

# Water Pressures and Social Oppression

## Social and Political Impacts of Smart Water Meter Technology in Cape Town, South Africa

Melissa Guckenberger

Defended April 6<sup>th</sup>, 2018  
Undergraduate Honors Thesis  
Department of International Affairs  
University of Colorado at Boulder

Advisor:

Dr. Yaffa Truelove, Departments of Geography and International Affairs

Defense Committee:

Dr. Yaffa Truelove, Departments of Geography and International Affairs

Dr. Richard Mansfield, Department of Economics

Dr. Shuang Zhang, Departments of Economics and International Affairs

## Abstract

This paper analyzes the social and political consequences of the implementation of “smart” water meters in Cape Town, South Africa. As policymakers around the world implement new solutions to ever-growing concerns about depleting water resources, technologies and ideas are exported to other parts of the world before experts understand how these concepts will function in different environments. It is imperative to assess the implications of technological solutions to ensure they are implemented sustainably. This paper employs a qualitative approach synthesizing findings from government documents, personal conversations, and traditional and social media to evaluate the societal impacts of smart water meters in Cape Town over the course of the city’s 2017-2018 water crisis. The methodological framework created for this study can be used in future contexts to anticipate how urban areas will respond to smart water technology. This paper concludes with policy recommendations including a historical assessment of water-related grievances, government engagement with business and civil society leaders, and the potential for a cap-and-trade-like system for water rights.

# **Table of Contents**

Abstract.....	1
Introduction.....	3
Methodology .....	5
i.    Terminology .....	6
ii.   Data Collection .....	9
Literature Review.....	11
i.    The Hydrosocial Cycle in an Urban Context .....	12
ii.   Scholarly Assessments of Smart Water Technology .....	14
iii.  Limitations and Contributions .....	16
Smart Water Technology: History and Background.....	17
i.    Benefits of Smart Water Meters .....	19
ii.   Geography of Smart Water Meters.....	20
The South African Hydrosocial Cycle .....	22
i.    Historical Context .....	22
ii.   South Africa and Smart Water Systems: Cape Town’s Current Crisis.....	26
Findings and Discussion .....	28
Frictions Between Residents and the State.....	29
i.    Existing Grievances .....	30
ii.   New Grievances .....	35
Inequality Among Social Groups.....	41
i.    State’s Role in Perpetuating Inequality .....	41
ii.   Differing Citizen Narratives .....	46
The Equitable Smart City and Cape Town .....	50
Conclusion .....	53
Appendix A .....	58
Appendix B .....	59
References .....	61

## **I. Introduction**

Three in ten people around the world, or 2.1 billion, do not have access to clean water inside their homes (World Health Organization, 2017). The world's water resources are running low, and experts around the world are striving to conjure up solutions to preserve the precious water that remains. For the first time in history, more than half of the population lives in urban areas, compounding the need for strategic allocation of resources. Many specialists contend that Earth's water problems are not borne out of pure scarcity, but rather centuries of mismanagement (Barrett, 2015). The United States intelligence community published a report in 2012 detailing the necessity of improving water demand management worldwide in order to promote stability, citing weaponized water and water terrorism as potential consequences of continued mismanagement (Global Water Security, 2012). The interdisciplinary nature of water management requires different approaches and mindsets to communicate and converge in order to develop comprehensive strategies that address the multifaceted challenges water presents. Engineering must be incorporated in policymaking, socio-cultural relations must be accounted for in economic analyses, and technological business strategies must not overlook the geopolitical implications of their actions.

The sensation of the smart city recently emerged as the most contemporary way to combat resource shortage across sectors in urban areas. Uniting the principles of green growth and technological progress, "smart" technology is a comprehensive concept that calls for the implementation of cutting-edge engineering solutions to environmental problems in a framework of good governance. These new technologies are borne out of the "Internet of Things," which is essentially composed of physical devices or sensors planted on or in just about any object, ranging from cell phones to cars to farm equipment (Chui and Löffler, 2010). The Internet of

Things captures enormous amounts of data by means of its various links to the outside world, and analysts can use the data to better understand the relationship these items have with the humans that operate them and the natural environments in which they function. The data have the potential to inform analysts on how to automate and optimize certain processes. Furthermore, the Internet of Things can transform data analytics, allow for dynamic pricing, and will doubtless change the face of everyday products.

In this paper I focus on the hydraulic aspect of the smart city as a potential mechanism to alleviate the world's water woes, honing specifically in on water distribution infrastructure and the smart water meters that are used to monitor water consumed by residents and businesses in developing countries. The overarching research question is *“What social and political effects do new water infrastructures, particularly smart water meters, produce in highly unequal societies?”*

For this project, I studied the use of smart water meters in Cape Town, South Africa to alleviate the city's water struggles in the light of increased water austerity measures and the impending “Day Zero”, a concept city officials introduced early in 2018 as the date when Cape Town will “go dry” due to an acute drought and the city's rapidly diminishing water reserves. Once Day Zero sets in, most of the city's water resources will be rerouted from residences to 200 established water collection points at which residents will queue to collect their water (though essential services such as hospitals and schools will receive rationed water). Disputes over water demand in Cape Town have been well documented over past decades, though the city only recently introduced smart meters into its arsenal of technologies. Given the potential for developing countries that struggle with water resources and infrastructure to leapfrog incremental improvements and adopt the most contemporary smart water technology, it is

essential to assess the political and social consequences of doing so in order to ensure the technology works to promote sustainable development. Thus, I develop a methodological framework to assess the impacts of smart water meters by identifying similarities and differences between the social tensions evoked by previous attempts to manage water resources in South Africa and those that emerged in response to smart water meters. I examine the implications of introducing this technology so that my analysis may also inform and dialogue with related studies of smart water technologies in other water-stressed areas, such as the Jordan River Valley and the Amu Darya river basin. This framework aids in the creation of more equitable plans for deployment of the technology in keeping with the idea of the inclusive smart city, in which technologies not only serve environmental purposes, but also further social equity. While lessons in smart water technology are difficult to translate from one case to another, an analysis of Cape Town's hydropolitics can nonetheless be beneficial for identifying key issues with smart meters and potential solutions (and occasional burdens that accompany them) that will not inflame social tensions and perpetuate instability.

## **II. Methodology**

I chose Cape Town as the primary case study for this project because of its biophysical components (i.e. historical drought, geographic location, and mismanaged water), its history of corrosive social and ethnic divides, the policies enacted over the decades, and its status as an urban hub in a developing nation that has the technical capacity to implement state-of-the-art technology. There are other areas saddled with dire water situations, such as many Middle Eastern states of vital importance to U.S. and global security interests, but they are in different stages of development and the technology must be tested in some other slightly more stable parts

of the world before it can be deployed in those contexts. Thus, Cape Town is an appropriate case study to examine how smart water technology can articulate these contemporary water debates. The water crisis that took hold of the city during the winter of 2017/2018 made this a timely and pertinent study. This research strives to identify lessons that can be learned in how authorities administer this technology in a cost-effective way that does not unfairly target certain communities.

*Notes regarding terminology:*

Below are key terms and concepts that appear frequently in this research. They are described using definitions that best fit their applications to this paper.

- References to “the government” mean the local government in Cape Town unless otherwise specified.
  - Cape Town’s municipal government (and the larger Western Cape) is currently controlled by the Democratic Alliance (DA) party, one of South Africa’s largest political parties. Western Cape is the only South African state under DA control; the others are administered by the African National Congress (ANC), the same party that controls the federal government. Previously, Cape Town was lauded as an example of good urban governance under DA mayors Helen Zille and Patricia de Lille, though this status crumbled once the severity of the water shortage became clear (News24, 2018).
- Level 6B water restrictions went into effect on February 1, 2018 in Cape Town, limiting water consumption to 50L per person per day and increasing tariffs for those who do not abide by these limits. (City of Cape Town, 2018). These restrictions figure significantly

in the “new” water demand management regime referred to in this paper.

- The hydrosocial cycle is a socio-natural process by which water and society shape and remake each other over space and time (Linton and Budds, 2013). It is an ever-evolving process that changes how residents relate to water socially and politically and how water (or the lack thereof) influences social behaviors. It is an especially potent framework for examining the social, political, and economic ramifications of urban water circulation due to the high density and political aspects of people sharing water resources.
- Smart water meter and water management device (WMD) are used interchangeably in this thesis. Typically, WMD refers to the meters used in Cape Town as this is the term locals use to refer to the meters.

Here, I describe the hypotheses that informed and were confirmed by my analysis. First, water technology deployment is reflective of endemic societal, ethnic, and political issues, especially when price changes figure prominently (as they did in Cape Town with the imposition of level 6B usage restrictions). Confusion and conflicts regarding the implementation of the smart meters arose because the political motivations regarding water sector reformation are not reconciled with public sentiment, which inflames existing social tensions and reduces political capacity to implement new water technologies. In other words, stakeholders are not aligned and do not effectively communicate with each other. Yet, political and social challenges facing smart water technology in new frontiers are not specific to the smart water meters; rather, they are manifestations of social struggles that are articulated by the introduction of any new technology concerning a resource important to development and quality of life. Therefore, tensions



surrounding prepaid analog water systems or whatever water system was previously in place can be used to map social and political problems with new technologies in the future.

To frame my research, I analyzed the current debates surrounding water technology in Cape Town. Most of the information for this part of the project was obtained from secondary data and previous discussions of these issues. There are several key points of contention that I study. One that has already been thoroughly explored by previous scholars is the conception of water as a human right as opposed to water as commodity (Turton, 1999). This debate is at the heart of water politics across Africa, Asia, and the Middle East, and its implications are significant for the success of capitalist creations in other cultural contexts. I explore this dichotomy in the context of metered water access in Cape Town.

Another debate of consequence is that surrounding the value of prepaid water meter systems. This debate is particularly salient in Africa. Prepaid water meters were introduced as a method of monitoring industrial and household water usage with the goal of providing water to poorer residents, and they have been popular among African regimes. However, prepaid meters, particularly for water, have been construed as anti-poor because lower-income groups have to pay ahead for their period's worth of water when their access to the utility could be cut off or incapacitated for any given reason. This system leaves them with no bargaining power and lacking assets they should otherwise possess. This is especially true for those employed in the informal economy without a reliable source of permanent income. However, proponents of prepaid water meters contend that they are not inherently anti-poor because they allow those with erratic or informal incomes to pay with the money that they know they have and then to budget their consumption according to what they paid for. The World Bank and its like have published reports on the merits of prepaid systems in Africa and developing countries, which is a primary

source of data for exploration of government intentions and public perceptions of how water is disclosing inequities.

Furthermore, I engage with scholarship that dismantles the pretense that smart water technology is equated with greater consumer choice. Though smart water meters may be intended to empower consumers, oftentimes there is only one option for a utility provider, or else city management mandates devices to some extent. Streamlined prepaid and smart connections eliminate many intermediaries, which, although usually beneficial for consumers, can give the company in question a monopoly over water supplies. The utility provider usually decides which system to implement, which discounts consumer input and runs counter to the premise that smart technology promotes individual agency. My research on smart meters shows that the role of Cape Town's local government has become very contentious as a result of this debate. Thus, this paper examines the conceptual discursive complaints surrounding the transformation of water management in Cape Town. Neoliberal policies tend to be at the root of much of this conversation and apply to other studies of water governance. This thesis will link to the literature on neoliberalism by arguing that new water technologies redefine relationships between residents and the state.

