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# Adaptive Leadership Roles and Tools of Government to Assist Geothermal Developers in Overcoming Barriers

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## ABSTRACT

The aim of this paper is to recognize barriers of geothermal development, tools to overcome them and leadership roles to further assist overcoming those barriers. It is discussed whether the tools developed increase bureaucracy. Interpretational analysis is applied to 46 issued geothermal licenses in Iceland since 2008 which is the data range of this paper. From analysis 12 dilemmas are derived. Out of 46 licenses 22 had no dilemmas encountered or 48% but 52% encountered barriers. The tools developed to overcome the barriers are described. It is estimated that the tools developed increased bureaucracy for six out of the twelve dilemmas or 50%. The tools are classified based on the level of coerciveness, directness, automaticity and visibility. Most of the tools are low on directness and visibility. However, about half of the tools are classified having low and the other half high level of coerciveness and automaticity. The adaptive leadership role for each of those barriers is suggested using a theoretical framework. It is hypothesized that the Principal Challenge Iceland faces for further geothermal development is associated to the most common dilemma encountered; public acceptance. It is proposed to apply the Transition Challenge to this dilemma due to the need to shift values in the mindset of the public. Before, geothermal development was for local use of space heating and generating electricity. With local demand being met further development is for the power intensive industry with reference to global warming and the potential for Iceland to harness its renewable resources beyond local need. Even though the new values have been recognized and proposed they have not yet been accepted by the public as is evident in the proceedings of the Master Plan through the Parliament. The developed toolbox derived in this study can help the licensing authority OS in assisting developers in resolving possible barriers for the development and what leadership role should be applied to different circumstances. It is proposed to include questions concerning identified barriers initially in the application process so that the applicant can realize the possible obstacle as soon as possible and react appropriately by suggesting actions in overcoming the barriers before they become impassable. Greater emphasis has been made on network governance across nations with globalization. Hence a selected comparison is made to New Zealand revealing similarities in dilemmas but a difference in the tools developed. Most importantly, a dilemma known in New Zealand is identified that has yet to surface through the licensing procedure in Iceland, emphasizing the importance of international networking for the intended new governance approach.

## 1. INTRODUCTION

The new governance approach shifts the unit of analysis from public agencies to the distinctive tools through which public purposes are pursued. It has been the policy of the Government of Iceland to harness further the renewable resources accessible in Iceland for several decades. The legal framework and national policy in place for geothermal is outlined in Ketilsson et al. (2020). Orkustofnun (OS – The National Energy Authority of Iceland) became a licensing authority in year 2008. Since then 46 licenses have been issued by OS for the research, utilization and power plant licenses, omitting the research and utilization of microbes found in geothermal areas. No review has been made on the success and lessons learned from this role of a licensing authority. An application form was introduced in year 2018 for geothermal utilization, as described in Ketilsson et al. (2020). However, obstacles encountered during this process have not yet been researched particularly. Hence, for a new developer, obstacles are rediscovered every time through the licensing procedure, often with negative impact on the project and in some cases causing the development to stop. To learn from previous processes, it is proposed to investigate the licenses issued and identify common barriers encountered. What tools have been developed to overcome the barriers and resolve issues at hand? What does classification of those tools reveal? This study will advance the licensing procedure by introducing a toolbox for the authority to assess applications and give the applicant beforehand a road map of known barriers that can cause delays in the licensing procedure and possibly halting it.

Leadership roles are important to embrace. By matching identified barriers and tools to overcome them to the appropriate leadership role for OS the assistance given by OS becomes more targeted. By classifying the tools, they can be further enhanced and their effect investigated. Instead of only reacting on a case by case basis the methodology proposed in this paper is that the licensing authority defines those barriers and tools to overcome them and presents them to developers with the aim of increasing the success rate of projects and reducing associated legal conflict of interest that is common to encounter during the licensing procedure. The vision hence proposed for OS is that of a pro-active licensing authority that recognizes common barriers that developers face and informs before procedures start.

The aim of this study is hence to recognize barriers of geothermal development, tools to overcome them and leadership roles to further assist overcoming those barriers. It is discussed whether the tools developed increase bureaucracy. In addition, the Principal Challenge is identified as being associated with the most common dilemma encountered that is thus causing the greatest barrier for development in Iceland. For comparison purposes case studies are analyzed from New Zealand to investigate similarities in dilemmas encountered.

## 2. LITERATURE REVIEW

Rethinking the role of government, as described by Salamon (11, 2002), incorporates tools instead of agencies, network instead of hierarchy, public + private instead of public vs. private, negotiation and persuasion instead of command and control and enablement skills instead of management skills. The nature of government tools can be understood by examining how they relate to four dimensions to analyze each tool. Key tool dimensions are the *degree of coerciveness* (measuring the extent to which a tool restricts individual or group behavior as opposed to merely encouraging or discouraging it), *degree of directness* (measuring the extent to which the entity authorizing, financing, or inaugurating a public activity is involved in carrying it out. A direct tool is one in which authorization, funding, and execution are all carried out by essentially the same entity), *degree of automaticity* ( measuring the extent to which a tool utilizes an existing administrative structure to produce its effect rather than having to create its own special administrative apparatus) and finally the *degree of visibility* (measuring the extent to which the resources devoted to a tool show up in the normal government budgeting and policy review processes) (Salamon 2002, 25-35). The new governance approach classifies tools of government which can reveal likely impacts, i.e. how effective, efficient, equitable, manageable and legitimate the tools are as a result of their design. *Effectiveness* measures the extent to which an activity achieves its intended objectives. *Efficiency* balances results against costs. *Equity* measures the success of redistribution and fairness for channeling benefits disproportionately to those who lack them. *Manageability* measures the implementability or ease in operating the tool. To perform effectively in this role, public managers must be able not simply to follow rules, but to engage in complex multiparty negotiations. To do so they must know far more about the operating realities of the instruments on which their programs rely, and how these instruments can best be utilized to serve public purposes (Salamon 2002, 609).

Leadership is thought to be the most important element in the success of organizations according to Mass (1990, 8). As stated in Milner and Joyce it is important that the leader embraces a powerful vision of the future with strategic thinking, coaching of his followers, integrity and receptivity (2005, 39). The difference between a leader and a manager in consonance with Milner and Joyce (2005, 18) is that a leader looks towards the future and finds new solutions. A leader leads, creates and develops a vision in his mind and asks his followers what and why. Managers however look towards daily affairs and ask their followers when. Leaders of the 21. century, according to Kotter (2012, 181) prefer decreased bureaucracy and fewer rules and presume that the leaders lead and followers manage. Uses multidimensional performance management systems accessible to all. Offers individual coaching. The leader is on duty, knows that leadership is a team work, can create and communicate the vision, can amplify broad based empowerment, delegates management for excellent short-term performance, respects the independence of staff and creates an adaptive corporate culture (Kotter 2012, 159-181).

