Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

Challenges and Synergies for the Local Energy Transition in Local Case Studies in the Netherlands and Hawai‘i

K. Vink[1] and L. Kilolu[2]

[1] Department of Construction Management and Engineering, Faculty of Engineering Technology, University Twente, The Netherlands
[2] Department of Urban and Regional Planning, University of Hawai‘i at Manoa

Abstract. The energy transition is already underway across the globe. This paper examines two very different approaches in the implementation of renewable energy projects—the Netherlands and Hawai‘i. In the Netherlands, 27 suburbs are acting as pilot areas for the goals to transition from gas to alternative energy sources by 2050, and initiatives are implemented that allow for novel techniques and methods of cooperation and governance. Meanwhile, the U.S. state of Hawai‘i is ambitiously attempting to reach its 100% renewable portfolio standards (RPS) goal by 2045 through the implementation of solar and wind projects across its islands.

The main questions to be answered by looking at these two cases are how the current transition approach can enable reaching the sustainable development goals locally along with other policy targets, and which synergies and challenges arise during this process. The results are grouped around four themes: (1) technologies; (2) data management; (3) government/policies; and (4) society. This study examines these themes and proposes potential solutions to each of the challenges where possible, as supported by relevant literature. Special attention is paid to the educational and human resources required for the energy transition, as the initiatives in the case studies are intended to be scaled and sped up in order to fulfil the national transition targets.

By showcasing these two diverse examples of local implementation of the energy transition, this analysis assists in providing insight on the challenges for diverse communities around the world, as well as informing and inspiring communities in transition.

1 Introduction

Despite the global COVID-19 pandemic, global CO_2 emissions are still rising to levels incompatible with the goals of the Paris agreement (NOAA, 2021). Our planet is not merely overpopulated with humans, our consumption patterns and resource use are unsustainable, which is why a global energy transition towards less consumption and more renewable energy sources is necessary. Simultaneously we face continuous marginalization and inequality. The current progress on Sustainable Development Goal (SDG) #7, “Ensure access to affordable, reliable, sustainable and modern energy for all”, shows there were still 759 million people in 2019 without access to electricity (United Nations Department of Economic and Social Affairs, 2020). Therefore, an energy transition in line with the SDGs is needed to maintain and reach a decent human life for all humans. (See also (WMO, 2019), “Limiting temperature to 1.5°C above pre-industrial levels would go hand-in-hand with reaching other world goals such as achieving sustainable development and eradicating poverty”).

Our research question focuses on determining what challenges and synergies exist when implementing the SDGs, whilst also attempting to achieve the energy transition on a local scale. To reach the SDGs and transform existing energy systems, we require a fundamental rethinking and integration of urban infrastructure design. This is an urban transformation, a systemic change of the urban system encompassing more than just technologies and buildings. It is a process of fundamental irreversible changes in infrastructures, ecosystems, agency configurations, lifestyles, systems of service provision, urban innovation, institutions and governance (Elmqvist et al., 2019). As there is little experience with implementing such a transition, let alone on this massive scale, there is a lot of uncertainty, which hampers decision-making. The involved costs are high, which further delays committing to technological choices where no flexibility for future change is possible. There is a clear need for gathering, sharing, and analysing technical and financial knowledge, knowledge about methods of consensus forming and governance, and innovative educational programs that anticipate the new professions and people who will make the transition happen.

Across these contexts, overlapping factors exist which can affect each other: temporal/spatial scale, resource access, understanding/taking on responsibilities, ownership, chance/fear of lock-in. Mapping the challenges of implementing the urban energy transition with other SDGs simultaneously helps develop planning perspectives that measure synergies and trade-offs between these goals. This can aid the many cities who face policy deadlines but still await a magic wand to help create integrated and sustainable plans.

As a reading guide, in section 2 we present the framework applied to gather and analyse data, as well as background of the case study areas. Section 3 groups the results into four energy transition related thematical challenges: technological, data management, governmental/policy, and societal challenges. In section 4 we reflect on how these results impact the ability to reach the related SDG targets, and which similarities and differences we find between the case study areas and implementation strategies. Section 5 summarizes the conclusions and prioritized actions.

2 Framework

In this section we lay out the framework motivating our choices for organizing the results related to the SDGs, the four different themes for challenges, and for looking at these two case studies in the Netherlands and Hawaiʻi.

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

2.1 Links Between the Energy Transition and the SDGs

In this study we link the discovered challenges and synergies to relevant SDGs, as the ultimate goal is not only to create a clean and affordable energy system, but a truly sustainable living environment for all. We find that many policies affect the same environment and these policies are all interconnected, so it is prudent to understand how impacting one goal can affect another and identify possible synergies and challenges.

According to the International Council for Science (2017), the most important links of SDG 7 are with SDGS 1, 2, 3, 6, 8, and 13 (see figure 1). Each of these links are briefly explored below. In our comparison we identify the most important links to other SDGs per case study to discover the reasons behind the similarities and differences.

SDG 1: Affordable energy for all can only be achieved if poverty is eradicated. The minimum amount of energy and related services for a decent life are still under debate.

SDG 2: There is a direct trade-off between land-use for agriculture or for energy. Largescale bioenergy utilization impacts food prices, access, and incomes.

SDG 3: Renewable energy directly impacts air quality, and less energy intensive forms of travel such as walking or cycling positively boost health and well-being.

SDG 6: The body of literature on the water-energy nexus is large, but many studies still focus on optimizing either water or energy goals rather than reaching these simultaneously.

SDG 8: While the need for increased human capital is clear, a current research gap exists on who stands to benefit more and who less when the transition is implemented. How can we ensure workers in the current technologies and resources are not left behind?

SDG 13: The need for the energy transition is directly linked to anthropogenic climate change and what we can do to decrease our impact on heating the Earth.

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

Fig. 1. SDGs most related to SDG 7 (International Council for Science, 2017; Image adapted from: Group on Earth Observations, 2021)

2.2 Systematic Exploration of Case Studies Focusing on Four Themes of Challenges

Data gathering for the Netherlands was accomplished by a combined literature search and the project results of FiDETT (FiDETT 2021), where local stakeholders (municipalities, housing associations, construction companies, installation companies, contractors, grid operators, and educational organizers) were questioned about the issues they anticipate for implementing the local energy transition, and which phases and tasks they distinguish in the process. Data gathering for Hawai‘i was accomplished through a literature review of Hawaii’s sustainability goals and investigating publicly available government documents and data related to energy.