### Data Collection

Engaging with the scholarly debates and frameworks outlined above, I analyze both primary data and secondary to assess social and political responses to the implementation of smart water technology in Cape Town. Given the nature of this project, I rely primarily on qualitative data. I look heavily at government documents and records, which are fortified by quantitative data, either in accounting what is currently happening in-country or in articulating

sustainable urban development ambitions. Statistics are inherently political, particularly when published by a body with an agenda, so I attempted to obtain data with as little bias as possible. Discrepancies between these documents and actual practices reveal differing political and/or economic tensions behind managing water issues. A significant portion of the material was drawn from media sources, both social media and conventional news channels. Social media in particular provides new platforms through which officials and citizens can interact. Individuals can receive updates from their politicians in real time, and people in power have a new method of crafting their own narratives. Such networks can be outlets for frustration, means of communication, and tools for organization. A key source of primary data comes from virtual conversations with people involved in Cape Town's civil society sector. While combing through Facebook pages centered around the water crisis, I sent a cold email to the address listed on the Water Crisis Coalition's Facebook page ([watercrisiscoalition@gmail.com](mailto:watercrisiscoalition@gmail.com)) and was put in touch with local businessman Riyaz Rawoot, who has become a leader in the opposition of city water austerity measures and is personally invested in the water situation in the Newlands community. Mr. Rawoot was able to answer some questions I asked him directly over WhatsApp. His responses are included in the analysis below. In addition to these comments, he shared with me 186 photos of the situation on the ground that convey the realities of everyday life as a result of the water restrictions in ways that words could not. Selected photos are included in Appendix B. Mr. Rawoot kindly included me in a group conversation over WhatsApp with sixty other civil society members, exposing me to their digital discourse. Being incorporated in this conversation allowed me to glean nuggets of information about what people in Cape Town consider to be the most contentious issues, get a better idea of the assumptions they are making about their government, and hone in on individual responses to the conflict.

Secondary data comes from other studies conducted both in South Africa and in the international community about politicization of water systems and the resulting social or political conflicts that arose as a result. Going into the field to conduct interviews with the populace and government officials would strengthen this research, though that is beyond the scope of this project due to time constraints. However, obtainable data can yield significant insight that will be applicable for policymakers and community leaders around the world.

In this paper, I explore more about the lived experiences of water in South Africa and attempt to understand how people of various social strata and ethnic backgrounds experience the social and political consequences of water management policies, especially given the water crisis the country is currently facing. The data come from news and more personal sources; I reached out to civil society leaders in the Cape Town water sector and connected with them by means of a shared WhatsApp group chat. This approach allowed me to access personal insights of key interlocutors and civil society groups, enabling me to understand how leaders on the ground are communicating with each other about this issue. As traveling to Cape Town to conduct fieldwork was not possible, this provided me with a better idea of how local individuals conceptualize the new water regime and problems, especially given the timeline of this project.

### **III. Literature Review**

Scholars have dissected the complex relationships between politics, infrastructure, ecology, economics, and sociology in cities for decades. Socioeconomic equality is characterized in part by equivalent access to biophysical utilities at a reasonable price, and as long as this access is denied, progress past eras of racial and ethnic tensions is unattainable. Research indicates that, going forward, cities in the Global South cannot pursue efforts to extend utility

services to poor populations without taking broader sustainability and job creation goals into account. City development plans that lack a comprehensive understanding of the political implications and the inherent conflicts which will arise as a result of them are unlikely to institutionalize beneficial practices (Pieterse, 2008). Thus, the ideal of the equitable smart city must remain at the heart of every step of policy implementation. This literature review summarizes findings from scholars of the hydrosocial cycle in urban areas and socio-political approaches to urban water before addressing scholarly literature regarding smart technology. Using these theoretical approaches as a backdrop, my analysis provides a new methodological framework used to understand the evolving techno-politics of urban water in developing countries, specifically South Africa.

i. The Hydrosocial Cycle in an Urban Context

The hydrosocial cycle is defined as a socio-natural process by which water and society shape and remake each other over space and time (Linton and Budds, 2013). This analytical framework attempts to bridge the naturalist/materialist and humanist binary that has characterized the scholarship of water and society for decades. Scholars working in this vein unite these two schools of thought, giving rise to conceptualizations such as Bryant's "object-oriented philosophy (OOP)" (Bryant et al, 2011) as well as Meehan's "tool-power" (Meehan, 2013). Object-oriented philosophy does not define materials as inherently powerful, but rather as tools through which socio-political paradigms are articulated, and their deployments, especially in urban areas, are critical to constructing lived social experiences. Expanding upon this idea, Meehan theorizes that infrastructure itself cultivates and/or delimits state power. Her work in Tijuana, Mexico explores the role that water networks play in cementing or confining the

government's control over resource distribution for political ends, as water technologies can "transform power geometries" and provide opportunities for citizen exploitation (Meehan, 2013). Analyzing physical entities as wellsprings of tool-power, as Meehan calls them, allows for a more dynamic understanding of the interactions between the state and the populace as told by way of water infrastructures. Here again, the emerging consensus in the literature is that experts must account for "historicized and politicized understanding of the cultural and discursive as well as the economic and technological dimensions of exclusion" in order to develop innovative and adaptable solutions to contemporary water issues (Kooy and Bakker, 2008). This object-oriented, tool-power approach to a city's hydrosocial cycle will inform the analysis of this paper as I explore the relationships between the city of Cape Town's deployment of smart water meters, articulations of state power, and the associated social frictions.

Scholars agree that it is essential for future work regarding smart water to understand divergent conceptions of water scarcity amongst stakeholders. A key theoretical breakthrough in this vein is the idea that all environments, natural, urban, or otherwise, are socially constructed, which enabled scholars to unite the two previously separate schools of thought (Swyngedouw, 2003). Swyngedouw also concludes that Marxist approaches to urban political ecology remain informative as scholars continue to excavate urban water issues. Mehta posits that water scarcity is typically "naturalized" by people in power, as they blame natural turns of events for modern problems and do not acknowledge human mismanagement of water. She creates a binary of "constructed" scarcity touted by politicians as opposed to the "material" water scarcity at the biophysical level, calling for institutional responses to both types to support sustainable water management (Mehta, 2011).

Leading scholar on environmental justice Julian Agyeman claims that there exists a better way of employing modern technologies to “create more just, inclusive, and environmentally efficient economies and societies” than past implementation did (Agyeman, 2015). Focusing on the people rather than the technology itself can make all the difference in the inclusivity of the city. Yet, Agyeman contends that leaders tend to chase technology over humanity. Other scholars agree that focusing on citizens’ lived experiences of water is of far greater importance than the technology itself. This understanding works in tandem with Meissner’s concept of “critical solidarity,” a positivist theory weaving together neoliberal, neo-realist, social constructivist, and institutionalist ideas to address the social protests he claims arise in response to the “rational techno-centric approach” that administrators of water technology employ in South Africa (Meissner, 2017). He advocates for resolution of these socio-technical disputes through compassion, empathy, and recognition of shared challenges among stakeholders. Smart technology strives to unite these concepts, and because water holds so much cultural and political significance, smart water and all of its associated mechanisms have the potential to effectively combat the world’s water scarcity. This research evaluates the rhetoric surrounding smart water meters in Cape Town using a derivation of these multidisciplinary approaches in order to explore the many dimensions of Cape Town’s hydrosocial cycle and the pressures it faces today.

ii. Scholarly Assessments of Smart Water Technology

There is a limited amount of academic literature regarding smart water technology at the time of the writing because it is such a nascent innovation. However, some studies have been conducted on the politics of smart grids around the world. Igor Calzada’s research of smart

networks in Bristol, Glasgow, Barcelona, and Bilbao offers insights concerning the technopolitics of smart utilities. For example, his studies have found that devolution practices combine successfully with data-driven solutions to include citizens in policymaking processes, such as is occurring in Bristol, UK (Calzada, 2017). Devolution, which occurs when the federal government empowers municipal and local authorities to determine their own infrastructure plans, is inherently conducive to inclusive policies as there is more bandwidth to incorporate local public opinions and implement sustainable solutions tailored to the area in question. This practice has played a major role in activating smart grids, and it has proved instrumental in smart network success for it is essential that citizens are perceived as decision makers instead of merely data providers (Calzada, 2017). Public acceptance of smart water technology and its political implications is key to the success of the endeavor, and devolution grants policymakers better odds at deploying solutions to which their constituents are amenable. Roles of local officials in cultivating a positive or negative public reaction are important to keep in mind when analyzing the impacts of smart water technology in cases where the society is highly unequal, such as Cape Town.

Finally, scholars of this matter should bear in mind is that the implementation of new technology must come partnered with evolving institutional and socio-cultural processes (Howe and Mitchell, 2012). This is the greatest benefit of the smart city; it is intended to be a comprehensive upgrade of public services, good governance, business opportunities, and individual empowerment all in the name of sustainability. Yet this also poses the greatest challenge, as projects undertaken gradually over time do not have the same power as all-encompassing urban transformations. Furthermore, we do not understand how those transformations will translate across borders, which will have profound implications for the



efficacy of smart technology in emerging economies. Hence, Howe and Mitchell stress the importance of a change in attitude from incremental improvements in systems, which characterized the 20<sup>th</sup> century, to undergoing radical systemic change. What remains to be seen is whether or not smart grids actually function in a way that optimizes mechanical as well as economic efficiency and simultaneously promotes inclusive behaviors on the part of both the state and the citizens, and that is the area of inquiry to which this paper contributes.

### iii. Limitations in the Literature

As mentioned above, one of the greatest limitations in the existing body of literature is that there are few studies focusing on the hydropolitical implications of smart water technology. It has only been rolled out comprehensively in a few cases, and the technology itself was initially conceptualized in the first decade of the 21<sup>st</sup> century, so not much time has elapsed.

Another challenge is that in the current state of the world, ideas and technologies travel quickly, meaning that scholars lack time to evaluate lessons and consequences. This can be problematic when exporting a technology from fully developed economies to emerging ones, as doing so minimizes the role that differing histories and cultures play in techno-politics. This is exactly what policymakers intend to do in order to preserve water resources in arid regions and prevent conflict from breaking out over water in the future. However, as the previous discussion illustrated, if not properly executed, water management techniques can inflame tensions and destabilize social order. Thus, it is essential that the social and political implications of smart technology in each case are explored as much as possible, so they do not backfire. Furthermore, there is little focus in the literature on creating networks that are equipped to respond to future challenges. There is a wealth of critique of the current practices, but critics tend not to offer

alternative solutions to what previously failed. While there is an emphasis on smart networks being dynamic, self-repairing, and self-improving, little scholarly analysis exists on the implications and plausibility of such propositions, especially in developing countries. A final problem with the current literature is that existing infrastructure in developing countries is often poor, making it difficult to collect reliable data. This allows the state to politicize the numbers it produces, skewing the dependability of secondary data (Truelove, 2018).

### Contributions

One of my contributions to the existing literature is the inclusion of smart water technology in my analysis as it is relatively recent and therefore few scholars have contemplated its implications. This exploration is primarily informed by Meehan's tool-power framework. I also contribute to the discussion of Cape Town's hydrosocial patterns by incorporating a tool-power analysis of smart water meters in the context of the water crisis of 2017-2018. My greatest contribution to the public policy sphere is a methodological approach requiring a historical assessment of water-related tensions in the urban area in question so that smart water implementation in other water-scarce situations may be executed more deliberately, equitably, and successfully.