Adaptive leadership involves identifying the principal challenge at hand and getting the people to face reality and take responsibility for the solution of the problem but render the support and guidance needed. Williams identifies six leadership challenges (2005, 58); Activist Challenge, Development Challenge, Crisis Challenge, Maintenance Challenge, Creative Challenge and Transition Challenge. A leader adapts his leadership to the Principal Challenge that is being faced at any given point in time. This analysis framework is applied in this study. Williams emphasizes the importance of looking out for counterfeit projects that don't confront the underlying issue. As stated it is important to distinguish between leadership and dominance as a control mechanism. Not to fail in engaging the group involved and be unwilling to look for solutions beyond one's comfort zone and hence prevailing group paradigm. Not to hold the conviction that the leader alone has the truth and knows the way forward (2005, 52), cf. also Gardner (1990, 38) on the importance of the situation. If the leader can adapt to the circumstances then leadership can resolve the issue at hand, cf. Hughes, Ginnet and Curphy (2009, 1) on the importance of defining the leader, his followers and the situation at hand. The intersection of those three unions is real leadership in the spirit of adaptive leadership. The need for servant leadership has increased requiring both progress in task success (Theory X) and social success (Theory Y) (Rainey 2014, 35). It is possible to manage dissent and reduce the likelihood of guerilla government with powerful collaboration and uncensored communication along with active listening according to O'Leary (2010).

Managing transitions and change is delicate and chances are more likely that one will fail (Kotter 2012, 196). Transformations can be bound to the self-awareness of the people in question and emotions. It is of the upmost importance how the journey of transition is initiated and under what assumptions. Whether the leader has sold the problem or the solution. The analysis framework proposed by Kotter is divided into eight steps (2012, 23). The leader has to recognize that the people can be emotionally attached to the way things are and hence it is so important that the solution for the problem that the leader has presented to them is discovered by the followers. The cost of applying dictatorial style, power and surveillance renders the approach unfeasible. It is more economical to open the eyes of the people for the problem at hand and get the group to work as a team to find the true solution to the underlying issue. Envision a future of where the group is going and how, applying a humble democratic style. Execute that plan and get rid of obstacles. Consolidating gains and anchor new approaches in the culture. Transformational leadership can be adapted using the four elements of McGregor Burns (Huczynski and Buchanan 2013, 673) to encourage intellectual stimulation, inspirational motivation, individual consideration and idealized influence. Leaders have to respect difference of opinion, create a workplace culture that embraces difference and diversity but draws a clear line which should not be crossed. Have empathy for the emotional process and stand by and support with the aim of reducing the physiological implications that otherwise can cause unexpected effects. Choose to embrace the phases of change management and respect their importance. With the first step of letting go with what is, moving on to phycological restructuring and finally to embrace a new self-image (Bridges 2016, 151). Look towards Kübler-Ross five stages of grieve (Bridges 2016, 33) and how the leader can reduce the impact on the person.

Performance management is obligatory according to Act on Public Finance nr. 123/2105 (Alþingi, 2019). Institutions are obliged to propose indicators and measures to track progress made. According to a handbook for official policy making of institutions issued by the Government of Iceland (2013, 21) it is important that institutions propose how to measure performance improvements. The aim of the performance management is to improve the service provided by the institution (Stjórnarráð Íslands 2013, 13). Public institutions have to have clear priorities to enable them in setting goals, determining performance levels and setting timelines, work towards improvement and determine who is responsible at any given point in time according to Drucker (1973, 43). The goals have to be exact, measurable, feasible, realistic and correctly time framed as stated in Drucker. He points out a number of studies illustrating the positive response of goal setting but in the meantime, studies also show that ill-defined goal setting can lead to deterioration of

morale. According to Ordóñez et al. (2009) economic incentives can lead to false conclusions. Research on administrative reforms by Kristinsson and Matthíasson (2014, 297) indicate that Icelandic leaders are more willing to reform in comparison to their colleagues in Europe but when asked if they have succeeded in reforming they are more pessimistic than the average. Kristinsson and Matthíasson point out that possibly the reason could be that systematic and cohesive actions with careful preparation is seldomly applied in Iceland in comparison to the countries compared to in the study.

Bureaucracy refers to rules, procedures and paperwork which allow control to be exerted (King and Lawley 2016, 29). But bureaucracy can be seen as something of a double-edged sword. Even though vast majority of the organizations would not be existing today without it (60-61, 2016). It ensures fairness. Its routines and procedures can though become dehumanizing and disenchanting. Encasing society and people in an iron cage when not done correctly. According to Bennis, in King and Lawley, it is wrong to proclaim the coming death of bureaucracy but rather that the world is shifting towards a post-bureaucratic stage with automation of processes and procedures. But it is important when setting new rules and procedures to keep in mind the quote by Oscar Wilde "*The bureaucracy is expanding to meet the needs of the expanding bureaucracy* "but at the same time remember the essence of the quote by J.A Schumpeter „*bureaucracy is not an obstacle to democracy but an inevitable complement to it "*. Bozeman's theory is applied to distinguish between the theory of bureaucratic rules and red tape (2000). Recognizing the difference between rule inception red tape when the rule is initially set with a clear purpose and the rule evolved red tape when the rule drifts from its original intension into something which it wasn't intended for in the beginning.

Employee engagement and motivation can be important to incorporate in the licensing procedure. Public Service Motivation (PSM) can rely on intrinsic values. Surveys have shown that public employees indicate that their main sources of occupational satisfaction is the importance of doing work that is worthwhile to society and to helping others. Hence is it natural to incorporate PSM into public leadership (Rainey, 2014, 313-319).

## 3. METHODOLOGY

The methodological approach taken in this paper was to review and categorize all geothermal licenses issued by OS since year 2008. In total 46 licenses were analyzed. Licenses for research and utilization of microbes associated with geothermal fields were omitted. All of the licenses, opinions and written procedure is open and accessible online and links are given for each license. The data was analyzed by reading through the licenses, written opinions, actions taken, referenced papers and conclusion of the licensing authority. From the analysis, barriers and tools were defined. The data range was chosen due to its accessibility and reliability since each licensing procedure is a legal procedure in which a repetitive process occurs and applicable legal entities give their opinions in a written format according to the legal framework. Hence it is unlikely that the information is false. The licensing procedure of OS follows established practices for this type of licensing as is further outlined in Ketilsson et al. (2020). The tools are classified based on the level of coerciveness, directness, automaticity and visibility in accordance with the analytical approach described in Salamon (2002). The author assessed whether the tool developed to overcome the recognized barrier entailed increased bureaucracy using the theory proposed by Bozeman (2000) by reviewing whether new rules and procedures were stipulated that would be applied to the industry overall or only to those that encounter the barrier itself, i.e. the difference between rule inception and rule evolved red tape. From theoretical framework on leadership proposed by Williams (2010) the relevant leadership role that best fits the dilemma is chosen. The overall principal dilemma for the country is then proposed based on the most common dilemma encountered during the beforementioned licensing procedure. For comparison purposes selected examples are chosen from New Zealand to compare different tools applied to the same natural dilemma. Research was done through several interviews with Chris Bromley at GNS Science to discuss challenges at hand in New Zealand and how they compare to Iceland. The author has been an employee of OS since 2007 and responsible for geothermal affairs for the duration of the period involved. Hence, by taking part in the licensing procedure the author has first-hand experience in the complexity of the dilemmas encountered which is likely to influence the research. The results and conclusion are hence possibly biased and not the opinion of an independent consultant. On the other hand, having first hand experience does deepen the insight into the process which could be difficult for a third party to recognize.