Combining our results, four separate though related themes emerged: technological, data management, governmental/policy, and societal challenges. Within each of these themes further links to the SDGs are possible, which we analyse after presenting our results. The reasoning behind grouping the information into each of these themes is as follows:

- Technological: Energy cannot be consumed without accompanying generation, transformation, and transportation systems and infrastructure. Existing and future mass applied technologies differ greatly and each face distinct as well as overlapping challenges to consider when deciding upon how to transition.
- Data management: The scale of the energy transition requires data beyond what is currently known. Especially intermittent energy sources of wind, water, and solar powered technologies lead to optimalization needs for energy storage. Existing

DOI: 10.3217/978-3-85125-855-4-21

aboveground and underground infrastructure (power cables, fuse boxes, etc.) need to be charted in order to plan changes efficiently.

- Governmental/policy: Traditionally governments have managed or regulated how energy is generated and distributed. Many current renewable technologies allow for more local generation and different forms of ownership than the existing infrastructure is based upon. Regardless of the scale of the transition, there are many new stakeholders involved and policies that could help smoothen or hamper the transition.
- Societal: Energy is required especially in densely populated areas, where there is less space available for energy generation and storage, leading to a spatial trade-off. The human capital required to implement the energy transition cannot be underestimated, in terms of how to educate and re-educate workers, but also how to harness enthusiasm for this sector which already faces employee shortages.

2.3 Case Study Descriptions

We explore in depth the local energy transition in the cases of Hawai‘i, USA, and the Netherlands, with a focus on the region Twente. These cases differ widely in terms of geography, government, culture, and existing energy systems. There are also similarities between these two areas. Both have ambitious goals and clearly defined targets, both in terms of energy transition goals as in deadlines.

Further, both are within developed countries with a high amount of resources and knowledge required for the proposed transitions. The goal of this comparison is to explore how these cases differ in their local challenges, the consequent local choices to reach the energy transition goals, and the resulting consequences for the related SDG targets.

2.3.1 The Netherlands

The Netherlands lies in Europe on the North Sea, with 2/3 of the country below mean sea level. There are nearly 17.5 million people on 42,000 km2 leading to a high population density of 423 people/km2 (CBS, 2021), and an energy consumption of 6,713 kWh/capita (World Population Review, 2021). The primary energy demand is 3100 PJ of which 42% is from natural gas, a large part of which comes from underground resources in the northernmost province and the North Sea. 8% is generated by renewable sources (Energy in the Netherlands, 2020). Since 1960 the energy infrastructure has been expanded based on the available natural gas, and 95% of all houses are connected to gas for cooking. The resources are now close to depleted (The Oxford Institute for Energy Studies, 2019), and extraction has led to a large number of induced earthquakes while the building infrastructure has not been made resilient against this hazard (Van der Voort & Vanclay, 2015).

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

From 2015-2019 the climate organization Urgenda has successfully sued the Dutch government to do more to implement the Paris agreement and to implement policy goals to reduce emissions with 25% by the end of 2020 (Urgenda 2021). This helped lead to the Dutch Climate Act of 2019, which has concrete goals to reduce emissions in 2030 and 2050 (Directorate-General for Climate and Energy, Climate Department, 2019; Energie van Noord-Oost Twente, 2020):

Cut CO_2 emissions in half by 2030 (compared to 1990) by 5 goals:

1. Built environment: by 2050 7 million houses and 1 million buildings should be disconnected from gas
2. Mobility (traffic and transport): by 2050 there are no emissions
3. Industry: circular by 2050 and close to no GHG
4. Agriculture and land use: climate neutral by 2050
5. Electricity: by 2030 all electricity comes from renewable sources

In concrete numbers, the expected emission and uncertainty per sector are shown in figure 2.

For the built environment and electricity sectors, the energy transition means that eight million buildings currently connected to the natural gas network need to have a different energy source, preferably renewable. To enable this, the Netherlands has been divided into 30 regions that each make their own energy strategy, and each municipality in these regions has to draft implementation plans and gather stakeholder feedback (including from citizens) in 2021. The smallest scale is the suburb or neighbourhood, which is the scale of implementation plans with a joint choice for energy alternatives for natural gas. 27 neighbourhoods have been selected for piloting projects to implement ‘gas-free’ living, subsidized by 120 million euros (National Government (2018). Other related spatial policies for implementing the Climate Act are the Delta Program for Spatial Adaptation (2017) and the National Adaptation Strategy - Implementation Program (2018).

DOI: 10.3217/978-3-85125-855-4-21

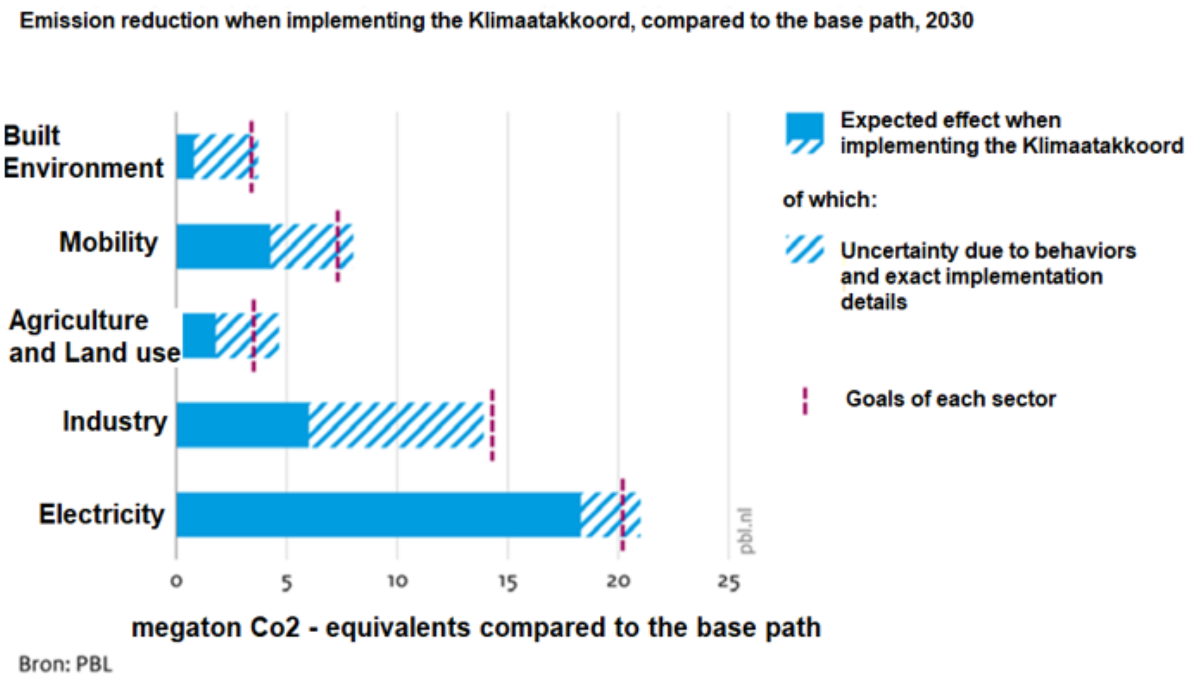

Fig. 2. Emission reduction when implementing the Climate Act (translated from Planbureau voor de Leefomgeving, 2019)