## **IV. Smart Water Technology: History and Background**

Smart water technology has been introduced as a way to curb the water stress the world is facing. Measuring water flows has posed problems for urban analysts since the era of city-states (Boyle et al, 2013), and technological innovations over the centuries have sought to improve this practice. Since the first smart water meters entered the market in the mid-2000s, they have been

adopted rapidly throughout the developed world to mitigate water losses and cut costs (Cutler, 2017). The defining aspect of this technology is advanced metering infrastructure (AMI), which enables utility providers to consistently take in data regarding a variety of factors including water usage, pH levels, leakage, and contamination and *channel this data back to consumers in a legible way* with the goal of moderating water demand (known as water demand management). While the sensors themselves form the core of the definition of smart water technology, this two-way communication is a key characteristic in making the technology “smart.” Consumers can then adjust their usage according to the reports from the utility for their own economic benefit while theoretically contributing to more sustainable water consumption patterns. Data is run through software programs administered by the utility and is also shared with other stakeholders, including government agencies, to contribute to modeling efforts or provide feedback about water distribution. This information is relayed to consumers through an in-home device (IHD) or a phone application that displays the meter’s findings using a few key metrics that inform the consumer and intend to encourage reduced use (Boyle et al, 2017). There are some cases where advanced meter reading (AMR) technology is used instead of AMI, which obtains data solely for the use of the provider and saves them from having to provide mechanisms to communicate with the public. While more cost efficient and easier to implement, critics claim AMR is less effective due to its uni-directionality. AMI water technology gained traction rapidly, even as the popularity of some other smart meters (such as electric energy gauges) stalled; according to a 2017 ABI Research report, smart water meters are expected to number 1.2 billion around the world by 2022 (Metering, 2017). In the United States, engineers have developed a so-called “deep learning” computing algorithm which simulates a six-layer human neocortex in devices, such as sensors, and has been applied to a number of contemporary technologies, such as the

entire Google Brain project, self-driving cars and language translation (Wu et al, 2015). Firms and universities are collaborating to apply deep learning to smart water networks to facilitate data collection, enhance performance modeling systems, and equip the networks to address problems by using thought processes resembling those of humans. While extremely promising, application of deep learning to smart water systems is still in its fledgling phase of creation and has yet to be deployed broadly. Cutting-edge AMI technology is at the forefront of the water infrastructure discourse, and therefore it is my focus in this paper.

i. Benefits of Smart Water Meters

These intelligent meters have tremendous potential to reduce water waste. A key feature is the technology's ability to detect leaks. Faulty infrastructure is responsible for a significant amount of the water distribution and hygiene issues that characterize many of the world's water networks, specifically in the developing world (which is home to most of the world's driest regions). Leak detection would be a huge boon to cities who employ the meters, as the sensors track amounts of water released through pipelines and how much is used or reused upon arrival at its destination. Automatic detection of failures can go a long way towards increasing water quality and efficiency.

A primary impact of smart metering is the ability for municipalities and utilities to adapt water prices according to new findings. Meters enable providers to recover costs more efficiently from the consumer as well as charge consumers only for what they use rather than instating a flat fee. Ideally, meter-related pricing would target "usually wealthy high users" of water resources in order to subsidize "poorer low users" which would hopefully discourage high users from consuming unnecessary amounts of water (Boyle et al, 2013). Changes in water pricing are

expected to alter behavior; previous studies determined that water maintains a price elasticity between -0.3 and -0.7. This means that doubling the price of water would reduce consumption by something between 30% and 70% (Warford, 2003).

While frequently touted as a silver-bullet solution, these smart water meters do not come without negative consequences. To start, it can be difficult to encourage consumer adoption of smart meters and associated in-home devices in places where analog meters have functioned quite well over the course of the 20<sup>th</sup> century. There are privacy concerns associated with connecting any device to a grid, and countries that struggle with reliably secure telecommunications systems are sure to face challenges as community leaders implement this smart technology. The meters have to be utilized properly in order to reduce consumption, which is likely to occur more frequently when pricing is a factor (which sometimes it is not). Finally, the deployment of smart water technology comes loaded with political and social implications, which can ultimately lead to resident resentment towards the technology and can cause civil unrest. The political and social implications of smart water technology will be analyzed at greater length in subsequent section.

ii. Geography of Smart Water Technology

As an emerging technology, most deployments of smart water metering have been in the developed world. Smart water meters were rolled out considerably in Australia due to its arid climate. Many of these initiatives were technically classified as “trials” and thus are lacking conclusive deductions regarding their impacts. Local governments have installed meters in both residential and industrial contexts. According to Boyle et al’s excavation of water meter deployments, areas in Australia that are undergoing to the upgrade to smart water technology

include Queensland (mostly residential, some commercial), Mid North Coast (10-15 industries, select households), and Kalgoorlie-Boulder, Western Australia (individual household meters). Other enthusiastic participants around the world include Kuwait (large scale rollout), Detroit (large scale rollout), San Marcos (city-wide AMI installation), and Toronto (city-wide installation). North America is commonly acknowledged to have the highest concentration of both AMR and AMI smart meters worldwide.

The majority of the world's growth is taking place in countries that are still developing economically. Yet, infrastructure is far from comprehensive and inclusive, and in many cases the network that exists is dilapidated and leaky. According to the water sector literature, stakeholder alignment is a key feature that often prevents sustainable technical progress from occurring in these countries (Walters, 2015) and in certain parts of the world, there is a concerted effort to unite utilities, governments, academics, and citizens to improve water networks and introduce cutting-edge technology to alleviate water stress.

In the developing world, there has been a large movement towards prepaid metered water systems in which residents pay a certain amount at the start of a time frame and are then allotted the corresponding amount of water and can manage their usage accordingly. While this method is riddled with controversy, which will be unpacked more thoroughly later in this paper, experts contend that prepaid metering can help manage scarce resources and empower consumers. Many countries are currently experiencing a mixture of prepaid analog meters and newly introduced intelligent meters, or, in some cases, prepaid smart water meters. Delhi, India has received a healthy endowment of AMR meters, as has Mumbai (Boyle et al, 2013). Ghana employs smart water meters in its electric and electromechanical sectors (Electricity Company of Ghana LTD, 2016) and in 2017 invested in 40,000 smart water meters provided by the Dutch company

Kamstrup (Kamstrup, 2017). Ghana has been using prepaid water metering since 2014, though it was met with much opposition on the basis that prepaid gauges can be construed as anti-poor. The city council of Harare, Zimbabwe moved in August 2015 to proceed with the pilot of a smart prepaid water metering system (Of Zimba, 2015). South Africa, as the economic hub of the region, has historically used prepaid water meters more than its neighbors. South Africa initiated its smart electric meter use in the Electricity Regulation Act of 2006, concentrating primarily on Cape Town. Over the course of 2016 and 2017, South Africa has begun to adopt smart water meters across sectors in Johannesburg (Johannesburg Water, 2015), and Stellenbosch University rolled out its own intelligent water meter, which is now associated with the company Bridgiot (Bridgiot). Over the course of the decade preceding my research, officials executed plans to use intelligent water meters to combat the issues in water-stressed Cape Town and the Western Cape, making South Africa one of the most significant emerging economies in the smart meter dialogue at the time of writing. Widespread adoption is still occurring around the world, which is why it is important to analyze the political effects of previous water technologies in addition to those of smart water technology itself.

## **V. The South African Hydrosocial Cycle**

### **i. Historical Context**

Water, society, and politics are intimately intertwined throughout South Africa's history. When the Dutch East India Company landed upon the shores of modern day Cape Town, they found an indigenous community, the Khoena, thriving upon a land nourished by fresh, clear mountain waters. Known to the Khoena as "Camissa," which means "clear water" or "place of much water," the abundance of water made the Western Cape an attractive location for settlers,

thus marking the beginning of the area's colonization and subsequent formation of racial and societal rifts (Von Zeil, 2011). Scholarly assessments of hydropolitical tensions in South Africa have explored the historical record of water management techniques and corresponding social issues that have emerged in response, which are important to take into account when considering the potential problems smart water meters can cause. Waves of water utility privatization periodically swept parts of the country between 1994 and 2017, beginning with the 1994 Reconstruction and Development Programme (RDP). The RDP strove to recalibrate South African society post-apartheid and reallocate state resources, which generally implied greater private sector involvement in state-run industries (Chirwa, 2004), though it was heavily critiqued for its emphasis on social equity when the country was struggling economically and did not have many resources to begin with (Nleya, 2008). In South Africa, privatizing utilities is usually associated with mechanisms of enforcing payment. Such measures can become thorny issues, especially regarding water, because people have historically not been required to pay for their water and for many people, especially poor groups, a right to water evolved synonymously with a right to life. While queuing for water and transporting it back home still imposes a cost upon consumers, the poor perceived this cost as acceptable; however, in several cases where the government instated a monetary charge for water in addition to the implicit cost of retrieving water, poor residents revolted (Bakker, 2012; Turton, 2004; von Schnitzler, 2008).

Water mismanagement can arise from different kinds of politics, and the culpability for the crisis in Cape Town's water sector is still very much up to debate. Though poor people were generally at a disadvantage under all past administrations, the previous payment regime actually worked to benefit the urban poor and those who lived in townships adjacent to big cities as they were able to tap into the metropolitan water supply without being charged for using it. Though



this water was unregulated and unreliable, it served the purposes of those consuming it. Thus, as policymakers began to demand fees in exchange for water use, the urban poor suffered disproportionately compared to wealthier socioeconomic groups. Authorities began to differentiate between the “right to water” and the “right to access to water,” claiming that the South African constitution protects the right to *access to water* but water itself remains a commodifiable good (Chirwa, 2004). This pervasive misconception is also referred to in the literature as the *free-water fallacy* (Turton, 1999). This particular discrepancy is at the root of many of the conflicts that are associated with new forms of water management, and it has not yet been fully resolved in South Africa.

During apartheid, utility infrastructure was one way for the regime to govern marginalized townships; tenuous biopolitical connections served as the only links these populations had to the state (von Schnitzler, 2008). Oftentimes, biopolitical connections (such as smart water meters) precede political representation for repressed populations (Chatterjee, 1993), though these connections have historically been implemented in ways that increase state surveillance capabilities. In the South African context, irrigation and water infrastructure development projects were implemented throughout the 20<sup>th</sup> century with the intent to employ poor whites and were ultimately successful in drawing struggling Afrikaners into jobs that enabled suitable quality of life (Turton, 2004). This practice strategically left native groups at an economic disadvantage, and as a general rule, they consumed less water than their wealthier counterparts. To this day, regardless of the city in question, the majority of water in South Africa still is consumed by a small minority of the population, a pattern known as “resource capture” (Turton, 1999). This minority, even post-apartheid, predominantly consists of wealthy white residents; as scholars have deduced, it is challenging for new leaders to divorce infrastructure

from its extractive colonial intentions and repurpose it inclusively (von Schnitzler, 2008). Statistically, South Africa is one of the most unequal societies in the world; in 2014, its recorded Gini coefficient was recorded to be 0.69 based on income data (World Bank, 2017). Hence, the outlook for reducing economic inequality is bleak. However, policymakers are aware of the uphill battle they face and are seeking more inclusive solutions to current water difficulties, at least in theory.

As a result of the gradual neoliberal transformation of the water industry over the decades, utility providers extracted payment from consumers who were in the habit of not paying for water consumption, particularly poor Africans. For example, during the mid-1990s, in a town in the Northern Cape named Douglas, authorities began cracking down on those who did not pay by cutting off access to all water services. These crackdowns resulted in sometimes violent protests pitting township residents against the connection teams. Enterprising members of the community referred to as “midnight plumbers” or “comrade electricians” installed “illegal” connections in order to restore access to water (Bakker, 2012), an example of the citizen exploitation of infrastructure Meehan highlights in her discussion of tool-power (Meehan, 2013). Some experts claim that enforced payment mechanisms are in fact government attempts to recover the costs incurred by years of providing water without charging for it, and residents of townships were billed for more than they would consume as compensation (Bakker, 2012). In addition, white populations in Pretoria organized protests in response to the nature of cross-subsidizing water consumption for lower-income Africans in townships. Cross-subsidizing entails charging wealthier populations for more water than they consume to make up for the lack of payments from their poorer counterparts. However, the wealthy who organized in Pretoria ultimately lost the case in court (Bakker, 2012). The movement to implement prepaid meters in

the 2000s shared cost recovery motives with the privatization efforts. Johannesburg waged one of the most significant campaigns to install prepaid meters, particularly in its townships, like Soweto. Antina von Schnitzler's analysis of Operation Gein'amanzi, Johannesburg's 2003 municipal movement to introduce prepaid meters, concludes that the imposition of this technology heralded a critical change in the relationship between civilian and state (von Schnitzler, 2008). Prepaid systems in contexts where water was not historically a transactional good signal a transformation of people from citizens to consumers, and water infrastructures are embedded with political content that "redefines the civil link with the state" (von Schnitzler, 2008). Evolution of citizenship is critical to bear in mind as experts attempt to implement nuanced solutions to the ecological challenges facing societies rife with inequality, such as Cape Town.

ii. South Africa and Smart Water Systems: Cape Town's Current Crisis

A relatively nascent democracy, South Africa, as well as Cape Town itself, is no stranger to political and social crises, and the remnants of apartheid still influence policymaking. Smart meters came onto Cape Town's radar in the first decade of the 2000s. Policymakers incorporated these new meters into city plans, though the tone surrounding the meters evolved significantly as the extent of Cape Town's water problems became clear and meters were perceived as a solution.