## 4. RESULTS

The findings of the study are outlined in three sections. In the first section the interpretational analysis of the licenses is reviewed with identified barriers and associated tools with an assessment of whether bureaucracy was increased with the selected tool to resolve the barrier. In the second section the dilemmas described are categorized and linked to leadership challenges based on a theoretical framework for real leadership. The third section compares to New Zealand.

### 4.1. Barriers and Tools of Government

Interpretational analysis of the 46 geothermal licenses reviewed resulted in 12 identified barriers and relevant recognized tools to overcome those barriers described in table 1. Table 2 gives an overview of all the licenses and dilemmas encountered in each of the license. No dilemmas were encountered in 22 license procedures out of the 46 or 48%. The most common dilemma was the Acceptance Dilemma encountered 15 times, next was the Greenfield Dilemma encountered 6 times, next Exploitation, Wastewater and Municipalization Dilemmas each encountered five times, then the Neighbor Dilemma encountered three times, the Refurbish, Period, Tremor and Abandonment Dilemmas each encountered twice, and finally the Finance Dilemma encountered once when reviewing the beforementioned licenses. The tools are classified based on the level of coerciveness, directness, automaticity and visibility. Most of the tools are low on directness and visibility. However, about half of the tools are classified having low and the other half high level of coerciveness and automaticity. When reviewing the tools developed the result is that in six of the twelve dilemmas the applied tool increased bureaucracy overall for all projects or 50%. This is the case for the tools of the Selection Dilemma, Tremor Dilemma, Abandonment Dilemma, Exploitation Dilemma, Wastewater Dilemma and Acceptance Dilemma. The red tape was not increased with the tools developed for the Finance Dilemma, Refurbish Dilemma, Municipalization Dilemma, Duration Dilemma, Greenfield Dilemma and Neighbor Dilemma. In terms of dimensions, most of the tools are low on directness and visibility. However, about half of the tools are classified having low and the other half high level of coerciveness and automaticity.

**Table 1: Barriers, tools to overcome them and degree of key tool dimensions. Tool dimensions as defined by Salamon on the scale from low-medium-high (2002).**

| | | | Dimensions |
|---|---|---|---|
| **Barriers** | **Description of the barrier** | **Overcoming Obstacles with Tools of Government** | **Coerciveness<br>Directness<br>Automaticity<br>Visibility** |
| **Finance Dilemma** | The greatest obstacle to geothermal development is the upfront cost of drilling and installing a district heating network. OS as a licensing authority has to review the financial viability of the project. OS also verifies the financial viability for a monopoly license of a district heating network. | 1. Finance Model to Review Financial Viability of Geothermal Based District Heating Monopoly License Application.<br>2. Soft loan from the Energy Fund operated by OS to finance up to 80% of the drilling for heat and installing a district heating network<br>3. Lump-Sum Payment of 12-15 years of subsidies that homes otherwise receive for heating with electricity or oil | Low<br>Medium<br>Medium<br>High |
| **Refurbish Dilemma** | When a developer wants to refurbish an older plant in some cases with increased efficiency a higher capacity can be installed with uncertainty which can become an obstacle due to the uncertainty. | 1. OS assists in issuing a new license with the total installed capacity taking uncertainty into account. | Low<br>Low<br>High<br>Low |
| **Municipalization Dilemma** | When a third party wants to harness geothermal energy for own use or for selling heat to other users when there is already in place a geothermal based district heating service an obstacle arises which can be difficult to overcome. | 1. Natural Monopoly License for a Geothermal Based District Heating prevents a third party to start harnessing and/or selling heat.<br>2. Municipalities have priority to utilization licenses within their area for the operation of a geothermal based district heating.<br>3. If no Monopoly License is in place and the known sources are not fully utilized a municipality or operator of a private district heating network is not able to prevent utilization of a third party. If the third party claims that the monopoly license holder is not interested in meeting his demand for heat OS investigates the matter | High<br>Low<br>High<br>Low |
| **Selection Dilemma** | When more than one applicant applies for a license for the same area an obstacle arises on how to select a candidate. | 1. More than one research license can be issued for the same area as long as the proposals for utilization differ. For utilization licenses the one that reaches an agreement with the owner of the resource is the one that is selected. Hence OS would grant both applicants a utilization license as long as they meet technical qualifications. Both parties have 60 days to reach an agreement with the resource owner. If neither reach an agreement both licenses are revoked. | Low<br>Low<br>High<br>Low |
| **Duration Dilemma** | The Resource Act stipulates that public resource owners can lease access to the resource for up to 65 years. The Resource Act however does not stipulate the time length of utilization licenses that OS issues. | 1. If a lease has been made for access to the resource the time length of the utilization license is set equal (max 65 years).<br>2. If no agreement has been made with the resource owner the time period is set equal to depreciable life (30-40 years).<br>3. If the plan for the area, technical, environmental or social factors indicate that caution is necessary OS limits the license period further (15-30 years). | Low<br>Low<br>High<br>Low |
| **Greenfield Dilemma** | When an applicant approaches OS for a utilization license for a large geothermal power plant requiring great amounts of extraction with unknown response of the resource and unknown environmental impact a barrier arises due to the upfront risk considering the expected role OS has in securing a long-term use of the resource. Which can affect the expected long-term energy security of the plant for the buyer of the electricity and the overall reputation of the industry. | 1. OS requires developers to illustrate with research wells half of the steam necessary for the proposed installed capacity. This is done with a research license. To secure the investment the developer could already have reached an agreement with the resource owner for exclusive rights to prevent others from being able to get an active utilization license. | High<br>Low<br>Low<br>Low |