2.3.2 Hawai‘i

Hawai‘i is an archipelago consisting of eight major islands in the middle of the Pacific Ocean, with approximately 1.4 million inhabitants. By the year 2045, the State of Hawai‘i aims to have all electricity and transportation fuelled by renewable energy sources, while also aiming to become carbon neutral by that same year (Act 97 and Act 15). In the year 2017, following President Trump’s announcement that the U.S. would be withdrawing from the Paris Climate Agreement, Governor Ige and Hawai‘i’s four county mayors came together to sign two state bills and a mayor’s agreement committing that Hawai‘i would meet the goals set forth in the ambitious global climate accord, becoming the first U.S. state to do so. Other energy-related targets include a state-wide ban of coal power for electricity generation by the year 2022, a goal for the state’s light-duty vehicle fleet transition to zero emission vehicles by the year 2035, and for the state’s public schools to become net-zero in energy use by the year 2035. For a chain of islands isolated by almost 4,000 kilometres to the closest landmass (California), these ambitious clean energy goals are no easy feat. Hawai‘i has traditionally relied upon a system of importing coal and petroleum products from different countries to produce electricity. In 2019, 75 percent of Hawai‘i’s electricity was produced using fossil fuels, while approximately 25 percent was produced using renewable energy sources (State of Hawaii Energy Office, 2020).

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

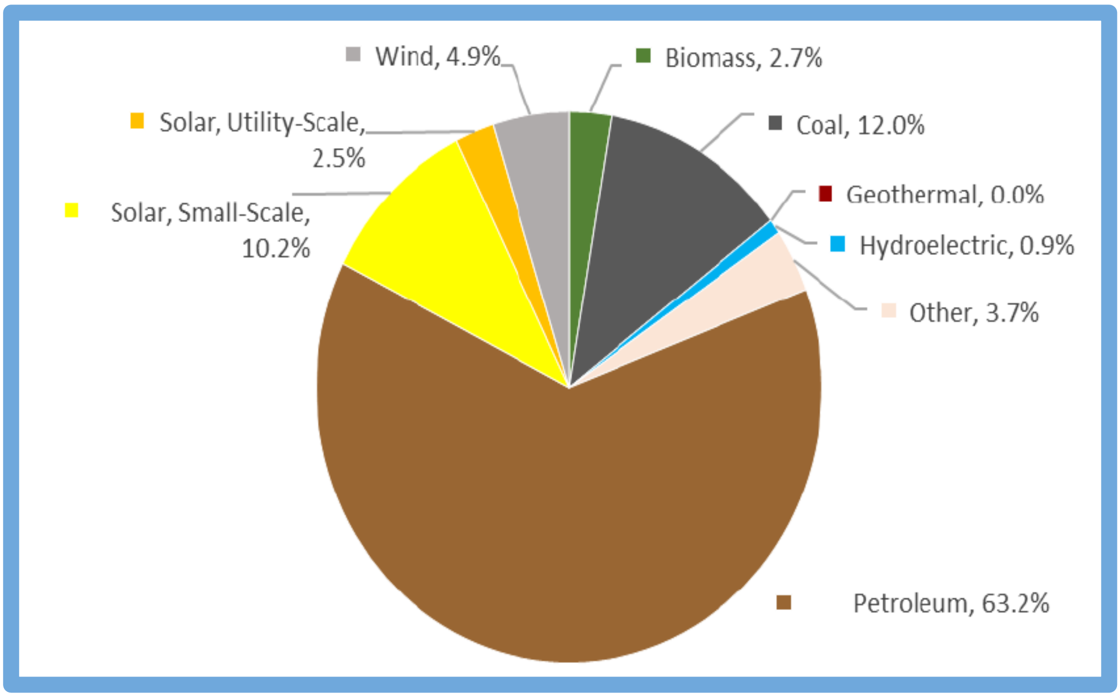

Fig. 3. How Electricity is Produced in Hawai‘i (Source: State of Hawai‘i Energy Office, 2020)

The reason for using fossil fuels for electricity is predominantly due to the economic cost—it is much cheaper to produce electricity with imported coal and petroleum products than it is to produce electricity from entirely new (or yet to be built) renewable energy systems. However, while Hawai‘i is importing these cheaper fossil fuel products, Hawai‘i still boasts the highest electricity costs in the U.S., with the average utility bill at $162.00 compared to $115.00 in the continental U.S (State of Hawaii Energy Office, 2020).

Nevertheless, Hawai‘i is taking great strides to implement a variety of renewable energy projects across its six main islands to meet its ambitious clean energy goals, which is hoped to eventually decrease energy costs in the long-term. Due in part to Hawai‘i’s isolated geography, construction costs are very high, as products, materials, and labour must also be shipped from other places. Hawaiian Electric, the major private electric utility company serving most of the islands, selects renewable energy developers through a competitive bidding process, which the State of Hawai‘i’s Public Utilities Commission (PUC) oversees and ultimately approves. Several renewable projects have been deployed and many more are in different stages in the approval process. The hope for these renewable energy projects is that they will produce clean and eventually, cheap energy to the Hawai‘i population.

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

3 Results: Challenges in Local Contexts

The following section covers the main challenges per case study area and grouped around four themes: (1) technologies; (2) data management; (3) government/policies; and (4) society.

3.1 Technological challenges

3.1.1 The Netherlands

Currently major investments are being made in solar and wind power. The Netherlands has no economically viable hydropower system possible, with the highest elevation being around 330m. Geothermal systems are not efficient in all parts of the country, and where they might be, areas are often already densely built or protected nature areas. Solar and wind power are intermittent, and the amount of critical infrastructure dependent on electricity requires a large amount of, and space for, backup storage. While initially these renewable technologies were subsidized, the existing electricity networks are being overloaded and several areas are now facing prohibitions for renewable energy sources being connected to the main network.