At the time of writing, Cape Town's urban water supply was in dire straits as reservoirs were depleted to crisis levels and neither groundwater nor desalination plants were capable of producing enough water for the city as a whole to maintain its current water consumption habits. On March 27, 2018, the total amount of water stored the dams that supply the Western Cape was recorded at 21.7 per cent of its normal levels (City of Cape Town, 2018). The concept of "Day

Zero” was introduced in the winter of 2017/2018 as the day on which most residential access to tap water in Cape Town would need to be shut off, forcing most residents to collect their quotas of water at one of 200 water distribution points around the metropolitan area. Areas exempt from this ultimatum include parliamentary buildings, five-star hotels (as tourism remains a critical source of revenue for Cape Town), and essential services, such as schools and hospitals. As government and private sector leaders scrambled to find solutions to avert Day Zero and mitigate long-term water stress, smart water meters were pitched as a way to manage demand for water in times of crisis as well as a permanent feature in future South African water infrastructure projects to produce water sustainability. It is imperative to pay close attention to the political consequences these smart water devices had and continue to produce in Cape Town.

a. Cape Town’s Crisis: Pricing Schedule

The tariffs introduced on February 1, 2018 as a result of the move to level 6B water restrictions indicated an enormous shift in the pricing structure of water in Cape Town. Below is a chart outlining the general increases in price for non-indigent households (City of Cape Town, 2018; Independent Online, 19 Jan. 2018):

<b>Consumption per month</b>	<b>Current tariffs - total household water bill</b>	<b>New tariff - total household water bill</b>
6 000 litres	R28.44	R145.98
10 500 litres	R109.50	R390.82
20 000 litres	R361.06	R1 536.28
35 000 litres	R1 050.04	R6 939.57
50 000 litres	R2 888.81	R20 619.57

*Source: City of Cape Town*

This chart shows that monthly prices for the first 6,000 litres of water increased by a factor 5.13.

For the next 4,500 litres, prices increased by a factor of 3.57. Once consumer use surpasses 20,000 litres per month, prices increased by a factor of 4.26. For 35,000 litres per month, prices increased by a factor of 6.61. Finally, users who consume 50,000 litres per month or more are charged 7.14 times more than they were before. Government plans promise that indigent households will receive their first 6,000 litres of water for free (Independent Online, 19 Jan. 2018; City of Cape Town, 2018). This policy is operating under the assumption that a household of four people limited to consuming 50 litres of water per day will use about 6,000 litres per month, meaning that average-size indigent households would in theory not have to pay for water as long as they were consuming responsibly (Level 6B Water Restrictions, 2018). However, should poor households exceed the 6,000 litre/month allocation, they are charged the same exorbitant amounts as the rest of the population.

## **VI. Findings and Discussion**

Over the course of this research, I sought to investigate the political and social effects smart water technology produced in Cape Town. Meters now occupy a primary space in both government and resident discourses around water demand management. As such, we must consider the nature of smart water meters in order to assess the effects they have on citizens' relationship with the state and the social fabric of a community.

Drawing on frameworks already established by other scholars of hydro- and technopolitics, my analysis of smart water meters in Cape Town unveils how this technology played out in a country still developing and plagued by inequality. As Cape Town's government placed unprecedented emphasis on water demand management devices (WMDs, an intentionally repurposed acronym many see as apropos to the socially destructive nature of the devices in Cape

Town), they were the closest thing to a silver bullet solution to the water struggles facing the city. Due to the espoused urgency of the environmental situation, authorities relied heavily on devices to help mitigate the crisis, though such devices are usually understood to constitute merely part of a city's water management plan, not the backbone of it. As a result of this lopsided, meter-focused government strategy, I analyze the hydrosocial and hydropolitical consequences of smart water technology that unfolded *alongside* concerns about water availability in Cape Town. In the following sections, I will explain how smart water meter implementation works to transform connections between water resources, residents, and the state. I explore two overarching themes regarding how smart water meters influence the hydrosocial cycle, specifically the formation of differing forms of power and inequality. The first is the inflamed frictions between residents and the state that emerged as a result of the implementation of the smart water meters. In particular, I examine how the state's use of the smart water meters work to effectively bypass existing water grievances while ultimately producing new grievances among citizens in Cape Town. The second theme is the inequality between social groups as articulated by smart water meters by means of the intentions and consequences of state-implemented policies and differing narratives between poor and wealthy residents.

## **VII. Frictions Between Residents and the State**

As a result of the evidence gathered for this project, I find that in Cape Town, implementation of smart water meters exaggerated tensions between the state and the city's residents. Meters are the objects through which the state attempts to exert control over a biophysical process and the groups of people affected by it, which harkens back to Bryant's and Meehan's concepts of OOP and tool-power respectively (Bryant, 2011; Meehan, 2014). Water meters are a particularly

intriguing source of state power because they are frequently used to exact payment from residents as well as control the flow of a natural resource loaded with cultural and environmental significance. Any society, especially one as harshly divided as Cape Town, is bound to experience friction as it develops; however, we expect inequality to lessen as the benefits of growth diffuse throughout society. Yet South Africa has been plagued by civil unrest, stunting its ability to develop comprehensively. Thus, the country is stuck in a murky middle ground in which it has access to and is able to deploy the newest technologies, though different sections of society lead disparate lifestyles and therefore make different uses of said technologies. South Africa is no stranger to controversies associated with water, as discussed earlier in our assessment of South Africa's historical context, and the introduction of smart water meters in Cape Town signaled the next chapter of the country's water woes. In this section, I analyze how meter implementation worked to a) bypass and amplify existing water grievances in Cape Town and b) create new water grievances as a function of the nature of smart meter technology and the water-scarce context in which the meters were deployed.

i. State Use of Smart Water Meters to Bypass Existing Water Grievances

South Africa and Cape Town have a long history of water grievances. For example, residents complained of leaks in public water pipes and at access points before meters entered the scene (Water Crisis Coalition, 2017/2018), particularly in poorer suburbs. Even before the introduction of smart meters or before Cape Town's current crisis emerged, residents construed water governance policies as oppressive and anti-poor (von Schnitzler, 2008; Bakker, 2012). Remnants of apartheid certainly influenced how different groups conceptualize the relationship between governance and utilities and have subsequently created varying lived experiences of

water for groups of differing socioeconomic statuses. The introduction of smart water meters aggravated these old grievances, which this subsection will unpack.

I contend that policymakers did not effectively take into account the existing water grievances when devising the city's water meter implementation strategy. I will first discuss the narrative the state constructed around the water crisis and the WMDs. To understand how WMDs relate to the issues surrounding the water system as a whole, I will analyze key complaints residents articulate with regard to WMDs, which include a) that the government is using WMDs as an alternative to fixing leaks in the water system and b) that WMDs disproportionately target poor households as a way of exacting fees for water use and meter installation. Using resident complaints as a foundation, I explore how meters function as mechanisms of state power and social organization, particularly how the new smart meters further existing tensions between the state and society.

The state's application of meters to water systems adds a new dimension to the biophysical and political pressures water already carries. The new smart water meters, which ostensibly primarily monitor water flows, are sometimes referred to as pressure management technology (Water Crisis Coalition, 2017). This terminology equates water flow with water pressure, which are at once contradictory and complementary. Aside from methods of quantification, these two ideas are fundamentally different, and equating them reveals a truth about water technology in a country such as South Africa. On one hand, the concept of "water flow" evokes thoughts of abundance, freedom, and uninhibited natural processes. On the other, "water pressure" connotes intent, that water is channeled along certain paths to achieve predetermined objectives. While pressure acts upon water of its own accord in an organic setting, the relationship between water and pressure changes when manmade infrastructure is imposed



upon an ecosystem. When this occurs, we can observe the transfer of water pressure from the biophysical realm to the sociopolitical. New actors exert different types of pressures on a previously free-flowing substance, as Anand found through his studies on water and pressure in Mumbai (Anand, 2011). Thus, not only are the smart meters a tool through which power is formed, they contribute to the way those in positions of authority can use water to further their political goals. Water itself becomes a tool for power (Meehan, 2013), a primary object through which socio-political motives are articulated.

This idea of tool-power is particularly salient when the imposed meters do not work or are associated with leaks in the water system, which citizens complain is a common occurrence (Water Crisis Coalition, 2018; R. Rawoot, personal communication, February/March 2018). In particular, my analysis uncovered resident grievances towards the government for sinking money into expensive WMD systems (as well as costly, energy intensive desalination plants) instead of simply fixing leaks in the pipes. Many of the insights regarding personal sentiments about the new water meters come from a WhatsApp conversation with local businessman Riyaz Rawoot and his associates, who are also members of the Water Crisis Coalition (WCC). The Water Crisis Coalition was created by a group of local civil society organizations in light of the water crisis starting in 2017 to formally oppose the city of Cape Town's water and crisis management policies. The WCC claimed that the city avoided simple fixes to leaking pipes by installing devices that were not up to the purported standards. These meters led to even more leaks throughout water systems. To justify their demand to recall all improperly installed WMDs, the WCC's draft manifesto asserts that "[l]eaking and defective devices led to about R1 billion of incorrect billing last year; which the City hid by "writing it off" (Water Crisis Coalition, March 16, 2018). The perceived simplicity of fixing leaks exacerbated the indignation surrounding the

smart meters; fixing leaks would have had little impact on individual lives, whereas WMD require civilians to adapt their own living habits and shoulder more responsibility for proper resource management (Water Crisis Coalition, Facebook, 2018; R. Rawoot, personal communication, February/March 2018). By placing the onus of water conservation on the citizens, the state burdened citizens with a disproportionately greater role in mitigating the water crisis.

In addition to the assertion of state control over water networks, residents opposed to Cape Town's WMDs see the devices as a way of coercively extracting payment from indigent households. This is a grievance that has been embedded in the South African social fabric since the introduction of prepaid meters (von Schnitzler, 2008). Mr. Rawoot's own opinions of the WMDs can be summed up in three words: "Punitive. Illegal. Faulty," after which he accused the city of "preying on easy targets... the poor," (R. Rawoot, personal communication, February/March 2018). The WCC's manifesto claims that civil society leaders are "totally opposed" to WMDs and calls for the removal of all those forcibly installed by the government (Water Crisis Coalition, March 17, 2018). Here, they condemn those meters that are unfairly imposed upon poor households, not the meters installed as punishment for wealthy people who regularly far exceed their water quotas. At the time of writing, this distinction has not been explicitly made in writing by opposition groups, which is a significant omission at this point in time.

Activists articulated that WMDs are an "unconstitutional force" that are used to "blackmail the poorest of the poor" into paying for water that they are not wasting (Water Crisis Coalition, 16 March 2018). Mr. Rawoot and his colleagues echoed these sentiments through our personal conversations (R. Rawoot, personal communication, February/March 2018). To

reiterate, the new WMDs in Cape Town are AMI smart water meters, meaning they provide that trademark two-way communication that separates smart water meters from their predecessors. Capetonians are sensitive in regard to this particular issue, and it is in this domain that the debate about the right to water emerges. What happened in Cape Town was another iteration of Turton's free-water fallacy debate (Turton, 1999) in which residents conceive of water as a right by relating the resource to the right to life whereas the state views water as commodifiable. The introduction of smart water meters is Cape Town's first chronicled experience with this struggle, and it is evident that those subject to the decisions of the local government perceive smart water meters as a mechanism of state oppression. To these people, meters represent a means of coercive payment extraction that disproportionately targets poor people, articulating the political objectives of those in power.