| | | | |
|---|---|---|---|
| **Tremor Dilemma** | Reinjection into the geothermal resource can maintain a water balance and pressure for a long-term sustainable yield of the resource. However, the reinjection can cause induced seismicity when tension is already in the bed rock. This can cause structural harm to buildings in the vicinity of the area and people. | 1. Rules on Releasing Water into the Ground to Prevent Induced Seismicity (OS-2016-R01-01). | High<br>Low<br>Low<br>Low |
| **Abandonment Dilemma** | Licenses stipulate that the license holder should return the area closest to its original state. However, if the company goes bankrupt it becomes uncertain whether that will occur. In addition, the Icelandic state was very active in drilling wells in the beginning but didn't close them securely when abandoned. This can create an obstacle for development. | 1. Rules on Drilling Wells stipulating the responsibility of the owner and the designers.<br>2. Income from renting access to state owned wells is used to securely close wells that can cause harm and endangerment e.g. to children | High<br>Low<br>Low<br>Low |
| **Exploitation Dilemma** | Geothermal systems can be over-exploited if the amount of water extracted is more than the resource is able to renew itself. This is common for large geothermal power plants. It is the role of OS to secure long-term use of geothermal resources for generations to come so that e.g. the infrastructure that is built assuming long-term use is not wasted on a short-term over-exploitation. | 1. Applicants are required to carry out a long term simulation of the geothermal resource that considers known factors. The applicant has to present a prediction of response to the proposed extraction rate. If the response is different than predicted a certain protocol is initiated. Firstly, the model is updated, secondly a new prediction is established and evaluated. If needed coercive action is taken by OS in accordance to the license. | High<br>Low<br>Low<br>Low |
| **Wastewater Dilemma** | When geothermal energy is used for electricity generation there is often large amount of waste water to be handled. If the waste water is allowed to flow onto surface it can infiltrate the bedrock down into the groundwater system and pollute with chemicals from the geothermal system which are harmful. In addition, lagoons can formulate which can cause danger to the surrounding. | 1. Waste water is injected below the groundwater system and preferably into the geothermal resource in a responsible manner.<br>2. If a lagoon is defined in the Regional Plan OS can allow it. Otherwise formulation of lagoons is a violation of the license.<br>3. For security reasons the lagoon needs to be secure. Waste water can be used for bathing purposes or other downstream activities as long as appropriate measures are taken for such activities. | Low<br>Low<br>High<br>Low |
| **Neighbor Dilemma** | When geothermal energy is already in use by another landowner or user issues can arise when a new developer comes into play. This can cause complicated issues which OS has to analyse and decide upon. Barriers can become impassable. For the development stagnation can be the result and the resource not used even though from an economical and environmental point of view the development would only have positive effects. | 1. If utilization has already started into the same resource an agreement is to be made for the utilization. OS looks towards macroeconomics with the aim of using renewable resources to the extent that the resource can yield. Hence, only compensation can be given to a priori for the increased cost of utilization, e.g. the cost of pumping. It can however not hinder the development. | High<br>Low<br>Medium<br>Low |
| **Acceptance Dilemma** | Geothermal Fields can be in beautiful and unspoiled areas. Associations and groups argue in some cases that certain areas are worth more intact than by exploiting it. This can become a barrier and prevent utilization. | 1. Master Plan for Geothermal and Hydro Resources is aimed at creating a Plan for Iceland where resources are categorized to be used, protected or further researched. The Master Plan goes through the Parliament where elected representatives decide how to categorize each resource for projects larger than 10 MW electric.<br>2. For projects smaller than the above OS always forwards applications to the Environment Agency and Icelandic Institute of Natural History. When matters of concern arise they are reviewed and taken into consideration. | High<br>Medium<br>Low<br>Low |

**Table 2: All licenses that OS has issued with barriers from tables 1-2 encountered during the licensing procedure and monitoring. (U: Utilization, R: Research, P: Power Plant). License ID incorporates a link to the license.**

| License ID with link to license | Area | License Holder | License Type | Year of Issue | Finance Dilemma | Refurbish Dilemma | Municipallization Dilemma | Selection Dilemma | Duration Dilemma | Tremor Dilemma | Abandonment Dilemma | Exploitation Dilemma | Wastewater Dilemma | Greenfield Dilemma | Neighbour Dilemma | Acceptance Dilemma | No dilemma |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OS-2019-L0X-01 | Bjarnarflag | Landsvirkjun | U | 2019 | | | | | 1 | | 1 | 1 | 1 | | | | |
| OS-2018-L021-01 | Reykjanes v/ Ísafj. | Ferðaþj.Reykjanesi | U | 2018 | | | 1 | 1 | | | 1 | | | | 1 | | |
| OS-2018-L015-01 | Litli-Laugardalur | Tálknafjarðarhreppur | U | 2018 | | | | | | | | | | | | | 1 |
| OS-2018-L007-01 | Lynghagi | Sigurður Hreinsson | U | 2018 | | | | | | | | | | | | | 1 |
| OS-2017-L025-01 | Svartsengi | HS Orka hf. | U | 2017 | | | | | 1 | 1 | | 1 | 1 | | | 1 | |
| OS-2017-L024-01 | Kelduhverfi | Orkuveita Húsavíkur | U | 2017 | | | | | | | | | | | | | 1 |
| OS-2017-L014-01 | Reykholt | Reykholtsstaður | U | 2017 | | | | | | | | | | | | | 1 |
| OS-2016-L019-01 | Ölfus | Raföld ehf. | U | 2016 | | | | | | | | | | | | | 1 |
| OS-2016-L010-01 | Lýsuhóll | Snæfellsbær | U | 2016 | | | 1 | 1 | | | | 1 | | | 1 | | |
| OS-2016-L001-01 | Bergstaðir í Blásk. | Hitaveita Bergstaða | U | 2016 | | | | | | | | | | | | | 1 |
| OS-2015-L026-01 | Hellisheiði | Orka Nátturunnar | U | 2015 | | | | | | 1 | | 1 | 1 | 1 | | 1 | |
| OS-2015-L005-01 | Flúðir og Kópsvatn | Hitaveita Flúða | U | 2015 | | | | | | | | | 1 | | | | |
| OS-2014-L021-01 | Möðruvellir | Kjósarhreppur | U | 2014 | 1 | | 1 | | | | | | | | | | |
| OS-2014-L019-02 | Stóra Ármót | Selfossveitur bs. | U | 2018 | | | | | | | | | | | | | 1 |
| OS-2014-L019-01 | Stóra Ármót | Selfossveitur bs. | U | 2014 | | | | | | | | | | | | | 1 |
| OS-2014-L013-01 | Reykir í Hrútafirði | Húnaþing vestra | U | 2014 | | | | | | | | | | | 1 | | |
| OS-2014-L012-01 | Drangsnes | Hitaveita Drangsness | U | 2014 | | | | | | | | | | | | | 1 |
| OS-2014-L008-01 | Þeistareykir | Landsvirkjun | U | 2014 | | | | | | | | 1 | | 1 | | 1 | |
| OS-2014-L005-01 | Reykir í Húnavatns. | Rarik ohf. | U | 2014 | | | | | | | | | | | | | 1 |
| OS-2013-L015-01 | Húsavík | Orkuveita Húsavíkur | U | 2013 | | | | | | | | | | | | | 1 |
| OS-2013-L004-01 | Stóri Klofi | Íslensk Matorka | U | 2013 | | | 1 | 1 | | | | | | | | | |
| OS-2011-L016-01 | Laugamýri, | Hitaveita | U | 2011 | | | | | | | | | | | | | 1 |
| OS-2011-L014-01 | Skarðdalur í Sigluf. | Rarik ohf. | U | 2011 | | | | | | | | | | | | 1 | |
| OS-2011-L005-01 | Langhús í Fljótum | Skagafjarðarveitur | U | 2011 | | | | | | | | | | | | | 1 |
| OS-2009-L009-01 | Kaldrananeshreppur | Hveraorka ehf. | U | 2009 | | | | | | | | | | | | | 1 |
| OS-2018-L022-01 | Bolaalda | Reykjavík | R | 2018 | | | | | | | | | | | | 1 | |
| OS-2017-L008-01 | Svínadalur | Hvalfjarðarsveit | R | 2017 | | | | | | | | | | | | | 1 |
| OS-2017-L004-01 | utan netlaga | North Tech Energy | R | 2017 | | | | | | | | | | | | | 1 |
| OS-2016-L018-01 | Krýsuvík | HS Orka hf. | R | 2016 | | | | | | | | | | | | | 1 |
| OS-2016-L003-01 | Hágöngur | Landsvirkjun | R | 2016 | | | | | | | | | | | | 1 | |
| OS-2015-L020-01 | Stóra Sandvík | HS Orka hf. | R | 2015 | | | | | | | | | | | | 1 | 1 |
| OS-2014-L009-01 | Gjástykki | Landsvirkjun | R | 2014 | | | | | | | | | | | | 1 | |
| OS-2013-L011-01 | Reykir í Húnavat. | Rarik ohf. | R | 2013 | | | | | | | | | | | | | 1 |
| OS-2012-L006-01 | Keilisnes | Íslensk Matorka ehf. | R | 2012 | | | | | | | | | | | | | 1 |
| OS-2011-L010-01 | Keis í Kerlingarfj. | Fannborg ehf. | R | 2011 | | | | | | | | | | | | | 1 |
| OS-2011-L004-01 | Grændalur, Ölfus | Sunnlensk orka ehf. | R | 2011 | | | | | | | | | | | | 1 | |
| OS-2011-L002-01 | Gjástykki | Landsvirkjun | R | 2011 | | | | | | | | | | | | 1 | |
| OS-2011-L001-01 | Hágöngur | Landsvirkjun | R | 2011 | | | | | | | | | | | | 1 | |
| OS-2010-L005-01 | Kelduneshreppur | Orkuveita Húsavíkur | R | 2010 | | | 1 | 1 | | | | | | | | | |
| OS-2009-L017-01 | Þeistareykir | Landsvirkjun | R | 2009 | | | | | | | | | | 1 | | 1 | |
| OS-2019-L0X-01 | Bjarnarflagsvirkjun | Landsvirkjun | P | 2019 | | 1 | | | | | | | | | | | |
| OS-2018-L008-01 | Kópsvatn | Flúðaorka | P | 2018 | | | | | | | | | 1 | | | | |
| OS-2017-L027-01 | Svartsengisvirkjun | HS Orka hf. | P | 2017 | | 1 | | | | | | | | | | | |
| OS-2014-L011-01 | Þeistareykjavirkjun | Landsvirkjun | P | 2014 | | | | | | | | | | 1 | | 1 | 1 |
| OS-2011-L013-01 | Reykjanesvirkjun | HS Orka hf. | P | 2011 | | | | | | | | | | 1 | | 1 | |
| OS-2011-L006-01 | Hellisheiðarvirkjun | ON | P | 2011 | | | | | | | | | | 1 | | 1 | |
| | | **TOTAL** | **46** | | **1** | **2** | **5** | **4** | **2** | **2** | **2** | **5** | **5** | **6** | **3** | **15** | **22** |