The main technological challenges when looking at the energy transition goals lie in implementation. In the Netherlands there are approximately 13,000 neighbourhoods, and if we look at just one of the 30 regions, Twente, there are 450-500 neighbourhoods to transition. Estimating 4-5 years to fully transition, this means around 80 neighbourhoods are in various phases of transition at any one point in Twente. Coordinating companies, available equipment, and required parts are becoming pressing. The pilot areas show that a single residence requires 50 hours to become gas free (Dubbeld, 2021). So far, in the first two years of starting and for all 27 pilot areas combined, only 206 houses are now finished (Van den Berg, 2021), proving that the scale of implementation requires increased management and coordination.

3.1.2 Hawai‘i

One of the major technological challenges that Hawai‘i faces in renewable energy deployment are interconnection issues with linking renewable energy infrastructure with the utility grid. The reason for delays for several renewable energy projects in progress are cited by the utility to be due in part to interconnection issues (Public Utilities Commission, Docket No. 2020-0136).

In 2014, the PUC released a document titled, “Commission’s Inclinations on the Future of Hawai‘i’s Electric Utilities” (2014). In this document, the Commission acknowledges that Hawaiian Electric appears to “lack movement to a sustainable business model to address technological advancements and increasing customer

DOI: 10.3217/978-3-85125-855-4-21

expectations.” This statement was based on the Commission’s belief that Hawaiian Electric’s integrated resource plan (IRP) appeared to be a series of unrelated capital projects without a strategic focus and of questionable long-term customer value. Interconnection challenges also relate to connecting infrastructure being built in remote areas, potential inter-island connections (via undersea cables), and microgrids, which are relatively new technologies that are still in development. Hawai‘i’s utility company will need to adequately address the challenges surrounding its interconnection issues to alleviate the concerns of the PUC, or risk more regulatory scrutiny. Further, as Hawai‘i is ahead of the curve in renewable energy deployment compared to other U.S. states, it is difficult to comprehensively assess the viability, benefits, and challenges of these new technologies.

3.2 Data Management Challenges

3.2.1 The Netherlands

Data supporting decision-making is a crucial part of the energy transition. A digital twin of our entire planet is already being made to support policy-makers to make steps to become climate neutral in 2050 (Ulmer, 2021). Creating a more localized digital twin of each neighbourhood has several challenges.

Aside from data gaps, existing data is not always ideal. The required data metrics of recentness, update frequency, history of data set, accessibility, reliability of methods, scale/resolution, geographical coverage are difficult to find in even a single dataset (Vink et al., 2017; Voskamp et al., 2018). For energy management, the data interval frequency could be minutes, yet there is no adequate system available to collect, manage, and store such data on multiple urban scales.

Coordinating data or data gathering also brings challenges. For ideal management, data need to be generated and exchanged between departments, devices, and regions (Li et al., 2018). This requires governance practices to settle ownership, management, and updating data. A proper impact assessment of climate change requires big datasets, which makes the calculations expensive (Mauree et al., 2019). Who pays for each step from data gathering to analysis and storage needs to be settled as well. The energy costs of data management are often not taken into account and are contradictory to the goals of reducing energy consumption.

Finally, there are privacy and safety issues concerning private citizens and organizations providing vital services. Digital twins would make data available to all users. Installation companies may need data of the inside of buildings to know how to connect cables and pipes, but other stakeholders do not. Therefore, “a new style of energy transition data management is required” (Willemsen, 2021), in which sharing enables implementation without breaching trust.

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

3.2.2 Hawaiʻi

When it comes to data management, Hawaiʻi's challenges include the lack of meaningful data transparency and the need for useful indicators and metrics for decision making. Transparency of information is crucial for sound decision-making (Bertot, et al 2010). The PUC, the regulatory agency tasked with overseeing Hawaiʻi's electric utilities, must review hundreds, if not thousands, of pages of information submitted by the utility in any given proceeding. However, the data submitted has at times deemed incomplete, or unnecessarily redacted, which has made the PUC's role in decision making more time consuming (Public Utilities Commission, 2021). Transparency in information sharing is crucial to a smoother decision-making process, as well as in building trust between the utility and government agencies.

Useful indicators and metrics are also in great need in order to justify the project costs to ratepayers. For example, an energy storage project that was recently reviewed for approval is said to provide the following grid service benefits: "...fast frequency response, load shifting capacity, primary frequency response, frequency regulation, real-time near instantaneous dispatchability, automatic voltage regulation, reactive power support, grid forming system stabilizing functionality, and blackstart capability," but when the PUC inquired if the electric had considered methods to quantify or otherwise valuate the aforementioned grid service benefits, the utility did not provide a clear answer. The lack of a clear way to quantify the value of certain projects makes decision-making also difficult, as these infrastructure projects will be in use for at least twenty years, and the costs will ultimately be shouldered by the ratepayers.

3.3 Governmental/policy Challenges

3.3.1 The Netherlands

Two large and related challenges are uncertainty and costs. No one wants to invest in something only to find out it is not as effective, requires more costs, or alternatives would have been better (lock-in effect). But no one knows yet what the best possible solution(s) might be. This leads to municipalities each waiting for others to take the initiative. Further putting pressure on the time factor is the lengthy change process in policies and building codes.

Despite the millions of euros available for the 27 pilot areas and while municipalities are positive about results so far, it is clear there are insufficient funds and authority to reach the goals. There is not an affordable solution for everyone (Dubbeld, 2021), which goes directly against the SDG principles of no one left behind. The fragmentation of ownership means that citizen organizations don't speak for all the inhabitants. Private homeowners aren't required by law to make changes and investments to their house, though a more sustainable energy rating of a house makes it more valuable

DOI: 10.3217/978-3-85125-855-4-21

when selling it. Nationally, the annual costs to implement the Climate Act for municipalities are estimated to be around €500 million in 2022, increasing to €770-950 million in 2030. Provinces and water boards are also expected to have increased costs (Andersson Elffers Felix, 2020). There is of yet no plan on how to finance these extra costs.

Merging policy implementation between impacted domains is still a slow process. Traditionally adaptation and mitigation have been treated as two different policy fields. This means that synergies between planned and ongoing measures are not exploited due to limited information sharing and poor coordination, and strategies that could potentially deliver co-benefits are not even examined (Frantzeskaki & Tilie, 2014).