Residents complain that the state tried to usurp control of water resources by closing or using meters to restrict access to local and communal water resources, something the South African state has tried to do in many circumstances (such as in Johannesburg with the prepaid meters and in the town of Douglas when authorities cut off access to non-paying consumers) (von Schnitzler, 2008; Bakker, 2012). One example of this pattern is the government initiative to shut down Newlands' Springs Way, which services communities in the Newlands suburb of Cape Town. Mr. Rawoot, who conversed with me about these issues over the course of this project, started a petition to keep the Newlands' Springs Way water collection point open in light of allegations that the city intended to close it. This particular spring is beloved to the community, and people have depended on it to collect fresh water that runs from the mountains for decades. When interviewed about the closure and restrictions, Mr. Rawoot said "I just took the information, which stated that there was a possibility of the spring closing and we need

water, it is a life necessity. It is unfair to close access to free water, while the natural spring has been around for thousands of years” (Williams, 2017; R. Rawoot, personal communication, February/March 2018). The city’s reliance upon metered water access is so heavy that it strives to replace other more traditional water networks with the meters. What is striking about the proposition to close the spring is that residents have been collecting water at the springs by walking and queuing to haul water to their homes for generations- the very way the city threatened will become the norm should water consumption continues at an unsustainable rate. Furthermore, it is challenging to bill citizens from shared access points because it is near impossible to discern exactly who is consuming the water and therefore it is hard to accurately charge people in these contexts. The city never publicly acknowledged plans to close the springs, though they did confirm it would remain open after receiving copious resident complaints (Williams, 2017). Mr. Rawoot’s conception of “free” water will be addressed in context of the broader debate around the right to water. Regardless, though policymakers attempted to use smart meters to bypass them, old grievances around water resurfaced in Cape Town, and the consequent responses frayed the relationship between the state and its citizens.

ii. Generation of New Water Grievances

Cape Town, at a critical turning point in urban water management, was a locale ripe for unrest, and new grievances emerged as a result of the state’s use of WMDs. This section will excavate the new developments in the resident-state discourse that came to light as a result of WMDs. Public frustrations manifested themselves in different ways ranging from online rants, communication with media outlets (local newspapers, international rights organizations), and sometimes culminated in protests. References to posts and news articles discussing protests and

events constitute a significant portion of the analysis here, as I was unable to be on the ground for any of these events. Furthermore, I analyze how the state constructed a narrative around Cape Town's water crisis at the time and how these developments provoked new objections from residents and contributed to the evolution of Cape Town's hydrosocial cycle.

The opinions articulated within protests and their associated media platforms are important to consider because they contain messages that the populace at large receives from respected community groups. According to my findings, most protests were on a relatively small scale (Water Crisis Coalition, 2017 & 2018; Daily Maverick, 2018). Though these protests focus on a wide range of aspects related to hydropolitics, devices compose a significant portion of the discourse articulated by protesting groups. One key protest occurred on January 28<sup>th</sup>, 2018 at the Cape Town Civic Centre. Several hundred attendees gathered to deliver a memorandum to Cape Town mayor Patricia de Lille, who evaded the event altogether (Daily Maverick, 2018). In the case of this event, the civil society organizations (the WCC) created a harsh division between the "politicians" as well as other premier members of society (who would continue to have water flowing through their taps even in the worst-case scenario) and the rest of Cape Town, who would bear the burden of Day Zero should it come to pass. In these posts, organizations such as the WCC also creates a binary and crafts a narrative pitting the poor and middle class against the elite and the government is clear.

One new grievance that emerged in the water discourse was the inability of the state to follow through on benefits promised to the residents, particularly those in indigent households. Government-installed meters were framed as beneficial to recipients; by allowing households of "R300,000 or less" and indigent populations to "qualify automatically," the city makes these devices seem desirable (City of Cape Town, 2016). Furthermore, city plans conveyed

implementation of the meters as a benefit because indigent households could have any water-related arrears waived and the installation would be “free of charge,” (City of Cape Town, 2016). Yet, a qualitative analysis of the resident response to the new meters finds little mention of these promised benefits, indicating that they were not the boon to society the city tried to frame them to be over the course of 2016, 2017, and 2018 as policymakers initiated a large-scale (and rapid) rollout of the devices. Due to the lack of consideration of the Capetonian context, the new WMDs served as a fountain of coercive state power and the innovative nature of the technology lead to new challenges for both policymakers and consumers.

The second new grievance residents reported is that the state forcibly installed WMDs in individual households. According to those writing from a civil society perspective, the city forcibly installed meters without working with the locals to ensure it was done consensually and equitably. Analysis of resident perceptions informed by Meehan’s concept of tool-power is helpful in understanding how WMDs articulate power dynamics in Cape Town. The WCC’s draft manifesto demands a total return of water management to “the communities and the people” (Water Crisis Coalition, March 17, 2018). The spokespeople for the WCC hone in on WMDs as emblems of state crisis mismanagement. The authors of the Cape Town Water Crisis Coalition’s pinned Facebook post use the word “force” three times in a single paragraph to emphasize how little flexibility the city allowed as it sought to implement the meters, claiming that these “devices are being installed at gunpoint” and calling them “illegal” (Water Crisis Coalition, 2018). Pictures of current water collection points are included in Appendix B. Figure 5 depicts a Sunday night queue at a spring collection point in Newlands. This scene highlights the people who are already working to use water responsibly. Civil society leaders opposing government measures claim that people like those pictured are the intended targets of the 6B

water restrictions (R. Rawoot, personal communication, February/March 2018).

There is an important caveat to note regarding forcible meter installation. Contrary to the incensed public opinion, the city of Cape Town's official plans specify that households who consume more than their allotted share of water will be subject to smart water meter installation. As of 2018, the plans described on the City of Cape Town's website clearly stipulate that as part of the "effort to force consumption down... WMDs are being installed on the properties of excessive water users in both indigent and non-indigent households" at the cost of the user (City of Cape Town, 2018). In this plan, the city directly addresses the legality of these imposed meters but does not provide any specific legal justification that permits officials to enter private property and install a piece of hardware. The ambiguous nature of this part of the urban water management plan lends itself to questions about the sincerity of government overtures and how far officials are willing to go to reassert control over the situation. Furthermore, purposeful evasion of any legal statutes that would permit officials to install meters implies that the city is trying to get ahead of accusations about the legality of their actions while still trying to hide some aspect of their plan. This ambiguity contributed to the social tensions that arose around the meters with many still attacking the imposition of the meters as illegal.

Though there are cases where citizens complain of being charged unfairly for the unsolicited meter installation or of receiving inaccurately high bills (Water Crisis Coalition, 2017; Water Crisis Coalition 2018; R. Rawoot, personal communication, March 2018), the greatest causes for grievance seem to be the violation of property rights and the principles behind the smart meters themselves (Water Crisis Coalition, 2018). Public officials, smart city proponents, and water management experts tout these meters as a means to a more equitable city and an individually empowering method of utility consumption. Yet in this case, a qualitative

analysis of twelve Facebook posts on formal group pages and news articles as well as conversations with civil society leaders revealed that the means of transition to smart meters have made people feel disenfranchised as they have lost the ability to opt out or make their own choices in regard to utilities on their properties. The fact that meters are installed as punishment for overuse reinforces the loss of autonomy.

The third new grievance that emerged as a result of the WMDs was deepened distrust of the local government due to accusations of government-constructed water scarcity, epitomized by Day Zero. Further evidence of the extreme politicization of water emerged throughout the course of research for this project. At the time of writing, many Cape Town residents claim that the DA fabricated Day Zero in order to launch a “political attack on the people of Cape Town... [And] justify the rapid privatization of water restrictor devices,” (Dougan, 2018). While the reality of the situation is still playing out at this time, the fact is that residents and the opposition movement accuse the local government of devising a farcical calamity as a way of scaring people into using less water rather than taking on more comprehensive solutions to inequality in utility access and abuse of ecological resources. The city’s reaction to the water crisis during the winter of 2017/2018 raises the question of how much of the water scarcity is material and how much is constructed, harkening back to Mehta’s binary explaining how scarcity crises are managed by public officials (Mehta, 2011). Day Zero dominated the official discourse with leaders in the public sphere using the concept to persuade residents to consume less water (or else). Skeptics emerged as Day Zero constantly shifted around from April 21<sup>st</sup> up to April 12<sup>th</sup>, then back to May 11<sup>th</sup>, then June 4<sup>th</sup>, and was finally pushed back to 2019. Critics have cast aspersions onto the city government’s end game, and in March 2018 more evidence emerged substantiating the claim that Day Zero was in fact a specter invented to spook residents into



conserving water (Gosling, 2018).

Here, it is worth noting again the role fear-mongering played in the city's communication of the water problem to residents. Threatening to take away access to what is regarded as a human right is bound to change behavior if all else fails, an assumption on which the government likely hedged its bets. This provided the city with a reason to fit households with water meters, particularly indigent households (free of charge, supposedly for the consumer's benefit) that officials may have suspected of evading payment. However, Day Zero plans as they were in the winter of 2018 were not exactly built to result in the best conservation of resources or time; professors from Stellenbosch University used system dynamics to model the impacts of different Day Zero scenarios on citizens, finding that the city's current plans will result in twelve hour waits at most water collection points (Musango & Currie, 2018). Furthermore, claims abound that many WMDs are faulty, particularly in poor communities (R. Rawoot, personal communication, March 4, 2018; Water Crisis Coalition, 2018). This usually involves uncontrollable leaking, burst pipes, and readers that do not function correctly, causing residents to sometimes receive exorbitant bills (Water and Sanitation Water Demand Management Strategy, 2015/16; R. Rawoot, personal communication, February/March 2018). Could the fear mongering be part of a grander scheme to convince residents that privatization of the water sector is not the worst-case scenario? At the time of writing, this question is still largely unanswered, and I will leave it for future analysts who will understand more about how this situation unfolds. Yet regardless of the legitimacy of Day Zero itself, the existence of such questions indicates a penetrating distrust of local government in Cape Town and its willingness to provide for its citizens, further evidencing the evolving relationship between the state and its citizens as told by water meters.

## **VIII. Inequality Among Social Groups**

The introduction of smart water meters in Cape Town highlighted the pervasive inequality between social groups. Smart water meters strive to connect residents more directly to the water they consume. Ideally, this helps individuals reduce their consumption as they know exactly how much water they use on a daily basis. Current inhabitants of cities and communities implementing smart systems (usually developed nations) are used to having perceived “necessary” resources (water, electricity, food) available to them at their disposal. Though they may be constrained financially, people were historically permitted to consume as much as they could afford. In Cape Town, these new meters are associated with restricted consumption of a resource to which most people believe they have a right to access. I will examine how official policies influenced the inequitable impacts of the smart water meters, whether intended by the state or not. Furthermore, since meters are connected to water, narratives often relate the imposition of the meters to infringement on the right to life. As residents wrestled with this new aspect of water consumption, differing narratives emerged among social groups, and I will discuss how these narratives articulate inequality in Cape Town in a new sense.

### **i. The State’s Role in Perpetuating Inequality through Meters**

The city played a key role in determining the socially disproportionate role smart water meters assumed in Cape Town. This subsection will investigate the intentions the government initially expressed with regards to the social aspect of meter implementation to understand how the city’s deployment of WMDs exacerbated social tensions. State power both explicitly and implicitly articulates social relations by producing relationships between residents and water in

which some are privileged and some are disadvantaged.

As stated in the historical account of hydrosocial relations in South Africa, the country consistently records an extremely high Gini coefficient, making it one of the most unequal societies in the world. Cape Town is a microcosm of that inequality as it is such a developed city and concentration of wealth due to its desirable location. How then could a static technological device like a smart water meter apply equally to every household in a metropolis where lived experiences are tainted by racial strife and clear reminders of socioeconomic inequality? Water meters are the city's tool of choice to regain control socially, politically, and environmentally, and policymakers introduced them with such enthusiasm that it is hardly surprising their controversial implementation became a prominent feature in the discourse. Cape Town is an example of what happens when there is gross inequality in resource distribution. The discursive discrepancies discernible in the media disclose the marked variations in the lived experience of water among the public officials, the wealthy (largely white) elite, and the poor that inhabit Cape Town and its surrounding areas. From my assessment of media responses to smart water technology, it is clear that the deployment of smart water meters to mitigate water scarcity concerns in Cape Town in fact led to greater distrust of the government, as discussed in the section on new water grievances, redefined the way that the government and its citizens interact through water, and ultimately deepened the divide between wealthy and poor.

