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ANALYSIS AND ASSESSMENT OF **ICELAND'S CLIMATE** **ACTION PLAN**

 COLUMBIA | SIPA
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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR COLUMBIA UNIVERSITY'S MASTER OF PUBLIC ADMINISTRATION DEGREE IN ENVIRONMENTAL SCIENCE AND POLICY, STUDENTS MUST SUCCESSFULLY COMPLETE A WORKSHOP COURSE, IN WHICH THEY WORK AS CONSULTANTS TO CLIENTS IN GOVERNMENT OR THE NON-PROFIT SECTOR TO ANALYZE IMPORTANT SUSTAINABILITY ISSUES AND TO RECOMMEND POLICY SOLUTIONS. THIS SEMESTER, WE HAD THE PRIVILEGE OF CONDUCTING AN INDEPENDENT ASSESSMENT OF ICELAND'S 2018-2030 CLIMATE ACTION PLAN, ON BEHALF OF THE MINISTER FOR THE ENVIRONMENT AND NATURAL RESOURCES, GUÐMUNDUR INGI GUÐBRANDSSON.

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EXECUTIVE SUMMARY

In 2018, Iceland's government launched a Climate Action Plan with the objective of meeting the country's Paris Agreement targets for 2030 and setting the goal of carbon neutrality before 2040. This report evaluates whether the steps outlined in Iceland's Climate Action Plan are sufficient to meet the two climate goals, which are ambitious and multifaceted.

Our team found that Iceland's 2040 carbon neutrality goal is achievable. We are less certain about Iceland's 2030 goals due to several significant implementation and execution issues. Increased collaboration, interest alignment, and knowledge sharing among key stakeholders would greatly increase the country's chances of meeting its goals. This finding is especially pertinent to stakeholder groups involved in land use changes. Our research focused on the carbon sequestration potential of land use changes, and clearly defining the European Union regulations related to the Paris Agreement goals.

Our research was informed by stakeholder interviews, which were virtual due to the COVID-19 pandemic. Throughout our research, we discovered several data gaps that must be addressed to ensure a deeper understanding of Iceland's potential for emissions reduction. These data gaps include in-depth research on wetland sequestration and rehabilitation, a map of soil types and determination of upper bound sequestration potential across the country and taking an inventory of carbon levels and fluxes of emissions for the types of land across the country.

Three sectors will have the most potential to meet Iceland's climate goals: reforestation and afforestation, wetland restoration, and transportation. Reforestation and afforestation will require additional funding to reach the sector's full potential. Wetland restoration has significant potential to reduce emissions through sequestration, however the aforementioned data gaps prohibited us from making a concrete estimate. Although projects aimed at reducing emissions from the transport sector are already underway, accelerated construction of public transportation projects and accelerated electric vehicle deployment and accompanying infrastructure will be essential to meeting the country's climate goals. Building such infrastructure will certainly pose a financial challenge, however given the reality of a weakening tourism industry due to COVID-19, the timing may be opportune. Agriculture has less potential than the aforementioned sectors, however it can still play a critical role in emissions reduction. With large scale sequestration efforts, the agricultural sector can be carbon neutral by 2040.

Iceland's economy, like other economies, will change to meet the challenges of COVID-19. However, these challenges also present opportunities to the government to restructure sections of its economy to incorporate green jobs related to a more sustainable infrastructure, ecosystem rehabilitation, and data collection necessary to inform future climate change initiatives.

PROJECT FRAMEWORK AND METHODOLOGY

This section will provide a structural overview of our project, specifically the division of research, the research methods utilized, and the effect of COVID-19 on our project.

RESEARCH QUESTIONS

In partnership with the Icelandic Ministry of Environment and Natural Resources, the team formulated three research questions to guide the project:

1. Is Iceland's Climate Action Plan sufficient to meet 2030 and 2040 targets?
2. Are the resources being allocated correctly and are they adequate?
3. What further steps can be taken to meet these goals, particularly related to technological innovation and policy design?

RESEARCH APPROACH

Research was conducted primarily through a thorough literature review as well as interviews with experts in Iceland's government, agricultural and energy sectors, and in the private sector. Our research focused on the carbon sequestration potential of land use changes and clearly defining the European Union regulations related to the Paris Agreement goals.

Throughout our research, we discovered several data gaps that must be addressed to ensure a deeper understanding of Iceland's potential for emissions reduction. These data gaps include in-depth research on wetland sequestration and rehabilitation, a map of soil types and determination of upper bound sequestration potential across the country, and a stock of carbon and fluxes of emissions for the types of land across the country.