3.3.2 Hawai‘i

There are two major challenges related to governance in Hawai‘i’s renewable energy policy. One challenge is the strained relationship that can occur between agencies, such as that of the electric utility and government agencies. Legislators and other political leaders may also fully support or vehemently oppose renewable energy projects, making deployment a challenge. Another major challenge is that of the permitting process. Usually, a developer must obtain a series of environmental, land use, and building permits, which sometimes can take years to be approved. The high cost of doing business in Hawai‘i is also a concern for attracting developers to pursue renewable energy projects. The procurement process involves the developer to conduct some of the project work even before the application is approved by the PUC. This means that the developer might have already begun the process of securing permits, conducting community outreach, and designing the project, while the application may be ultimately denied. More inter-agency coordination is needed to address these challenges and improve efficiency in this process. As a recent example, the governor of Hawai‘i has put together a “Powering Past Coal” task force to bring together the different agencies (i.e., the utility, government agencies, developers, and environmental agencies) to collaborate on planning as the closure of the island’s coal plant is set for September 2022. The goal of the task force is to, “convene stakeholders to increase transparency, coordination, collaboration, and urgency to timely facilitate, coordinate, and align project development and reviews by Hawaiian Electric, state, and county agencies for those measures anticipated to provide electricity for O‘ahu to replace the coal plant’s electricity…” (2021). In doing so, more efficient processes, such as speedier permitting and regulatory processes, are anticipated.

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

3.4 Societal challenges

3.4.1 The Netherlands

What is often forgotten in communicating the energy transition plans is that it is not just a transition from one type of technology to more renewable energy technologies. The transition is not just technical; a focus on emission reduction is required with the same tenacity. The issue here is that what is considered a decent standard of living that should be protected or that sustainably (including economically) could be guaranteed or strived for may lie below the current high standard in many developed countries, including the Netherlands. People may not accept a less comfortable life with alternative modes of transportation, smaller living spaces, or exposure to heat and possible floods (ScienceDaily, 2019). The division of responsibilities to act and pay may not be accepted. People may adhere to the thought that since governmental regulations allowed for negative environmental consequences to come into being, the government should solve it.

People may also simply not have resources to implement measures on their private properties, or have different priorities. Residents often prefer to have other problems solved first before a new project like the energy transition is started (Programma Aardgasvrije Wijken, 2021).

Another large issue which ultimately becomes a societal challenge is the required human capital. It is estimates around 35,000-70,000 new fulltime-equivalent jobs are needed to implement the current plans (EIB, 2020; NVDE – Ecorys, 2021; PBL, 2018; PBL, 2020; ROA & PBL, 2019; Van Dril, 2019). In the Twente region this is around 2,500 FTE. These professions and related competences need to be newly developed, including their training capacity. If the sector does manage to attract the required human capital, other sectors like education, health, and agriculture lose people.

3.4.2 Hawai'i

While climate change and renewable energy initiatives appear to be supported by the general public, there are numerous societal considerations as the state moves towards its ambitious renewable energy goals. First and foremost, the literature shows that climate change impacts will pose the greatest threats to communities that typically have the fewest resources to respond or are socially and politically marginalized (World Resources Institute, 2014). As previously mentioned, energy costs are not insignificant for Hawai'i residents. While Hawai'i has a relatively high household median income when compared to the U.S. ($85,000 versus $68,000), Hawai'i is considered to be one of the highest costs of living in the U.S. (US Bureau of Economic Analysis, 2019). Meanwhile, the official U.S. poverty rate reflects a relatively low poverty rate (13%),

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

but other reports demonstrate a starker picture—that up to 42 percent of Hawai‘i’s population is actually struggling to make ends meet (ALICE Report, 2020).

Further, approximately 17,000 households on the island of Oahu alone have an energy burden that is higher than 6 percent, while the national average is approximately 3.6 percent (City and County of Honolulu, 2021). A high energy burden means that households, particularly low-income households, are paying significantly more for their energy needs. Therefore, finding ways to reduce this energy burden and improve community benefits through deploying renewable energy would be most advantageous, particularly focusing on households that are already struggling to make ends meet.

Another major societal issue in Hawai‘i is that indigenous Pacific Island communities are disproportionately impacted by climate change due to historical governance structures (Honolulu Climate Change Commission, 2020). Hawai‘i’s colonial history created institutions and structures that have marginalized and disenfranchised Native Hawaiian communities, evident in sociodemographic data and indicators. Meanwhile, a strong sovereignty movement among Hawaiian communities exist and are manifesting themselves through opposition of state-led initiatives such as the Mauna Kea telescope project (TMT) and renewable energy projects such as the wind farms in the rural town of Kahuku. There are cultural impacts to development projects that need to be addressed.

More models of collaboration and partnership with local communities are needed for projects to be accepted by communities. Without community support, developers will have increasing difficulty in securing projects in Hawai‘i, which could disincentivize other developers from attempting to do business in Hawai‘i.

4 Analysis: Combining SDGs and Comparing Locations

Ideally the world is transformed in such a way that all SDGs are achieved. However, addressing all aspects is a challenge in itself which requires integrating policies, technologies, stakeholder perspectives, as well as resources. In this section we first look at how addressing these challenges can lead to reaching several SDG targets. Secondly, we look at the similarities and differences between the two case study areas to discover potential synergies in each other’s approaches.

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

4.1 SDGs Related to Reaching SDG#7

4.1.1 The Netherlands

For the Netherlands (figure 4), no poverty (SDG#1), zero hunger (SDG#2), and clean water and sanitation (SDG#6) are of less importance in relation to affordable and clean energy, as these are for the most part addressed in full by other policies and services.

Fig. 4. SDGs related to achieving SDG#7 for the Netherlands

We do see a link to good health and well-being (SDG#3) and climate action (SDG#13) through the climate act goals and policy links to the delta plan for spatial adaptation. We also see a strong link to decent work and economic growth (SDG#8) as the existing gas infrastructure is scheduled to be abandoned and replaced with mainly renewable technologies.

What the challenges further show is that the human capital factor to implement the transition goals is critical, making quality education (SDG#4) a priority. Industry, innovation, and infrastructure (SDG#9) are important for managing intermittent renewable energy sources in the existing national electricity network. Sustainable cities and communities (SDG#11) are important for increased management and coordination, and finally responsible consumption and production (SDG#12) come into play as we need to consider not just transitioning to other technologies, but also promoting reduced energy consumption.