Authorities' responses to the water crisis severely lack any thorough consideration of the issues of class and race surrounding water. Though some prominent members of the government such as Helen Zille, Premier of Western Cape, actively participate in the discussion of race in South Africa (<https://twitter.com/helenzille>), they do not connect the issues of water and race. Disregarding the racialized aspect of utilities in the public sphere prevents policymakers from

ultimately making any progress. Contrary to officials' promises that these meters would mitigate the water problems (and, at least in theory, empower individuals to monitor their own consumption), the meters have only wreaked greater social havoc.

The forcible installation of the meters mentioned in the discussion around grievances is a key articulation of social inequality. Confusion around this issue could be due to increasing divergence between policy and practices over the years. According to a May 2016 presentation on WMDs by the City of Cape Town, should homeowners decline to make the switch to a metered water system, meters will supposedly not be installed (City of Cape Town, 2016). However, this was significantly before the new water restrictions were put into place, and widespread citizen outrage at waves of forcible installation in 2018 indicates that something with the city's management strategy has shifted. This suggests that the social contract established between the local government and its citizens has disintegrated, meaning less to the authorities than it did prior to the crisis. Much of the disgruntled public would attribute this shift to political motivations and the socioeconomic divisions that plague the city.

The government repeatedly emphasizes that the new meters are *not* prepaid meters, nor do they function as such (City of Cape Town, 2016). That this motif has appeared in the municipal rhetoric is meaningful because officials want to disassociate new policies from the negative stigma attached to water meters in South Africa. This stigma arises from conflicts with prepaid meters in Pretoria, Johannesburg, and other townships around the nation during the 1990s and early 2000s (Bakker, 2012; von Schnitzler, 2008) that largely punished poor groups for not paying for water. Underscoring the difference between the two devices in its communication with the public reveals the city's awareness of the historical problems encircling water demand management devices in the country. Local officials knew marginalized

populations reacted poorly to water meters in the past, and in the publicly accessible documents, they tried to dispel the negative associations residents had regarding water meters as a general concept. However, in practice, they did little to introduce the new generation of meters in a palatable fashion; in fact, the hurried implementation of the new meters only exacerbated existing grievances. If this rollout had occurred more gradually or in a less critical situation, perhaps the meters would not have come to represent social inequity as did their prepaid counterparts. This is an important implication for future policymakers to consider as new water management systems and meters are introduced around the world to mitigate water shortages. Although WMDs can function properly in Cape Town when they are used to discourage overuse by wealthy citizens, it is clear city officials misappropriated them in poor parts of the city and used them as a method of punishing indigent populations for just that: being indigent.

Interestingly, long-term government plans for smart water management devices are highly focused on indigent households, at least from an official standpoint. The City of Cape Town's website provides an easy-access channel (assuming one has access to internet, which is a loaded assumption) through which designated indigent households can apply to have a WMD installed free of charge. This municipal initiative even offers an extra 4.5 kl water per month in addition to the 6 kl baseline and promises to write off any water-related arrears. South Africa's National Framework for Municipal Indigent Policies defines "indigent" to mean "lacking necessities of life," including sufficient water and basic sanitation uses (DPLG, 2005). This document further acknowledges the many flaws of South African institutions that have excluded groups of indigents from obtaining assistance to which they are entitled and created an informal economy that runs parallel to the official South African system. This document reveals a conscious acceptance of the poor's plight by national policymakers as well as outlines a course

of action for local government to take in righting these institutional wrongs. These plans were conceived in 2005, over a decade before the writing of this paper.

Yet today, there exists little evidence of outspoken government support on behalf of indigent rights in Cape Town, even as the water crisis escalated and citizens responded roughly according to their socioeconomic status. Cape Town Mayor Patricia de Lille tweeted once to express the city's view of the poor, saying "We as [@CityofCT](#) make rates rebates to poor households available as a relief. That is the caring city we are building in Cape Town," (de Lille, 8 January 2018). This message comes off as patronizing and falls in line with the government rhetoric that the poor need help with water consumption. This message also does not align with the practices of city officials. De Lille's Twitter feed (<https://twitter.com/PatriciaDeLille?lang=en>) noticeably lacked focus on the water crisis, primarily because she was handling her own political crisis at the time, which is beyond the scope of this paper. The City of Cape Town's official Twitter account discusses the water crisis frequently in a variety of dimensions, though they maintain a positive outlook and principally encourage all residents to reduce water use (City of Cape Town [Twitter], 2018).

In an attempt to encourage water saving behavior, the city published a map of water usage indicating how much water households in Capetonian neighborhoods used according to January 2018 meter readings (City of Cape Town, 2018). The city articulated that this map is intended to give positive reinforcement to people who abided by water restriction policies and to downplay "water wasters." The theory was that this strategy would not pit citizens against each other by not stigmatizing "water wasters." Yet, this strategy inherently favors wealthy consumers, who have less financial incentive to decrease their water consumption and who might be persuaded to do so by social pressures. In releasing this map and allowing excessive users to

fly under the radar, the city revealed its bias towards the wealthy, though it was thinly disguised by positive, water saving rhetoric. Furthermore, a comparison of the city's portrayal of a wealthy suburb (Camps Bay) and a poor suburb (Nyanga) paints the wealthier resident as more conservative without accounting for household size or lack of meters. The map triggered negative responses for its creation of an "us versus them" mentality (Olivier, 2018), and reveals another means through which the city's policies highlighted differences in treatment of the wealthy and the poor.

Though the local government has relied heavily on new meters as a part of the revamped water management strategy, government strategic plans do acknowledge that highest percentage of losses in the water sector come from water meter inaccuracies (Water and Sanitation Water Demand Management Strategy, 2015/16). Acknowledgement that smart meters sometimes cause more problems than they solve is an important step. However, the state clearly has not made accommodations to account for the flaws with the meters or the plans to use them to reduce water consumption. The concessions disclosed in the Water and Sanitation Water Demand Management Strategy further substantiate claims that management has been installing the meters to further their own interests at the expense of those who suffer as a result of these meters. Awareness without action will not do anything to help the plight of the poor members of society.

ii. Differing Citizen Narratives Regarding the Impacts of Smart Meters

This subsection assesses resident perceptions of WMDs in the context of Cape Town's water crisis to understand how poor residents' perspectives differ from those of wealthy residents and how the WMDs work to accent social inequality. The evidence obtained for this paper it is not substantial enough to claim that the elite principally accuse the poor of causing Cape Town's

water struggles, but these opinions are important to consider when discussing differing conceptions water consumption across social classes.

The poor's response to the implementation of meters casts the civil discourse of class and water in a new light. Access to media gave these historically oppressed voices a new means of being heard, allowing them to share their stories. Twitter and op-eds were popular forums through which lower socioeconomic brackets of Cape Town and South Africa expressed their discontent with water management policies. Poor Capetonians active on these platforms were quick to respond to the austerity measures imposed in Cape Town in the early months of 2018. Columnist Sune' Payne wrote an opinion piece for the Daily Maverick that unabashedly attacks the view that those in townships would ever dream of wasting something to which they have limited access (Daily Maverick, 2018). Twitter bloggers reached large audiences by firing off threads explaining the role water played in their childhoods, which has been met with a chorus of agreement from people of similar upbringings (Independent Online, January 2018). According to these people, poor communities in townships and rural South Africa have been living well within their water means for decades as a result of how water has been allocated to them in the post-colonial era. Many live in areas without easy access to clean water and have been forced to carry it from trustworthy sources for their entire lives. Children are taught to ration water as routinely as they are taught to brush their teeth before they go to sleep. Smart water meters have been installed in townships, though many have deemed them unnecessary because most township and rural residents use far below the restricted amounts anyways. Those educated about the government's historical actions in townships accuse policymakers of intentionally creating water networks that did not serve poor and native populations, making it difficult to gain access to water in the first place. Thus, it is hard to imagine a poor family wasting any drop of water which



cost them so much to obtain. Among those active on online platforms, the outrage for this misplaced blame is tenable, and, while justifiable, these sentiments contribute to differing narratives of the water crisis according to different social groups. Activists claim that poor African people who grew up with limited access to water will survive this crisis while the whites will suffer because they come from backgrounds requiring differing levels of resilience.

The concept that water meters connect consumers more directly to the resource they are consuming is important to consider for assessment of wealthy narratives. In Cape Town, social groups are generally shaped by relics of the colonial social structure. It is important to note that narratives among the elite vary, and the scope of this research (as it was conducted remotely) was unable to ascertain a comprehensive narrative detailing elite sentiments about inequality in light of the water crisis. However, many members of the Water Crisis Coalition and opposition groups criticize the city's water governance as favoring elites and being, on the whole, anti-poor. This section discusses the effects the smart meters had on wealthy people in Cape Town.

In Cape Town, I find that smart water meters frustrated wealthy water consumers because they are required to think about ecological processes as mosaic of pressures and adapt their consumption accordingly. Changes like these affect their daily habits, which intuitively results in resistance. By educating consumers about what they are using, properly-utilized smart meters and their associated in-home communication devices force people to come to terms with biophysical realities from which they had previously been removed. While this can be good for sustainability efforts, such a change can also result in a rude awakening about resource consumption. Coupled with the fact that government-imposed level 6B tariffs place greater responsibility on citizens for resource conservation, changes in the water demand management regime inflame tensions among those who bear the costs as well as widen civil rifts. Yet the

harsh reality of making people aware of their water consumption aggravated relations among groups. It was possible for people to petition to increase their daily quotas (City of Cape Town, 2018), but this was only on temporary grounds and it was an opportunity generally only afforded to the wealthy.

As the water emergency unfolded over the course of 2017 and 2018, some of the middle and wealthy classes expressed that they felt like they were bearing the brunt of the suffering imposed by water austerity measures. Interviewed for an Independent Online article titled “How the Rich are Dealing with the #WaterCrisis,” a Camps Bay, Clifton Ratepayers Association spokesman Byron Herbert indicated that people belonging to wealthier social strata have different conceptions of how to cope with water stress than do poor groups. Representing two affluent suburbs of the Western Cape, he was quoted saying:

*“When we speak to our staff from poorer communities, they don’t appear to understand the urgency of saving water and that is where one needs to speak to people in a narrative that they will understand - not a language they understand, but a narrative,”* (Tswana, 2018).

Herbert’s contention regarding poorer communities’ differing understandings of urban water begin to reveal dimensions of the core of the class conflict that encompasses hydropolitics in Cape Town (and South Africa as a whole). When wealthy and middle-class bodies are suddenly experiencing the consequences of environmental mismanagement, inequitable politics, or sheer economic recalibration, the people affected are quick to blame those they identify as separate from themselves. Some members of the elite classified the poor as “too many,” and as a result, wasted water that they did not appreciate; more forgiving accounts attribute water waste to the fact that poor people constitute a major portion of the population and they have historically not been able to afford water demand management systems (Eberhard, 2018; Sieff, 2018). I also observe these people using their influence and status to make their struggles known and spurring

the government to take action, which it has not done even though the poor have been struggling with water resources for decades. Though Herbert speaks of narratives that poor people will understand, he is crafting one of his own so that the wealthy come across as enlightened and proactive. It is evident that the rich view themselves as the victims of a nationwide dilemma; victims who have made sacrifices (i.e. filling pools with non-potable water and switching to artificial grass that does not require constant watering) in the name of the greater good whilst the poor continue to squander the resources for which they do not care to pay because they cannot comprehend the magnitude of the water problem. Yet the reality of the situation is that the wealthy will always have access to another resource that can save them from almost any catastrophe: money. Despite warnings from environmental activists (and the government), the rich can afford to drill their own boreholes for anywhere between USD6,000 (Sieff, 2018) to USD15,000 (Cheslow, 2018) to tap into underground water reserves. Money also affords them the opportunity to relocate. Poor people do not have the luxury of paying for alternatives, which separates their perspectives from that of the rich and works to construct differing narratives that have yet to be reconciled.