EXPERT INTERVIEWS

The team interviewed government and private-sector experts working on topics related to Iceland's Climate Action Plan. Team members asked interviewees targeted questions related to challenges in meeting the 2030 and 2040 targets and possible solutions. Interviews were executed through the use of a standardized 'Interview Guide', which aimed to provide continuity in the information gathered from the interviews. The full list of experts interviewed by the team, as well as the interview questions, can be viewed in the Appendix.

The team initially planned to travel to Iceland to meet with government officials and public and private sector experts in person. Given the evolving COVID-19 situation, the trip was canceled, and the team conducted virtual interviews with stakeholders.

BACKGROUND

This section will provide the background information that informed our findings and recommendations.

Iceland has a unique opportunity to demonstrate global climate leadership through its fulfillment of its Climate Action Plan for 2018-2030. The country has proven itself to value innovation and efficiency in many sectors, which stems from the political environment. Formal institutions in Iceland have an important economic relationship with nature as nearly 10 percent of the country's GDP comes from tourism, much of which is contingent on the natural wonders the island nation has to offer.

Iceland's Climate Action Plan for 2018-2030 covers 36 measures ranging from waste management to agriculture and transportation, though it focuses on two primary actions. The first is to phase out fossil fuels used for transport. The second is to remove carbon by the means of afforestation and ecological regeneration.

Iceland Climate Action Plan Sectors
Clean Energy: Transport
Clean Energy: Other Sectors
Land Use and Forestry
Other Measures

FIGURE 1: ICELAND CLIMATE ACTION PLAN SECTORS

ICELAND'S CLIMATE ACTION PLAN FOR 2018 - 2030

In 2007, Iceland's Ministry for the Environment and Natural Resources worked across governmental agencies to build a strategic plan to reduce greenhouse gases (GHG) by 50 to 70 percent by 2040 based on 1990 levels. In 2015, Prime Minister Katrin Jakobsdottir mobilized Iceland's environmental efforts by pledging that the country would be carbon neutral by 2040 at the United Nations Climate Change Summit (1). This set the framework for Iceland's 2018 Climate Action Plan, which commits to a target of 29 percent emission reduction by 2030, as specified in the 2015 Paris Agreement, and its own target of carbon neutrality by 2040 (Figure 2). This plan is populated by action items that the Ministry of Environment and Natural Resources compiled along with other government agencies. Prime Minister Jakobsdottir was the former chairperson for the Left-Green Movement, and her pledge to devote government policy money toward the plan's implementation underscores the government's commitment to the implementation of this plan and the country's broad support for mitigating the impacts of climate change (2).

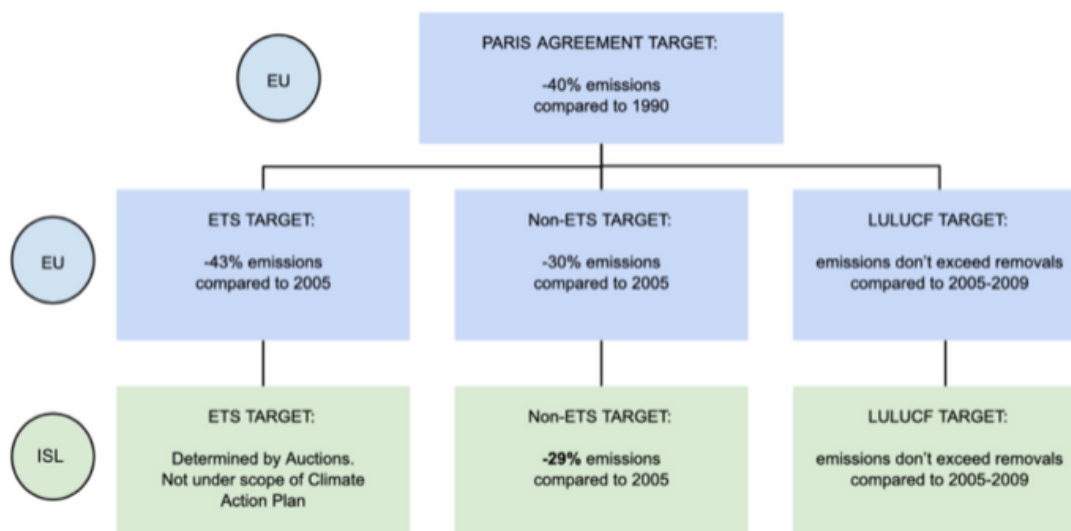


FIGURE 2: PARIS AGREEMENT TARGETS (2030)