### 4.2 Public Leadership Roles to Assist Developers in Overcoming Identified Barriers

The theoretical framework for real leadership identifies six main challenges. Based on those challenges in comparison to the dilemmas it is concluded that the leadership role of the Activist Challenge is applicable to the Finance, Municipalization and Neighbor Dilemmas. The Creative Challenge for the Wastewater Dilemma, the Crisis Challenge for the Tremor Dilemma, the Transition Challenge for Acceptance and Selection Dilemmas, the Maintenance Challenge for the Exploitation Dilemma and the Development Challenge for the Refurbish, Period, Abandonment and Greenfield Dilemmas respectfully. This is further outlined in Table 3.

Since the Acceptance Dilemma is the most common Dilemma coming up in 15 licensing procedures out of the 46 licenses processed it is concluded that the Principal Challenge for Iceland is the Transition Challenge further discussed in next chapter.

**Table 3: The leadership role applicable to corresponding set of dilemmas defined in tables 1-2. The leadership roles as defined by Williams (2010).**

| Challenge | Leadership Role | Dilemma |
|---|---|---|
| **Activist Challenge** | The leadership task is to get the people to entertain ideas and aspects of reality that threaten their prevailing worldview (Williams 2010, 150):<br>• Know what threat you represent to the people.<br>• Be strategic in where and how you intervene.<br>• When the group stalls you on one front, open up another.<br>• Find good partners to support you and keep you alive. | Finance Dilemma<br>Municipalization Dilemma<br>Neighbour Dilemma |
| **Creative Challenge** | The leadership task is to get the group to do something that has never been done before (Williams 2010, 324-325):<br>• Attend to the mood, energy, and focus needed to make a discovery.<br>• Keep the powerful from dictating the solution.<br>• Allow for friction, but keep people from fleeing.<br>• Get people to set aside their notions of the truth long enough for the novel ideas to emerge. | Wastewater Dilemma |
| **Crisis Challenge** | The leadership task is to defuse the explosiveness of the situation so that the real problem can be addressed and the group can return to normal functioning (Williams 2010, 368):<br>• Dissipate the explosive fumes and create some time to think.<br>• Hold steady, don't get pulled into the fracas.<br>• Keep people from striking a match: remind them of the higher purpose.<br>• Don't be pigheaded or naïve – explore every alternative. | Tremor Dilemma |
| **Transition Challenge** | The leadership task is to transition the group or organization to a new place or condition with minimal opposition and loss (Williams 2010, 243):<br>• Provide an orienting purpose.<br>• Get people to own the passage, or they will probably deceive you.<br>• Determine what must be preserved, and help people deal with losses.<br>• Become a visible symbol of the transition ideal. | Acceptance Dilemma<br>Selection Dilemma |
| **Maintenance Challenge** | The leadership task is, due to a "storm" or downturn, to protect and preserve group resources until better times (Williams 2010, 280):<br>• Keep the fire burning: maintain hope<br>• Maintain the mission and core values.<br>• Keep the destructive forces at bay. | Exploitation Dilemma |
| **Development Challenge** | The leadership task is to get the people to develop their latent capabilities, new skills, and underutilized resources (Williams 2010, 195):<br>• Create robust holding environment to keep people from getting distracted.<br>• Develop in stages: give the people time to discover what works.<br>• Find the right combination of levers to develop new values and capabilities. | Refurbish Dilemma<br>Duration Dilemma<br>Abandonment Dilemma<br>Greenfield Dilemma |

### 4.3 Selected Examples from New Zealand

A review of the licensing procedure in New Zealand reveals that although the setup is different, some of the dilemmas are similar. However, the tools developed are not entirely the same. An assessment of environmental impact is normally required in New Zealand as part of resource consent application which should be reflected in the application for the take and discharge of geothermal fluid greater than a certain minimum. These consents are granted by the regulating authorities (Regional Councils) under the provisions of the Resource Management Act (RMA) following an application. For large fluid take and discharge proposals there may be a public hearing. The application and entire geothermal resource management process is managed by Regional Policy Statements and Regional Plans which are periodically reviewed through public consultation and hearings and give effect to the RMA (Luketina, 2000). All of New Zealand's high-enthalpy power and direct-use geothermal projects are regulated by regional rather than central government (Doorman & Mcleod, 2018). The key aspect of the New Zealand legislation for dealing with environmental risks can be summarized as "effects-based" with a staged sequence of actions: a) to avoid if possible, b) to remedy if practical, and c) to mitigate if necessary (see Table 4 with selected examples). Mitigation can take the form of an environmental enhancement (preferably locally, but alternatively in other geothermal fields) to compensate for an adverse effect that cannot be avoided or remedied.