## **IX. The Equitable Smart City and Cape Town**

Smart cities require smart governance. Devices can only work to benefit society if they are employed effectively. The analysis conducted over the course of this research revealed a wealth of frustration and unrest in Cape Town's hydropolitics due to newly introduced smart water meters, which figured prominently in shaping the city's current water paradigm and hydrosocial structure. Thus, understanding the evolution of techno- and hydro-politics an important endeavor. Cape Town's situation further substantiates suggestions made by previous

scholars of smart cities and techno-politics (Agyeman 2015) about the importance of good governance of utility infrastructure.

The evidence discussed in this paper indicates that the issues facing Cape Town during the beginning of 2018 were largely a result of poor governance and mismanagement. Newly conceived water management plans fell short of expectations because they were constructed by politicians who have historically implemented policy using processes of social exclusion. The water meters were no exception. Despite the rhetoric espoused in official documents about supporting indigent households, the division of the policy between indigent and non-indigent people is itself subject to inequitable execution of the policy. This is especially true in terms of this research because of the values embedded in water. While essential to identify the nuances of each group impacted by a policy and make accommodations accordingly, Cape Town's officials did not understand the lived experiences of water or how they varied amongst their constituents. They understood the severity of the environmental situation enough to spin it into a socio-ecological crisis, though many experts and residents now doubt the inevitability of the fabled "Day Zero" (R. Rawoot, personal communication, March 4, 2018).

Previous scholars of smart technology communicated the efficacy of devolution, or empowering local authorities instead of national leaders, in policymaking (Calzada, 2017). In accordance with this school of thought, one might think that since the city of Cape Town and its leaders had significant autonomy in the introduction of smart water meters, they would have been better able to adapt the technology to suit the city's characteristics. However, due to the lack of functional integrity of the meters and the social friction they caused, it is evident that either the devolution framework does not always work or policymakers in Cape Town did not wield their power appropriately. After analyzing the evidence obtained for this project, I surmise

that the fault lies with Cape Town's policy implementation. There is not enough evidence to reject the plausibility of devolution in other circumstances, but in the case of Cape Town, policymakers did not take the necessary steps to ensure a smooth technological transition. The cornerstone of devolution is public acceptance of policies (Calzada, 2017). Ideally, devolution incorporates citizens into the process as decision-makers, not just consumers or data providers, which is empowering in and of itself. However, that is not the framework the city followed in Cape Town, which contributed to the exclusionary nature of the endeavor discussed above. In order to make this technological evolution successfully, cities must make a more complete and thorough transition as recommended by Howe and Mitchell in all realms of society.

Evidence gathered for this project further substantiates the concept that water management policies disclose social power relations (Truelove, 2011). Whether those in power always understand that water is available as a tool for power and exploit it as such is another question, but in the context of Cape Town, decades of concerns regarding city water usage (de Koker, 2011) pushed ecological concerns to the forefront of most agendas. Though it may be tempting to attribute issues surrounding water to experimentation with a new technology, there is enough evidence to suggest that Cape Town's policymakers were conscious enough of the importance of water, the historic tensions related to water management, and the divides embedded in society to foresee that these meters could cause further problems. Yet, with this contextual framework in place, they still elected to deploy these meters in ways that were construed as punitive and unfair by both poor and wealthy groups. However, these groups experienced different negative impacts and this analysis finds that the poor were punished relatively more severely than the wealthy.

Inherently exclusive policies run directly counter to inclusive smart city ideals.

According to civil society members involved in water management, communities with defective WMDs are already facing their own Day Zero as a result of the manmade devices (R. Rawoot and group, personal communication, March 4, 2018). This result is exactly the opposite of what smart water technology is supposed to do. To understand why the water meters did not work, I return to Aygeman's and Messiner's contentions that techno-centric development policies mean little if project leaders lose focus on the human aspect of the city. Cape Town's policymakers are poster children for this fatal mistake. Instead of allowing smart water meters to be a matter of choice and a means of consumer empowerment and equitable resource distribution, inept officials deployed the meters in a hasty fashion and corrupted the function of the technology so that it could not work in a just and equitable way.

## **X. Conclusions and Future Considerations**

The intent of this paper was to discern the effects of smart water meter implementation on social and political relations in a relatively unequal society. Our world is becoming increasingly flat, facilitating technology sharing, which has the potential to expedite sustainable practices if utilized correctly. As policymakers around the world turn to technological solutions to their problems, it is essential to exercise caution and think through the potential consequences of these changes. This is especially true when using new technologies; given the relatively recent advent of smart water technology and its ilk, it can be near impossible to anticipate how each society will respond to the new realities created by new policies and devices. However, these technologies have profound implications for different social groups and they are inherently political. Below is a summary of my findings from a qualitative assessment of media discourses and government policies, followed by a discussion of considerations for future policymakers working with smart water technology.

This research revealed two primary themes that permeate the social and political realities of smart water meters in Cape Town. First, the implementation of smart water meters worsened relations between residents and the state by amplifying existing water grievances and creating new ones in the process. Using the water crisis as a pretense for a massive water demand management scheme, local authorities tried to bypass existing water tensions by means of meters and their cutting-edge technology; however, my analysis demonstrates that old grievances constitute a significant portion of the discourse opposing smart meters. Furthermore, residents see meters as a method of extracting payment from poor consumers. This is a new iteration of the long-standing debate around whether citizens have a right *to water* or a right *to access to water* (Chirwa, 2004). Cape Town's government stands by the South African principle that the right to access to water is protected, though water itself is still commodifiable. Here, the perspectives of residents and the authorities diverge enormously, aggravating tensions between residents and the state. To exacerbate the incongruent implementation of the meters, residents who have had these meters imposed upon them often report that they are faulty, at times shutting down and cutting off the household's entire water supply without cause. This is one of the new water grievances that figure prominently in the narrative of those opposing the government, and the idea of dysfunctional devices interfering with access to water damages the citizens' relationship with the state. Frictions between state and citizen became even more salient as the government fabrication of Day Zero came to light, even as the city continues to run dry (Gosling, 19 March 2018).

The second chief finding of my research is that smart water meters explicitly articulate social inequality in Cape Town. Differing narratives from the poor and wealthy populations highlight the variations in lived experiences of water in the city. In the context of the water crisis, meters enhance resident awareness of their ability to consume water, and they become more

conscious of their social standing. In this case, these two concepts are inextricably linked. The rich may purchase more water to use in their daily lives and are more able to ensure a supply of clean water in their homes even in times of drought and purchasing a water meter does not impose much of a cost upon them. Poor people do not have this luxury, and an automated device that restricts their water use is a constant reminder of their inability to pay for a life with equal access to a basic resource as their wealthy counterparts. Government strategies would in theory help indigent households manage their water more efficiently and would provide other benefits (i.e. waived outstanding water arrears) to individuals. However, evidence from social media and sentiments expressed through personal conversations with local civil society leaders suggests that these benefits have not been maximized, and local officials have in fact installed water meters inappropriately and illegally. On the other hand, the wealthy's lifestyles were also affected by the water crisis, and narratives from this section of society reveal that the introduction of the meters drove a wedge between the wealthy and poor and articulates the societal differences in new and tangible ways that is bound to aggravate inter-class tensions. I expect that the introduction of any new water management system would create social and political friction between the classes as well as aggravate the larger public into mobilizing against those in charge of the systemic change.

If the smart water technology craze continues to spread as rapidly as it did over the first half of the decade, how do policymakers implement the devices and policies effectively in the future? As a result of a qualitative analysis of smart water meters in Cape Town, I conclude that it is difficult to formulate a blueprint that will work in every city. Each urban area has its own hydrosocial and techno-political contexts which have been formed and reshaped by too many factors to predict exactly how residents would react to such a comprehensive shift in technology



and governance. Thus, new technologies must be dynamic enough to adapt to the nuanced challenges each city presents. Lessons from Cape Town raise the question of whether or not smart water meters would be more successful in more equitable societies. While an interesting line of inquiry, many of the water scarce environments around the world that would benefit from the technology are brimming with socioeconomic and political tensions, rendering this question moot for the purposes of crisis management. However, the findings from Cape Town's water crisis and reaction to water meters indicate that factors determining inequality *must* be taken into account when deploying such technology, particularly when it involves access to utilities and basic resources. Proper governance is crucial. Stakeholder alignment, and at the very least mutual understanding, is key. Cape Town lacked both of these elements when the local government unleashed WMDs on the city. Political motives overcame concerns of environmental health and social equity, the two basic tenets of smart technology. Future leaders hoping to modernize their municipalities by means of smart water technology need to consider the hydrosocial histories of their respective cities and seek out ways to mitigate heightened concerns about social inequity.

Finally, cities must work with other parties in implementing the water meters, especially civil society and business leaders, though international input could be beneficial as well. This is important to keep government officials from weaponizing meters for their own gain, as they have in Cape Town. A more business-like approach may be beneficial here; perhaps by implementing a cap-and-trade-like system where members of different social strata can trade water rights in exchange for cash or another form of reimbursement, policymakers could assuage some of the inequities Cape Town experienced as a result of WMDs.

Ultimately, smart water technology can still be used for good. However, the situation in Cape Town during the first half of the 2010s is a clear example of what can happen to urban hydrosocial structures when water meters are deployed incongruently. As one of the first major case studies in how smart water management can go awry, it is essential that future policymakers consider the mistakes made in Cape Town and the subsequent social and political issues that arose. Going forward, those working with smart water technology must stay true to the principles of enhanced equality and environmental conservation in order to maximize meter efficiency, stimulate social well-being, and preserve precious water resources while they exist.

**Appendix A: Cape Town Water Crisis Coalition Media Releases and Facebook Posts**



Figure 1. Graphic posted as a part of the WCC’s attempt to expose what they view as government fear mongering to justify the installation of WMDs in Cape Town (Water Crisis Coalition [Facebook update], 6 February, 2018)

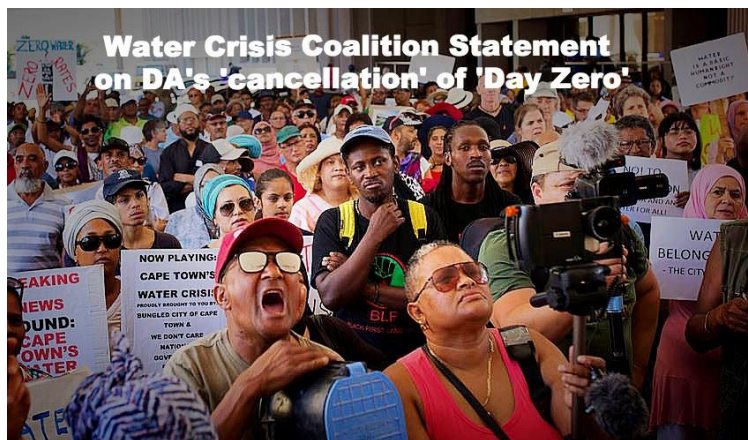


Figure 2. Members of Cape Town’s Water Crisis Coalition protest the DA’s “conjuring” of Day Zero, which they claim to be a scheme to privatize water. (Water Crisis Coalition, Facebook update, 9 March 2018).

Figure 3. Photo and graphic created on March 9, 2018 for Facebook event regarding the Water Crisis Coalition’s meeting the following week. (Water Crisis Coalition, Facebook update, 9 March 2018).