4.1.2 Hawai'i

The Aloha+ Challenge is a state-wide public-private initiative to achieve Hawai'i's social, economic, and environmental goals by 2030. Launched in 2014, the Aloha+ Challenge identified six priority goals and local metrics that reflect the global United Nations Sustainable Development Goals (SDGs). Hawai'i Green Growth is the organization tasked to oversee the Aloha+ Challenge and work with public and private organizations to facilitate the realization of these goals. Within this framework, a publicly available dashboard features Hawai'i's initiatives towards each of the 17 UNSDG goals. The dashboard reflects that efforts are in place to track progress in each of these goals, though the goals are in different stages of development. The challenge for Hawai'i, as in many places, is to address each goal in a holistic and culturally respectful manner. For example, the goals are generally divided into categories, differentiating environmental concerns from societal ones, which for indigenous cultures such as ones found in Hawai'i, is not a paradigm that completely resonates with communities. Hawaiian epistemology reflects the belief that humans and the environment are inextricably connected and thus, indicators or goals should reflect this relationship (Pascua, et al., 2017).

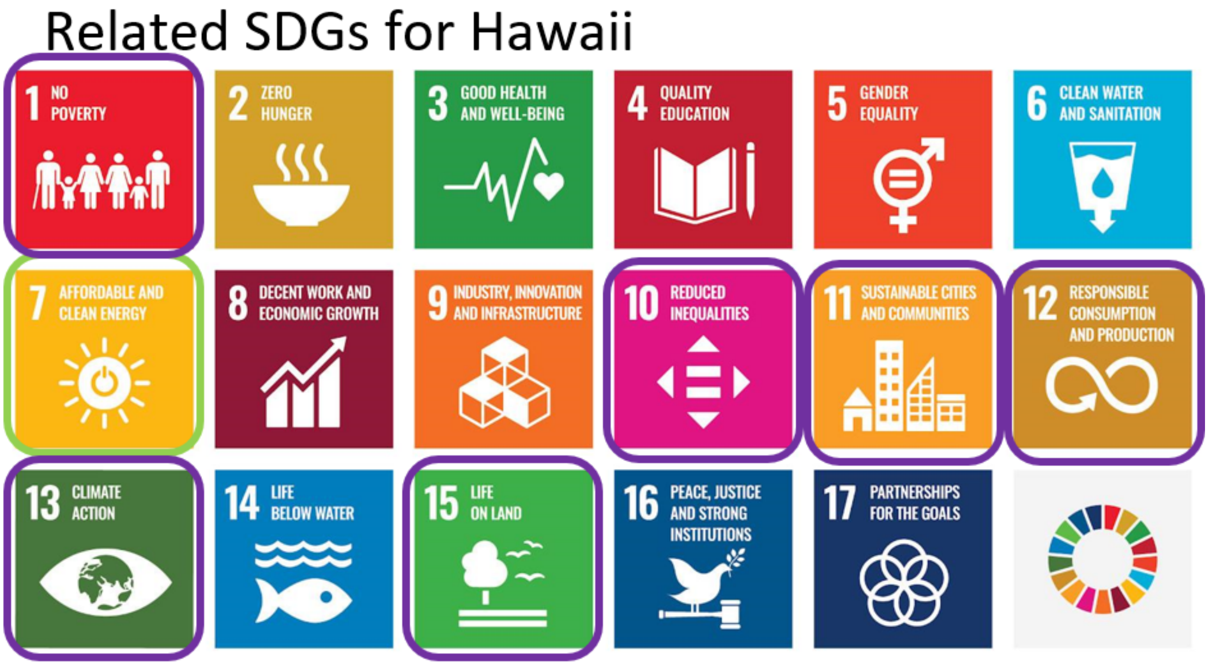

Fig. 5. SDGs related to achieving SDG#7 for Hawai'i

Using the UNSDG framework as a guide, the corresponding goals to support SDG#7 for Hawai'i include SDGs #1 (No Poverty), #10 (Reduced Inequalities), #11 (Sustainable Cities), #12 (Responsible Consumption), #13 (Climate Action), and #15 (Life on Land) (figure 5). However, there are challenges in attempting to assess

DOI: 10.3217/978-3-85125-855-4-21

Hawai‘i’s progress towards the UNSDG goals. First, HGG (the organization tasked with tracking Hawai‘i’s progress) does not have enforcement authority to ensure that these goals are met. In fact, there is no agency that is tasked to enforce these goals. Therefore, HGG relies heavily on public-private partnerships and collaborative efforts to meet these needs. Another related challenge is that according to the metrics shown on the dashboard, the goals are in different stages of development, and it is unclear who is responsible for each goal, and which policies are involved in reaching each target. Lastly, when using a holistic, place-based approach, it is difficult to separate each UNSDG goal from the other. An island ecosystem in particular shows the interdependence of each goal. For example, life on land affects life on water through runoff and pollution. The goal of reducing inequalities is related to the goal of eradicating poverty.

4.2 Comparison of Cases and Implementation Strategies

The challenges show various similarities and differences. For technical challenges, despite the huge difference in geographic settings, there are mostly similar challenges with regard to connecting new and intermittent renewable technologies into an existing electricity infrastructure. The same is found for data management, where both cases show challenges for data gathering, data quality, and transparency or privacy. For governmental and policy challenges there is a notable difference. Both cases mention the time factor of policies and permits as a challenge. Both also mention costs, but for the Netherlands this is a challenge for local governments and in Hawai‘i this is mostly part of the permit process. Societal challenges prove to be the most diverse between these two cases. Both cases face challenges in implementing the energy transition goals while not leaving anyone behind, especially people with less financial resources. For the Netherlands a large societal issue is the lacking human capital, whereas Hawai‘i needs to change the continuous marginalization of the indigenous Pacific Island communities and their rights.

Comparing our two cases in relation to the SDGs, only one of the globally related SDGs is relevant for both our cases, namely #13 climate action. Two new SDGs are relevant for both our cases, namely SDG#11 sustainable cities and communities and SDG#12 responsible consumption and production. This shows the diversity of related goals on a local scale and the need for localized solutions.

Many technical solutions and suggestions for policy reform already exist (Falk & Gaffney, 2019; Hsu, 2020). For the Netherlands, we need to adapt these plans to local small-scale circumstances, and we need to gain stakeholders’ trust and active support, as well as their interest to become experts in energy transition themselves and thereby increase the human capital required for the transition. The available resources in terms of knowledge and materials cannot compensate for the people required to implement the plans.

While working towards the UNSDG goals is admirable for any jurisdiction, for Hawai‘i’s context, there is an urgency to do so in a holistic and culturally-sensitive way. A theme that continues to surface in the literature and in work directly relating to communities is a need for a more indigenous, place-based framework that is better aligned with Native Hawaiian epistemology. For non-native researchers and developers interested in indigenizing energy-sector processes, it is strongly recommended to hire a cultural consultant and work closely and collaboratively with these communities. Otherwise, the UNSDG goals, while admirable and important, will not be seen as relevant to Hawai‘i’s communities, and may not be strongly supported.