Official monitoring is done through an independent Peer Review Panel (PRP) reporting directly to the Regional Council. The Regional Council can act decisively if an operator is not following the agreed resource consent conditions or if monitoring shows serious deviations from anticipated environmental outcomes. However, in this situation, peer-reviewed scenario modelling using calibrated and history-matched reservoir simulators is the key means for predicting future changes and optimizing strategies through a flexible and adaptive reservoir management philosophy. The model improves with time as monitoring records are fed in to the model and the history match is updated. Consequently, experience has shown that a holistic and cooperative regime of review and regulatory feedback is better than a strict policing role for the PRP. Council regulators also advise the operator (with the assistance of the PRP experts) on suggested improvements in reservoir management strategy (for example, better use of production and reinjection wells) and utilization efficiency. These will provide improved future outcomes for all users and optimize sustainability of the overall energy extraction and utilization process. For surface thermal features (hot springs, geysers, steaming ground, etc.) the environmental controls are determined by a set of criteria that depend on surface feature significance. This requires some form of ranking. The development of appropriate significance ranking criteria can be tracked through a series of New Zealand Geothermal Workshop publications: Bromley, (2011), Scott et al., (2017), summarizing advice provided to Regional Councils. For existing hot water bores that are used by local communities or by small-scale commercial operators, the consent conditions are tailored to ensure minimal risk of adverse interference on the pressure, temperature or productivity of such bores.

**Table 4. Some environmental risks from long-term power-plant operation - avoidance, remediation and mitigation options.**

| | | | Dimensions |
|---|---|---|---|
| **Barriers** | **Description of the barrier** | **Overcoming Obstacles with Tools of Government** | **Coerciveness<br>Directness<br>Automaticity<br>Visibility** |
| **Hot-Spring Dilemma** | Hot spring interference can cause surface manifestations to disappear due to pressure and water table decline. This environmental risk can stop possible development or have negative impact on public acceptance. | 1. Avoidance measure: Use injection to sustain shallow pressure/temperature.<br>2. Remediation measure: Restore affected features.<br>3. Mitigation measure: Create new thermal features using waste hot water/steam. | High<br>Low<br>Low<br>Low |
| **Tremor Dilemma** | Large magnitude induced seismicity can cause danger to structures and people. | 1. Avoidance measure: Limit injection pressure & temperature gradients.<br>2. Remediation measure: Repair induced seismicity damage.<br>3. Mitigation measure: Construct quake safe public amenities. | High<br>Low<br>High<br>Low |
| **Exploitation Dilemma** | Unsustainable utilization rate can result in depletion of the resource within depreciable time-frame of the power plant and wells. | 1. Avoidance measure: Conservatively sized development stages informed by monitoring & models.<br>2. Remediation measure: Production-injection strategy changes.<br>3. Mitigation measure: Retire resource to allow recovery. | High<br>Low<br>Low<br>Low |
| **Wastewater Dilemma** | Discharge effluent surface water and groundwater contamination can have negative environmental impact. | 1. Avoidance measure: Reinject all mineralized liquid discharges and avoid injection into potable aquifers<br>2. Remediation measure: Re-instate natural surface water quality and pump out and treat or reinject into geothermal aquifer<br>3. Mitigation measure: Replace or treat affected water supplies | High<br>Low<br>Low<br>Low |

## 5. DISCUSSION

The study of issued licenses in Iceland reveals distinct barriers of development which have not been reviewed in previous research. The new understanding revealed with this study is that it is possible to identify repetitive barriers and what tools are used to overcome them. Instead of only reacting to issues as they arise in the licensing procedure, the licensing authority can, using the toolbox developed, inform the developer through e.g. a questionnaire as an addendum to the application form explaining the tools developed to overcome recognized barriers before the developer hits the barrier. Which has in some cases unintended and unforeseen consequences. A licensing authority that pro-actively engages and directs the applicant on the right path before matters arise is likely to have improved the service provided by the institution in accordance with stipulated performance management and handbook on performance improvements issued by the Government of Iceland. Also, such a strategic vision is in line with Milner and Joyce (2005) and new governance (Salamon, 2002). In conclusion of the procedure the licensing authority can ask the developer to fill out a form as to how they liked the service provided and if the barriers and direction given turned out to be useful. Feedback can then serve the aim of maintaining the toolbox up to date with what has been learned with every step taken. The importance of the licenses issued for society as a whole and how the role of OS improves the future of Iceland is also important to emphasize, incorporating the ideation of Public Service Motivation (PSM) into daily affairs (Rainey, 2014) by e.g. having a feed back survey after the license has been issued.

Classification of identified tools reveals that most of the dilemmas have a low directness and visibility. According to Salamon this implies that likely impacts of those relevant tools is a low effectiveness, equity and manageability but a high efficiency and legitimacy. In contrast the level of coerciveness and automaticity is evenly distributed between highs and lows. Those dilemmas with high coerciveness are likely to have a high effectiveness, efficiency and equity but low manageability. Whereas for dilemmas with low coerciveness are likely to have low effectiveness, moderate efficiency, low equity and moderate manageability. For dilemmas with high automaticity their likely impact has low effectiveness and equity but high efficiency and manageability. In contrast for dilemmas with low automaticity their effectiveness and equity are likely to be high and efficiency and manageability is likely to be low. Reviewing the tools developed for the intended dilemma the comparison is interesting to key tool dimensions and evaluation criteria developed by Salamon (2002). By embracing new governance approach suggested by Salamon it is possible to enhance further the tools developed and using the analytical framework to design those tools to the identified need and intended impact.

An adaptive pro-active leadership role for OS as a licensing authority is of greatest importance according to Mass (1990, 8). OS does serve as a mediator in many of the described dilemmas in table 1 and it can be important to lead the discussion and not only manage it. A guideline as shown in table 3 can serve an important role in off-setting the mindset of the OS employee by looking at the obstacle at hand from another perspective and not only that of OS. At first glance the leadership role can be perceived as obscured for e.g. an engineer or a lawyer but when the matter is approached more widely from a leadership point of view it can have great consequence if the licensing authority is able to reconcile parties and point the developer in the right direction towards cohesion and the task at hand embracing the Y-theory of McGregor. The importance of leading and not managing, as pointed out by Kotter, becomes obvious and so does the importance of realizing the methodology of change management (Kotter, 2012; Bridges, 2016). Indeed, realizing that the licensing procedure can question the status quo for the effected parties which can become an emotional endeavor to overcome. Then it is important to assist, support and reduce the reactions by simply acknowledging the effects beforehand. Active listening can serve an important role as discussed in the literature review.