**Appendix B: Images of Cape Town During the Water Crisis**



Figure 4. *Mwai Halala, with her son, Jaden, holds water from Newlands on Feb. 3 (Subotzky, 2018).*

Figure 5. *Queues at Kildare Spring (Newlands, Cape Town) on a Sunday evening. (R. Rawoot, personal communication, February 2018).*



**Appendix B (continued)**

Figure 6. *A young boy collects water with his family. (R. Rawoot, personal communication, February 2018)*



Figure 7. *Family brings cart to help transport as much water as possible to store for future use. (R. Rawoot, personal communication, February 2018)*

## **References**

- Bridgiot. "About Us." Retrieved October 2017 from [www.bridgiot.co.za/about-us/](http://www.bridgiot.co.za/about-us/).
- Agyeman, Julian. (2014). "'Smart Cities' Should Mean 'Sharing Cities'." *Julian Agyeman*. Retrieved 2017 from <https://julianagyeman.com/2014/09/29/smart-cities-mean-sharing-cities/>.
- Agyeman, Julian; McLaren, Duncan. (2015). "Sharing Cities." Accessed November 2017.
- Anand, N. (2011), PRESSURE: The PoliTechnics of Water Supply in Mumbai. *Cultural Anthropology*, 26: 542–564. doi:10.1111/j.1548-1360.2011.01111.x.
- Baker, Aryn; Subotzky, Mikhael; Miller, Johnny. (2018). "What It's Like to Live Through Cape Town's Massive Water Crisis." *Time Magazine*. Accessed 15 March 2018.
- Bakker, K, and D Hemson. "PRIVATISING WATER: BoTT and Hydropolitics in the New South Africa." *South African Geographical Journal* 82.1 (2000): 3–12.
- Barrett, Kelli. "Is water being underpriced?" *Green Biz*. 1 October 2015.
- Bluefield Research. (2017). "Convergence of Water and Data Drives \$20B U.S. Smart Water Forecast." Accessed October 2017.
- Boyle, Thomas, et al. "Intelligent Metering for Urban Water: A Review." *MDPI, Multidisciplinary Digital Publishing Institute*. 11 July 2013.
- Bryant, Levi; Srnicek, Nick; Harman, Graham. "The Speculative Turn: Continental Materialism and Realism." *RE-Press*. 2011.
- Calzada, Igor. "The Techno-Politics of Data and Smart Devolution in City-Regions: Comparing Glasgow, Bristol, Barcelona, and Bilbao." *University of Oxford, Urban Transformations ESRC & Future of Cities Programmes*. 22 February 2017.
- "Camissa Meaning." *Camissa People: Cape Slavery and Indigene Heritage*. Accessed 4 March 2018.
- Chatterjee, P. (1993). "The Nation and Its Fragments: Colonial and Postcolonial Histories." *Princeton, Princeton University Press*. Accessed 15 October 2017.
- Chirwa, Danwood Mzikenge. (2004). "Water privatization and socio-economic rights in South Africa." *University of Cape Town, Law Democracy and Development*.
- City of Cape Town. (2018). "Apply for exemption from water restrictions." *Apply: Water and Sanitation*. Accessed February 2018.

- City of Cape Town. 27 March 2018. “Dam levels.” *City of Cape Town*. Retrieved 27 March 2018 from <http://www.capetown.gov.za/Family%20and%20home/residential-utility/services/residential-water-and-sanitation-services/this-weeks-dam-levels>.
- City of Cape Town. (1 February 2018). “Level 6B Water Restrictions.” Retrieved 2017 from <http://resource.capetown.gov.za/documentcentre/Documents/Procedures%2c%20guidelines%20and%20regulations/Level%206B%20Water%20restriction%20guidelines%20eng.pdf>.
- City of Cape Town. (2018). “Water Management Devices.” *Residential and Water Services*. Accessed February 2018.
- City of Cape Town. (2016). “Water Management Devices – Water Saving and Revenue Protection through installation of Water Management devices.” Presentation.
- City of Cape Town (2018). We've almost met our target Cape Town. Our current water consumption is 511 million litres. To get to 450 million litres, we all need to stick to 50ℓ per day. Join the [#50LitreLife](#) Challenge by calculating your actual usage here: <http://bit.ly/2thMR88> [Twitter]. Retrieved from <https://twitter.com/CityofCT?lang=en>.
- City of Cape Town. (2015/2016). “Updates and additions to existing long-term water conservation and water demand management strategy.” *Water and Sanitation*. Accessed March 2017.
- City of Johannesburg. (24 April 2015). “Johannesburg Water SOC. 2015/16 Business Plan” *Johannesburg Water*. Accessed November 2017.
- Cheslow, Daniella. (25 March 2018). “Cape Town’s Water Crisis Marks Divide Between Rich and Poor.” *National Public Radio*. Retrieved March 2018 from <https://www.npr.org/2018/03/25/596880493/cape-town-s-water-crisis-marks-divide-between-rich-and-poor>
- Chui, Michael; Löffler, Markus. “The Internet of Things.” *McKinsey & Company*. March 2010.
- Cutler, Seth. “Smart Water Metering Networks: An Intelligent Investment?” *Waste and Wastewater International*. Accessed 2017.
- Defense Intelligence Agency. (2 February 2012). “Global Water Security: Intelligence Community Assessment.” *Office of the Director of National Intelligence, United States of America*. Accessed October 2017.
- De Koker, Verelene. (2011). “Focus on Water Engineering.” *Civil Engineering*. Accessed 10 March 2018.
- De Lille, P. [Patricia de Lille]. (8 January 2018). “We as [@CityofCT](#) make rates rebates to

- poor households available as a relief. That is the caring city we are building in CapeTown.” [Tweet]. Retrieved from <https://twitter.com/PatriciaDeLille/status/950285812897341441>.
- Dougan, Leila. “#CapeWaterGate: ‘Day Zero’ is a political attack on the people, says water crisis coalition.” *The Daily Maverick*. 29 Jan 2018. Accessed 7 Mar 2018.
- Eberhard, Rolfe. (2018). “Blame game won’t solve Cape Town’s water crisis.” *BusinessDay*. Retrieved 2018 from <https://www.businesslive.co.za/bd/opinion/2018-01-09-blamegame-wont-solve-cape-towns-water-crisis/>.
- Gosling, Melanie. (19 March 2018). “ANALYSIS: Why Day Zero was Scrapped.” *News24*. Accessed 20 March 2018 from <https://m.news24.com/SouthAfrica/News/analysis-why-day-zero-was-scrapped-20180319>.
- Hutton, Guy; Haller, Lawrence. (2004). “Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level.” *World Health Organization*. Water, Sanitation and Health. Geneva, Switzerland.
- Independent Online. (19 January 2018). “Punitive tariff charge will force Capetonians save water’ - City of Cape Town.” Accessed 21 March 2018.
- Itron, Inc. (17 Sept. 2013). “Meter Data Management.” Itron Named Top Global Supplier of Water Meters and Communication Modules. Accessed September 2017.
- Kamstrup. (25 April 2017). “Intelligent water technology makes all the difference in Ghana.” *News*. Accessed 23 October 2017.
- Kooy, Michelle; Bakker, Karen. (9 June 2008). “Technologies of Government: Constituting Subjectivities, Spaces, and Infrastructures in Colonial and Contemporary Jakarta.” *International Journal of Urban and Regional Research*. 375-391.
- Meehan, Katie M. “Tool-power: Water infrastructure as wellsprings of state power.” *Geoforum, ScienceDirect*. 14 September 2013.
- Meissner, Richard. “Water Research in South Africa. In: Paradigms and Theories Influencing Policies in the South African and International Water Sectors.” *Springer, Cham*. 2017.
- News24. (30 January 2018). “What the water crisis means for the DA.” Retrieved March 2018 from <https://www.news24.com/Columnists/GuestColumn/what-the-water-crisis-means-for-the-da-20180130>.
- Nleya, Ndodana. (02 September 2008). “Development policy and water services in South Africa: An urban poverty perspective.” *Development South Africa*, pgs. 269-281.
- Olivier, David W. (17 Jan. 2018). “Cape Town’s map of water usage has residents seeing red.” *The Conversation*. Retrieved March 2018 from <https://theconversation.com/cape-towns-map-of-water-usage-has-residents-seeing-red-90188>



- Of Zimba. (October 2015.) "Hot potato at Harare's smart water meter system stakeholders meeting today." Accessed 22 October 2017.
- Pieterse, Edgar. "City Futures: Confronting the Crisis of Urban Development." *Zed Books Ltd.* New York, NY. 2008.
- Sieff, Kevin. (2018). "Divided by Drought." *The Washington Post*. Retrieved 2018 from [https://www.washingtonpost.com/news/world/wp/2018/02/23/feature/as-cape-towns-water-runs-out-the-rich-drill-wells-the-poor-worry-about-eating/?utm\\_term=.c36816327591](https://www.washingtonpost.com/news/world/wp/2018/02/23/feature/as-cape-towns-water-runs-out-the-rich-drill-wells-the-poor-worry-about-eating/?utm_term=.c36816327591).
- Swyngedouw, E. (2004). *Social Power and the Urbanization of Water: Flows of Power*. University Press, Oxford.
- Truelove, Yaffa. (2018). "Negotiating states of water: Producing illegibility, bureaucratic arbitrariness, and distributive injustices in Delhi." *Environment and Planning D: Society and Space*. Accessed March 27, 2018.
- Truelove, Yaffa. (2011). "(Re)Conceptualizing water inequality in Delhi, India through a feminist political ecology framework." *Geoforum* 42. Accessed March 2018.
- Turton, Anthony Richard. *The political aspects of institutional developments in the water sector: South Africa and its international river basins*. Diss. 2005.
- Turton, Anthony R., et al. (2004). "A hydropolitical history of South Africa's international river basins." No. 1220/1. Report. Accessed Nov. 2017.
- Tswana, Yolisa. (2018). "How the rich are dealing with the #WaterCrisis." *Independent Online*. Retrieved 15 February 2018 from <https://www.iol.co.za/news/south-africa/western-cape/how-the-rich-are-dealing-with-the-watercrisis-13062543>.
- Van Zyl, Je. (October 2011). "Introduction to Integrated Water Meter Management." *Water Research Commission*. Retrieved 2018 from [http://www.wrc.org.za/Pages/Drought/4.2/Water%20loss/water%20meter%20management\\_TT%20490-11.pdf](http://www.wrc.org.za/Pages/Drought/4.2/Water%20loss/water%20meter%20management_TT%20490-11.pdf).
- Von Schnitzler, Anita. "Citizenship Prepaid: Water, Calculability, and Techno-Politics in South Africa." *Journal of Southern African Studies*, vol. 34, no. 4, 2008, pp. 899-917.
- Von Zeil, Caron. (3 May 2011). "Reclaiming Camissa." *TEDxCape Town*. Accessed March 2018.
- Water Crisis Coalition. (2017). In Facebook [group page]. Retrieved 2018 from <https://www.facebook.com/WaterCrisisCoalition/>
- Water Crisis Coalition. (16 March 2018). In Facebook [group page]. Retrieved 2018 from

<https://www.facebook.com/groups/watercrisiscoalition/permalink/339522766558428/>.

Walters, Jeffrey P. (2015). *A Systems Approach to Sustainable Rural Water Infrastructure in Developing Countries*, University of Colorado at Boulder, Ann Arbor. Dissertations & Theses @ University of Colorado, Boulder; Dissertations & Theses @ University of Colorado System; ProQuest Dissertations & Theses A&I. Accessed 13 October 2017.

Williams, Justin. (15 September 2017). "Future of Newlands Spring decided by City of Cape Town." *CapeTownEtc*. Retrieved 26 March 2018 from <http://www.capetownetc.com/watercrisis/future-newlands-spring-cape-town/>.

World Bank. (03 May 2017). "The World Bank in South Africa: Overview." *South Africa*.

World Health Organization. (12 July 2017). "2.1 billion people lack safe drinking water at home, more than twice as many lack safe sanitation." *News Releases*. Accessed September 2017.

Wu, Zheng Y., Mahmoud El-Maghraby, and Sudipta Pathak. "Applications of Deep Learning for Smart Water Networks." *Procedia Engineering*, vol 119, 2015. pp 479-485.