5 Conclusions

In this study we found both similarities and differences in the different themes of challenged for the local energy transition examples in the Netherlands and in Hawai‘i.

Despite the large geographical differences, the main technical challenges are comparable due to the intermittent nature of the most popular renewable energy systems (solar and wind). Data management challenges we also found to be comparable, with issues of data gathering, data quality, transparency, and privacy. We found notable differences in the latter two themes of challenges. For governmental and policy challenges a comparable challenge is time, whereas funding is handled in a different manner organizationally. For societal challenges, we found widely differing themes. These results, combined with related national policies, also led to different relevant SDGs on the local scale. For the overall goals of the SDGs, leave no one behind, we find that still large strides need to be made when combining the targets of clean and affordable energy systems with no poverty for Hawai‘i; and quality education, and decent work for the Netherlands, when implementing these goals for all people.

References

Andersson Elffers Felix (2020): Uitvoeringskosten van het Klimaatakkoord voor decentrale overheden in 2022–2030. GR142/eindrapport. (Dutch)

Bell, Shannon E.; Daggett, Cara; Labuski, Christine (2020): Toward feminist energy systems: Why adding women and solar panels is not enough. In Energy Research & Social Science 68, 101557. DOI: 10.1016/j.erss.2020.101557.

Bertot, John C.; Jaeger, Paul T.; Grimes, Justin M. (2010): Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. In Government Information Quarterly, 27 (3), pp. 264-271. DOI: 10.1016/j.giq.2010.03.001.

CBS (2021): Statline. opendata.cbs.nl

City and County of Honolulu Climate Change Commission (2020): Climate Change and Social Equity. https://static1.squarespace.com/static/5e3885654a153a6ef84e6c9c/t/5feb95d232da5052ae2fb8da/1609274837864/Climate_Change_Social_Equity_Guidance_Document_FINAL.pdf

City and County of Honolulu. "Six Years of Energy Burden Impacts: Honolulu in Focus." February 2021.

Directorate-General for Climate and Energy, Climate Department (2019): National Climate Agreement – The Netherlands. https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/national-climate-agreement-the-netherlands

Dubbeld, Julian (2021): Responsibilities but no funding: PAW pilot areas ask for more resources. Stadszaken. (Dutch) https://stadszaken.nl/artikel/3481/wel-de-taken-niet-de-knaken-paw-proeftuinen-vragen-om-extra-middelen

EIB (2020): De bouw in 2030. (Dutch) https://www.eib.nl/publicaties/de-bouw-in-2030/

Elmqvist, Thomas et al. (2019): Sustainability and resilience for transformation in the urban century. In Nature Sustainability 2, pp. 267–273. DOI: 10.1038/s41893-019-0250-1

Energie van Noord-Oost Twente (2020): Climate agreement: what's the deal? (Dutch) https://www.energievannoordoosttwente.nl/nieuws/klimaatakkoord-uitgelegd/

Energy in the Netherlands (2020): Energy numbers of the Netherlands. (Dutch). https://www.energieinnederland.nl/feiten-en-cijfers/energiecijfers/

Falk, Johan; Gaffney, Owen (2019): Exponential Roadmap. Scaling 36 solutions to halve emissions by 2030 https://exponentialroadmap.org/wp-content/uploads/2019/09/ExponentialRoadmap_1.5_20190919_Single-Pages.pdf

FiDETT (2021) Exploratory stage, results. Information needs and process phasing. https://www.fidett.com/resultaten-verkennende-fase

Frantzeskaki, Niki; Tilie, Nico (2014): The Dynamics of Urban Ecosystem Governance in Rotterdam, The Netherlands. AMBIO, 43, pp. 542–555. DOI: 10.1007/s13280-014-0512-0

Fujii-Oride, Noelle (2021): How to Resolve Community Conflicts. In Hawai‘i Business Magazine. https://www.Hawai‘ibusiness.com/how-to-resolve-community-conflicts/

Group on Earth Observations (2021): SDGs. Image from: https://www.earthobservations.org/images/articles/202007_cs_sdgs_01.jpg

Hawai‘i Green Growth (2021): Aloha+ Challenge Dashboard. https://alohachallenge.Hawai‘i.gov/

Hsu, Angel (2020): Cities are driving climate change. Here's how they can fix it. TED Conference. https://www.ted.com/talks/angel_hsu_cities_are_driving_climate_change_here_s_how_they_can_fix_it

International Council for Science (2017): A Guide to SDG Interactions: from Science to Implementation. Paris. DOI: 10.24948/2017.01

Li, Zongmin; Xu, Shuyan; Yao, Liming (2018): A Systematic Literature Mining of Sponge City: Trends, Foci and Challenges Standing Ahead. In Sustainability, 10(4), pp. 1–19. DOI:10.3390/su10041182

Mauree, Dasaraden, et al. (2019): A review of assessment methods for the urban environment and its energy sustainability to guarantee climate adaptation of future cities. In Renewable and Sustainable Energy Reviews 112, pp. 733–746. DOI: 10.1016/j.rser.2019.06.005

McNish, Tyler (2018): Reform Incentives, Transform the Grid: Making Good on Hawai‘i's Renewable Energy Ambitions. In Ecology LQ 45 (3), pp. 583–646.

National Government (2018): 120 million euro for ‘pilot areas’ gas-free neighborhoods in 27 municipalities. (Dutch) https://www.rijksoverheid.nl/actueel/nieuws/2018/10/01/120-miljoen-euro-voor-%E2%80%98proeftuinen%E2%80%99-aardgasvrije-wijken-in-27-gemeenten

National Renewable Energy Laboratory (2018): Hawai‘i Clean Energy Initiative: Celebrating Ten Years of Success, 2008-2018. DOE/GO-102017-506. https://energy.Hawai‘i.gov/wp-content/uploads/2021/01/HCEI-10Years.pdf

NOAA (2021): Despite pandemic shutdowns, carbon dioxide and methane surged in 2020. https://research.noaa.gov/News/ArtMID/451/ArticleID/2742/Despite-pandemic-shutdowns-carbon-dioxide-and-methane-surged-in-2020