The importance of understanding the Bozeman theory of bureaucracy in preventing rule inception into becoming rule evolved tape is of great importance. It is evident that 50% of the tools developed increased bureaucracy for all incidents to solve an issue that isn't a dilemma in all cases. This can be difficult to prevent but important to think logically when increasing bureaucracy whether it is possible to isolate the issue so not to burden other projects with pointless bureaucracy. This is also not in line with the vision presented by Kotter (2012) except perhaps if what goes with it is a clear road map for the developer so that the path forward doesn't become too complex and cumbersome.

In other areas of study, this approach can be applied for all licenses and monitor related roles of OS for the electricity market, hydro, groundwater, materials, hydrocarbons, microbes, monopoly licenses etc. that OS has a leading role in decision making. With reference to Kristinsson and Matthiasson (2014, 297) it could increase the chances of success by taking a systematic and cohesive development approach for all licenses issued with careful preparation instead of selecting a group of licenses concerning only one type of a resource like is done in this study. It could also be applied to all governmental tools needed for geothermal embracing the first new governance paradigm of Salamon (2002, 9).

Comparison to New Zealand reveals similarities in regards to the Wastewater, Tremor and Exploitation Dilemma. However, the Hot Spring Dilemma, has yet to be an issue in Iceland but could be in the near future. Classification of the tools developed reveals minor differences compared to those in Iceland respectfully. However, the tools themselves are different. That reveals an important lesson learned that an international tool comparison to the same natural dilemma can reveal interesting aspects and can contribute to enhancements of the instruments themselves. In addition, identification of dilemmas yet to be encountered like the Hot Spring Dilemma can illustrate the importance of international networking and globalization when it comes to governmental tool enhancements and creation. Such collaboration can reveal important aspects of expected impact of new tools and how best to design them taking into consideration the intended effectiveness, efficiency, equity, manageability and legitimacy into account. However, by sharing knowledge learned as is done in this paper a contribution is made towards globalization of resolutions of the dilemmas described and designing of tools to overcome them and choosing the right leadership role to stimulate, resolve and reach the objective at hand.

The six leadership challenges of Williams are discussed broadly in the next paragraphs in association with recognized dilemmas:

**Activist Challenge:** The first challenge of leadership for Iceland was to get people to wake up to the fact there was a problem that the country was avoiding which was its energy dependence and air pollution due to the use of coal for space heating in populated areas which was expensive. During the municipal election in Reykjavik in year 1938 the public was called attention to a contradiction


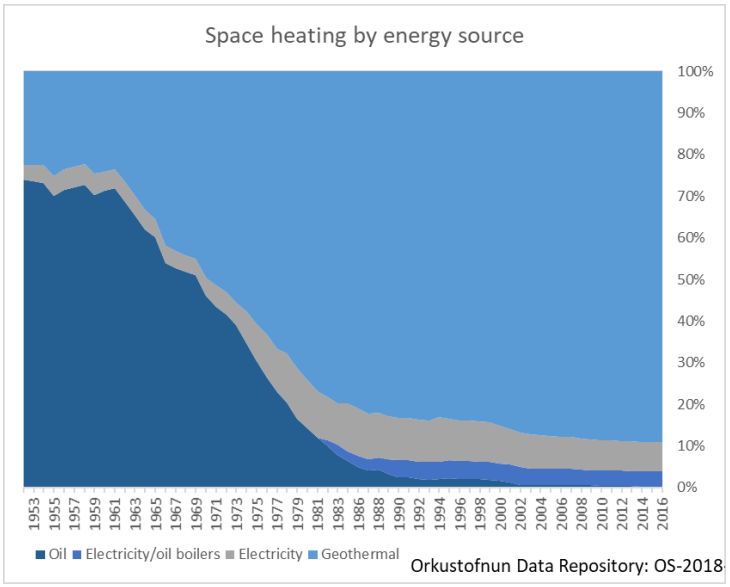


**Figure 1: On left the front page of Morgunblaðið (1938), the main newspaper at the time in Iceland showing a political promise of a clean city if the C-party is elected. A political promise that was achieved and caused a shift in values for the rest of the country. Instrumental in passing of the regulation in year 1953 allowing the state to finance the cost of drilling and installation of geothermal based district heating in Iceland causing what can be seen to the right the disappearance of fossil fuel for heating homes in Iceland (Orkustofnun, 2018).**

in their values. The front page of Morgunblaðið, see figure 1, illustrated two opposing visions of the future: One with smoke looming over the capital versus a clean one using geothermal based district heating networks instead of coal, see figure 1. By challenging the status quo, the politicians were able to get public acceptance for a high upfront cost of expanding the district heating network by exploring a far-away geothermal system in Mosfellssveit at Reykir requiring a long transmission pipeline to be installed. This was possible because the politicians could illustrate that the first district heating network at Laugarnes was such a great success, lowering the cost of heating by a factor for those living in that neighborhood. After a successful expansion the attention of politicians from the rural regions of Iceland was grabbed, i.e. with envy and the obvious fact that people wanted to move to Reykjavik just to lower their heating bill, yet another reason to move to the capital! This led to the passing of regulation nr. 3/1953 which so bluntly illustrates the fact with its name, for developing geothermal district heating outside of the capital area. By doing so the main barrier was resolved, which was financing risky geothermal exploration which has been identified to be the main reason hindering the development of geothermal energy worldwide (World Bank, 2012) which has not been the case for Iceland due to the financial tool developed early.

The leadership task was to call attention to the contradiction in values and intervene to disrupt the thinking and patterns of behavior that allow the people to persist in avoiding the reality of their condition. The front page of Morgunblaðið for the municipal election is an example of such a clear strategic intervention. Calling for attention of contradicting values with a political party willing to intervene. The expansion could have been a failure and hence this approach required courage to do the right thing for the future with inspiration, even poetry, of a clean city which became reality against the odds. Other cities in the World face today health threatening air-pollution levels. Perhaps here the tool developed in Iceland and a lesson learned is to confront the public directly to gain political leverage to invest in clean energy technologies. Today, 97% of all heating is with geothermal energy in Iceland. Still, the government uses the same financial mechanism to support smaller communities to use clean technologies like geothermal. A recent example of that is Kjósaveita, see table 3, and Skagaströnd geothermal based district heating recently installed and soon to be the utility in Höfn í Hornafirði. Market stimulation for that is done by offering lump sum of 12 years subsidies for the up-front cost (Ketilsson et al., 2020). In additions the government has also supported the projects directly. All with the political accepted goal that having access to geothermal energy with a local swimming pool is considered human rights by majority of Icelanders. With reference to the Neighbor and Municipalization Dilemma it can be useful to refer to managing transitions (Kotter, 2012) and the importance of selling the problem and not the solution as reviewed by Bridges (2016). Transformational leadership can also assist to encourage intellectual stimulation, inspirational motivation, individual consideration and idealized influence. Even though the Finance Dilemma came only up once since year 2008, see table 2, in the early stages of the development for geothermal this was the dominant dilemma which has been resolved with the tools developed and still are being applied today after OS issued well over 500 loans (Ketilsson et al., 2020).

