smart grid development in other jurisdictions, such as Norway and British Columbia, which are dominated by quasi-monopolies, generating abundant, cheap, non-fossil electricity.

To conduct this review and answer our research question, we use

* Corresponding author.
E-mail address: jegen.maya@uqam.ca (M. Jegen).

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Kingdon's [2] multiple streams approach, which has been used widely to explain policy change and to analyze when and why issues get attention, how issues are framed, which actors participate in decision-making, and how policy entrepreneurs seek to push their ideas [3,4]. Kingdon argues that ideas float in a kind of "primeval soup". They only stick on the policy agenda when the three streams of *problems*, *policies* and *politics* converge. The coupling of the streams leads to the opening of a policy window, which is the "opportunity for advocates of proposals to push their pet solutions, or to push attention to their special problems" [2].

Using this approach, we argue that the path of smart grid development in Quebec has been narrow and lacked political salience because no policy window has opened for a more expansive, comprehensive smart grid strategy. In the problem stream, we show that key actors in Quebec's electricity sector do not link smart grid development to policy challenges such as climate change or sustainable energy transition. In contrast to other jurisdictions, abundant renewable electricity removes the pressure to substitute "dirty" fossil sources by "green" energy and, thus, to rely on smart grid for its integration. In the policy stream, we show that despite the presence of different ideas on smart grid development among Quebec experts, the state-owned electric utility dominates the policy scene and frames smart grid mainly as a technological fix to upgrade the existing grid; smart meters contribute to rationalize its "business-as-usual" operations. In the political stream, we observe that the issue has low salience. Based on a media analysis, we show that the public discourse about smart grid is somewhat negative and focuses mostly on the potential impacts of smart meters. Low political salience is reinforced by the fact that no significant policy entrepreneurs have emerged either for or against the deployment of smart grid. As the three streams do not converge and no policy entrepreneur promotes a broad vision of smart grid requiring fundamental changes of the electricity system, we conclude that smart grid has developed narrowly and in the form of a technological, security- and invoicing-focused upgrade.

From a theoretical point of view, our results confirm the strength of the policy approach: as Kingdon predicts, there is, in the absence of converging streams, no policy agenda setting. Beyond this finding, this review of the Quebec case helps to refine the dynamics of non-agenda-setting, that is to improve our understanding of why certain policy energy "solutions" may not end up on the policy agenda of certain jurisdictions, while they are salient elsewhere.

2. Smart grids in Quebec

The concept of smart grid has been promoted as an ambitious strategy both to upgrade the electricity infrastructure and to accelerate a sustainable energy transition that is considered indispensable given the growing threat of climate change. Two global policy imperatives have been identified as triggers for the smart energy transition: (1) policies to mitigate CO_2 emissions are required in order to reduce the impact of climate change, and (2) energy security must be enhanced to ensure economic stability, especially for countries that depend on imported fuels [5].

The concept of smart grid regroups different technologies. For example, it includes smart meters that measure generator outputs (supply side) or consumption (demand side) in real time. The smart meter helps the supply manager control loads, but may also help the consumer to control consumption. Other technologies such as sensors and communication networks also belong to the smart grid family [6]. It should be noted that advocates of the smart energy transition imply not only technical innovations and changes, but also social, behavioural and institutional adjustments with regard to, among others, issues of privacy, security, invoicing and access [7,8]. Several US and European jurisdictions have embraced smart grids to decentralize, rationalize, and/or reduce electricity production [9,10]. In Canada, Ontario has been at the forefront of such efforts with the most comprehensive smart grid strategy [1].

Table 1
Summary of ongoing smart grid initiatives in Quebec. Sources: Data adapted from [18] and [19].

Smart grid components	Hydro-Quebec	Hydro-Sherbrooke
Smart meters	Rollout by 2018	
Demand response	Smart zone in Boucherville	Peak shaving Control of electric water & heat
Network monitoring	Smart zone in Boucherville	
Network automation	PARD Programme: deployment of 3 600 automated switches CATVAR: deployment of volt & var on 130 substation	
Transport	Development of charging stations for plug-in electric vehicles Vehicle-to-grid (V2G) Vehicle-to-home (V2H)	

In Quebec, in contrast, smart grid has been limited to operations and security-based applications that are not linked to a larger policy agenda. So far, the most salient smart grid component in the public sphere has been the rollout of smart meters. In 2011, Hydro-Quebec, the state-owned integrated public utility, launched its program to replace 3.75 million traditional meters by a system of remote meter reading [11]. Even if the new infrastructure is conceived as two-way communication, the meters are actually used by Hydro-Quebec to collect usage, voltage and power quality data, but no time-of-use rates have been introduced and consumers cannot monitor and adapt their energy consumption in real time. Table 1 gives an overview of the other smart grid initiatives that are ongoing. These initiatives are about optimizing and securing the grid, improving energy efficiency, reducing CO_2 emissions and testing vehicle-to-grid and vehicle-to-home appliances [12–14]. Hydro-Sherbrooke, the electricity provider of the city of Sherbrooke with about 80,000 clients, also has two smart grid programs related to demand response [15]. Other actors are involved in research initiatives such as the *Smart Energy Research Institute* [16] or *Equation*, a public-private partnership to reduce energy consumption and CO_2 emissions [17].

In sum, smart meters are mainly construed as a means to rationalize and securitize Hydro-Quebec's operations. All other activities are in the realm of technology development and there is no policy agenda, with the possible exception of the sectoral *Electric transport strategy 2013-17,* which promotes electric-powered means of transportation such as electric public transportation, light electric vehicles and solutions for freight transportation [19]. The upgrading of the existing grid and operating activities – optimization and security – is the main objective, in continuation with the established centralized system of supply.

3. A policy approach

What explains the inception, the scope and the political saliency of smart grid development? Given the multiple meanings of smart grid it is not surprising that the literature has put forward different drivers for its development. Based on American and European case studies several factors can be identified: the need to upgrade an obsolete infrastructure [7], the general trend of decentralization due to the integration of more renewable energy into the grid [20], new applications such as electric vehicles and more "intelligent" information and communication technologies [21], or incumbent actors from the ICT sector [22]. European studies have also shown that regulation may be important. According to van Renssen and Belin [23], EU legislation on energy and climate as well as on market liberalization "was probably the catalyst for industry to mobilize 'smart technologies' a few years ago".

Technology-driven explanations are crucial to understand the