NVDE – Ecorys (2021): Klimaatbeleid en de arbeidsmarkt, Een verkennende studie naar de werkgelegenheidseffecten van CO_2-reductiemaatregelen. Rotterdam. (Dutch) https://www.nvde.nl/wp-content/uploads/2021/02/Klimaatbeleid-en-de-arbeidsmarkt-Ecorys-rapport-26-februari-2021.pdf

DOI: 10.3217/978-3-85125-855-4-21

Pascua, Pua‘ala, et al. (2017): Beyond services: A process and framework to incorporate cultural, genealogical, place-based, and indigenous relationships in ecosystem service assessments. In Ecosystem Services 26, pp. 465–475. DOI: 10.1016/j.ecoser.2017.03.012

PBL (2018): Effecten van de energietransitie op de regionale arbeidsmarkt – een quickscan. Publication #3006. (Dutch) https://www.pbl.nl/sites/default/files/downloads/pbl-2018-effecten-van-de-energietransitie-3006.pdf

Planbureau voor de Leefomgeving (2019): Effecten Ontwerp Klimaatakkoord. (Dutch) https://www.klimaatakkoord.nl/klimaatakkoord/documenten/rapporten/2019/3/13/pbl-doorrekening-ontwerp-klimaatakkoord

PBL (2020): Regionale arbeidsmarkteffecten van de energietransitie: een scenarioverkenning. Publication #4207. (Dutch) https://www.pbl.nl/sites/default/files/downloads/pbl-2020-regionale-arbeidsmarkteffecten-van-de-energietransitie-een-scenarioverkenning-4207.pdf

Programma Aardgasvrije Wijken (2012): Mensen Maken de Transitie | Leren over de uitvoering. (Dutch) https://www.youtube.com/watch?v=S-W_GBBBAUo.

ROA & PBL (2019): Frictie op de arbeidsmarkt door de energietransitie: een modelverkenning. Publication #3438. (Dutch) https://roa.nl/sites/roa/files/pbl-2019-frictie-op-de-arbeidsmarkt-door-de-energietransitie-3438.pdf

ScienceDaily (2019): Cities under pressure in changing climate. Newcastle University. www.sciencedaily.com/releases/2019/03/190327203440.htm

State of Hawai‘i DBEDT Office (2021): Powering Past Coal Task Force. Executive Order 21-01. https://energy.Hawai‘i.gov/wp-content/uploads/2021/04/PPCTF_EO_March2021.pdf

State of Hawaii Public Utilities Commission (2014): Commission’s Inclinations on the Future of Hawai‘i’s Electric Utilities https://puc.hawaii.gov/wp-content/uploads/2014/04/Commissions-Inclinations.pdf.

State of Hawaii Public Utilities Commission (2020): Docket Number 2017-0352 (To Institute a Proceeding Relating to a Competitive Bidding Process to Acquire Dispatchable and Renewable Generation; Hawaiian Electric Companies' Letter Request for Additional Procedural Steps). Status Conference for AES Plant Retirement. December 18, 2020. https://www.youtube.com/watch?v=cgqU0viTgBI

State of Hawaii Public Utilities Commission (2021): Docket No. 2020-0136 (Hawaiian Electric Energy Storage Power Purchase Agreement for Energy Storage Services with Kapolei Energy Storage I, LLC; Responses to Commission Information Requests filed April 19, 2021. https://dms.puc.hawaii.gov/dms/dockets

State of Hawaii Public Utilities Commission (2021): Docket Number 2021-0024 (Opening a Proceeding to Review Hawaiian Electric's Interconnection Process and Transition Plans for Retirement of Fossil Fuel Plants). Status Conference for HECO's Initial Update for AES Oahu Coal Plant Transition Plan. March 16, 2021. https://www.youtube.com/watch?v=cgqU0viTgBI.

The Oxford Institute for Energy Studies (2019): The great Dutch gas transition. https://bronnenvanenergie.weebly.com/fossiele-brandstof.html#

Ulmer, Simone (2021): Scientists begin building highly accurate digital twin of our planet. Eidgenössische Technische Hochschule Zürich. https://ethz.ch/en/news-and-events/eth-news/news/2021/02/a-highly-accurate-digital-twin-of-our-planet.html

United Nations, Department of Economic and Social Affairs (2020): Goal 7 Infographic. https://sdgs.un.org/goals/goal7

Urgenda (2021): About Urgenda. https://www.urgenda.nl/

U.S. Bureau of Economic Analysis. "Real Personal Income by State and Metropolitan Area, 2019." https://www.bea.gov/news/2020/real-personal-income-state-and-metropolitan-area-2019

Van den Berg, Jurre (2021): After two years of experiments in gas-free neighborhoods only 206 residences are gas free. Volkskrant. (Dutch) https://www.volkskrant.nl/nieuws-achtergrond/na-twee-jaar-experimenteren-in-aard-gasvrije-wijken-zijn-slechts-206-huizen-van-het-gas-af~b-f523a4d

Van der Voort, Nick; Vanclay, Frank (2015): Social impacts of earthquakes caused by gas extraction in the Province of Groningen, The Netherlands. In Environmental Impact Assessment Review, 15, pp. 1–15. DOI: 10.1016/j.eiar.2014.08.008

Van Dril, Ton (2019): Verkenning werkgelegenheidseffecten van klimaatmaatregelen. TNO P10369. (Dutch) http://publications.tno.nl/publication/34627734/KBGZLx/TNO-2019-P10369.pdf

Vink, K; Ahsan, Md. N.; Sawano, Hisaya; Ohara, Miho (2017): Global Water-Related Risk Indicators: Meta-Analysis of Indicator Requirements. In Journal of Disaster Research, 12 (2), pp. 355–367. DOI: 10.20965/jdr.2017.p0355

Voskamp, Ilse M. et al. (2018): Space-time information analysis for resource-conscious urban planning and design: A stakeholder based identification of urban metabolism data gaps. In Resources, Conservation and Recycling, 128, pp. 516–525, DOI: 10.1016/j.resconrec.2016.08.026

Karina VINK, Layla KILOLU
DOI: 10.3217/978-3-85125-855-4-21

Willemsen, Ype (2021): The FiDETT Project. ConcepTueel. https://www.concept.utwente.nl/professional/conceptueel

WMO (2019): United In Science, High-level synthesis report of latest climate science information convened by the Science Advisory Group of the UN Climate Action Summit 2019. https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/ckeditor/files/United_in_Science_ReportFINAL_0.pdf?XqiG0yszsU_sx2vOehOWpCOkm9RdC_gN

World Population Review (2021): Energy Consumption By Country 2021. https://worldpopulationreview.com/country-rankings/energy-consumption-by-country