**The Development Challenge:** Cultivating the latent capabilities needed to progress is important. Iceland established an institution in year 1967 with the sole aim of researching and developing hydro and geothermal energy, the National Energy Authority. Through a special division for geothermal research and another for drilling research and exploitation wells and the fact that Orkustofnun managed the Energy Fund that issued over 500 loans for development illustrates the importance of this challenge. The Development Challenge was hence resolved with a centralized role of a single governmental body, a body that now is the licensing authority and no longer takes part in the development as an operator or a developer with a few exemptions. To apply this leadership role to the Refurbish, Period, Abandonment and Greenfield Dilemma can be useful to push the issue forward towards a resolution. Remembering the difference between leadership and dominance as a control mechanism (Williams 2005, 52). Not to fail in engaging the group involved and be unwilling to look for solutions beyond one's comfort zone and hence prevailing group paradigm. It could also be argued that these tools need further improvement and hence fitting to the Development Challenge. An example of that is the Duration Dilemma. For equality it is perhaps best to keep the period of licenses to depreciable life (30 years).

**Creative Challenge:** The Blue lagoon is perhaps the best example of a creative challenge turning waste to value and hence the Wastewater Dilemma is thought to apply to the Creative Challenge. The same argument applies to other geothermal power plants where wastewater is being spilled to surface but can be turned into value like e.g. Jarðböðin near Mývatn. Icelanders have applied the creative challenge vigorously e.g. in the Iceland Deep Drilling Project, in the Gas to Rock project operated by ON Power to name a few (Ketilsson et al., 2020). Here Icelandic culture and trends for innovation becomes evident.

**The Maintenance Challenge:** Protecting and sustaining what is essential during hard times is important and in particular to maintain a sustainable yield. Hence OS has created a resource management tool which requires applicants to predict the pressure response of geothermal systems for the duration of the license in response to the Exploitation Dilemma. If the response goes out of bounds a certain procedure is initiated. Hence, it is not only up to the license holder how the resource is treated but a collaborative effort between OS and the operator.

**Crisis Challenge:** Induced seismicity can cause dramatic behavioral effect on communities that have encountered recently devastating earthquakes. It can be difficult for communities to accept that reinjecting water back into the geothermal reservoir can trigger earthquakes. The reaction can be as if the communities are in a period of extreme danger. Hence the right leadership role is that of a crisis leader. The tool developed by OS was setting rules for all reinjection procedures into the ground (Ketilsson et al., 2020) which could be argued falls under rule evolved red tape when an issue of one is turned into an issue for all. This is why the Tremor Dilemma is associated with the Crisis Challenge because when an event does occur, the leadership role needed from OS is that of a crisis leadership role, as was evident e.g. after a large earthquake induced by reinjection of Hellisheiði Power Plant (Ketilsson et al. 2020).

**The Transtition Challenge:** Moving from one system of values to another can be difficult to achieve. The most common dilemma encountered in this study is that of the Acceptance Dilemma, see table 2, which is associated with the Transition Challenge, see table 3, because there is a need to shift values in the mindset of the public. Before, geothermal development was for local use of space heating and generating electricity. Having met local demand, further development is for the power intensive industry with reference to global warming and the duty of Iceland to harness its renewable resources beyond local need. Even though the new values have been recognized and proposed they have not yet been accepted by the public. Then with growing environmental conservation the need for the electric power has been questioned by environmental groups. Their aim being the conservation of wilderness and not that of using renewable resources globally to reduce greenhouse gas emission as OS argues for. This issue was recently debated by the Director General of OS, Guðni A. Jóhannesson and the well-known writer and activist Andri Snær Magnusson, author of several books on the issue and a leader of a political group that wants to create a natural park for the highlands (Rúv, 2019). The natural highland park would prevent large power projects that are thought to be quite economical. Johannesson argued that the World faces global warming and hence Iceland has a moral obligation to use its economic resources for power intensive industries with emissions that are only a fraction of what they are if electricity is produced with coal. Magnusson replied with the fact that the World uses its resources inefficiently. Increasing the supply will only continue extravagant uses and low recycling. In addition, Magnusson argued that development in Iceland probably has no effect on development in e.g. China and that the power intensive industries brought to Iceland recently have shown to increase local pollution and greenhouse gas emissions themselves. Another example of this deep-rooted political issue is the fact that the third phase of the Master Plan has yet to be passed by the Parliament. The reason being that politicians have difficulties in taking the political risk of arguing for or against particular power projects even though that is demanded of them by the law. This is the Principal Challenge Iceland phases hindering geothermal development and hence the use of economical renewable resources and is the most common barrier encountered by applicants reviewed. In addition, when the behavior of the environmental groups is analyzed one can argue it to be similar to guerilla government. As O'Leary (2010) points out the solution to that is powerful collaboration and uncensored communication with active listening. It can also be effective to look towards how to manage transitions (Kotter, 2012) and how to embrace phases of change management (Bridges, 2016). The reason why the Selection Dilemma is categorized under Transition Challenge is because of the ESA decision, from April 20$^{th}$ 2016 requiring the Government of Iceland to change the licensing procedure so that licenses in the future will be open for applications instead of being resolved on an ad-hoc basis.

## 6. CONCLUSION

It is concluded that a pro-active licensing body can recognize common barriers of development and define tools to overcome them. By applying a relevant leadership role to further assist the parties involved to resolve the barrier can increase the likelihood of successful projects and decreases the cost otherwise incurred when barriers are discovered by developers on a repetitive basis.

Rethinking the role of OS as a licensing authority and the role of governments overall in regulating the energy market incorporates tool development like this paper provides a useful foundation to which to build upon. To do so effectively public managers must be able not simply to follow rules and procedures, but to engage in complex multiparty negotiations to solve dilemmas that arise which requires in-depth knowledge on the operating realities of the instruments on which the license procedure relies upon and how they can best be utilized to serve public purposes.

The Principal Challenge for Iceland is recognized to by the Transition Challenge since the set of values need to be changed from local incentives to global. This shift has not been accepted and the shift of values to the protection of the highlands is growing. Rule evolved red tape with increased bureaucracy increased in 50% of the dilemmas with the tools developed which indicates that perhaps better tools can be developed. By bringing them forward, the resolution or amendment of them becoming more likely. An example of that is the Duration Dilemma. It could be argued that for equality it would be best to keep the period fixed for all incurrences. The same can be said about the other tools. It is important not to fail in engaging the group involved and be unwilling to look for solutions beyond one's comfort zone and hence prevailing group paradigm. Not to hold the conviction that the leader alone has the truth and knows the way forward.

This new way of thinking, by analyzing issued licenses in Iceland reveals distinct barriers of development, in which some have not yet been reviewed in previous research. The new understanding revealed with this study is that it is possible to identify repetitive

barriers and what tools can be used to overcome them. It is proposed that OS informs possible applicants of these known barriers and tools to overcome them without losing impartiality. It is also proposed that applicants be able to give written feedback on the services provided by OS so to improve and maintain the toolbox developed. It is also worth noticing that the applied approach to issued geothermal licenses can be applied to other types of licenses to recognize common barriers encountered but yet undiscovered in the literature. International networking can reveal unknown dilemmas yet to be encountered but need consideration. Through networking a tool comparison can reveal possibilities for enhancements and transformational changes otherwise not discovered.

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