Iceland's Policies and Measures and Projections Report (PaM Report), an annual report released by the government, shows how the non-ETS (emissions trading system) are projected to be reduced by 19 percent by 2030 (2,513 ktCO₂e emissions in 2030) compared to 2005; representing a gap of 10 percent (or 320 kt CO₂eq) with respect to the 29 percent target (Table 1) (3). The report has only included the projections from the existing measures of the Climate Action Plan (With Existing Measures Scenario, WEM) and therefore, a higher reduction can be expected including the additional measures of the plan not yet implemented (With Additional Measures Scenario, WAM). The following table from the PaM report shows the non-ETS emissions (ESD) for 2005 and the projections for 2030.

Sector	Emissions (kt CO ₂ e)					
	2005	2015	2020	2025	2030	2035
Total ETS	856	1 821	2 009	1 995	1 973	1 948
Total ESD (ktCO ₂ e)	3 091	2 881	2 965	2 827	2 513	2 210

TABLE 1. SECTORAL ETS AND ESD GHG PROJECTIONS, WEM SCENARIO (4)

To close this gap of 10%, different sectors will need to act in concert to reduce their emissions, as Iceland's Climate Action Plan indicates. The amount that each sector will need to reduce their emissions varies by their current level of emissions. The National Inventory Report (Table 2) informed our focus on the land use, land-use change, and forestry (LULUCF), as they are a main contributor to emissions. It is important to note that within Iceland's Climate goals, the most immediate goal of reducing 29% of emissions by 2030 comprises 'non-ETS' emissions, meaning non-industrial emissions. It is for this reason we are not focusing on the industrial processes category of emissions for this project.

	1990	1995	2000	2005	2010	2015	2016	2017	Changes '90-'17	Changes '16-'17
1 Energy	1,867	2,069	2,210	2,184	2,057	1,877	1,858	1,907	2%	3%
2 Industrial Processes	958	571	1,009	965	1,951	2,023	1,974	2,039	113%	3%
3 Agriculture	593	548	552	519	546	571	571	578	-3%	1%
4 Land Use, Land Use Change and Forestry	9,407	9,361	9,387	9,427	9,472	9,363	9,345	9,321	-1%	0%
5 Waste	181	239	267	279	291	245	237	230	27%	-3%
Total emissions without LULUCF	3,598	3,426	4,038	3,947	4,845	4,715	4,640	4,755	32%	2%
Total emissions with LULUCF	13,005	12,787	13,425	13,375	14,317	14,078	13,985	14,075	8%	1%

TABLE 2. TOTAL GHG EMISSIONS BY SOURCE SINCE 1990 (KT CO₂E) (5)

ENERGY MIX

Iceland's energy mix is characterized by its unique geographic location and geologic features. Glaciers cover 11 percent of the country's landmass and melt seasonally. This natural flow of water has been used to power 20 percent of the country's total energy needs through hydropower. Iceland's location over a continental rift allows it to meet an additional 65 percent of its energy needs with geothermal energy. Significant efforts from the government of Iceland helped make geothermal power a reality by establishing a geothermal drilling mitigation fund in the late 1960s.

The United Nations (UN) attributes Iceland's success in its clean energy transition to its geographic and geologic fortune, but also recognizes the success brought by cohesion between municipalities, government and the public to exploit their local green resources (6). In total, these geologic phenomena allow Iceland to power its country with 85 percent domestically produced renewable energy, with the remaining 15 percent not met by clean energy sources (7). Iceland's electricity sector and residential heating is powered by nearly 100 percent renewable sources. This is a unique scenario, in which energy emissions are not a significant part of a reduction strategy. Due to this, our focus shifted to identifying other sectors that contribute to Iceland's emissions.



DISCUSSION OF RELEVANT SECTORS

The next section of this paper looks at the sectors relevant to Iceland's climate goals: reforestation and afforestation, wetlands, transportation and agriculture. Reforestation and afforestation, wetlands, and transportation have the most potential to meet Iceland's climate goals due to their potential to reduce CO₂ levels and the feasibility of these reductions considering the current landscape of each sector. Agriculture will play an important role in meeting the climate goals, but has less potential than other sectors.

REFORESTATION AND AFFORESTATION

Ecological considerations are critical to meeting its climate goals. Iceland has a long history of deforestation, combined with periodic volcanic eruptions and intense windstorms, which has resulted in high levels of soil erosion for centuries. Recent efforts to restore Iceland's forest cover have successfully doubled the total forest cover to 2 percent of the country's land area from 1950 levels (8).

While there are currently no maps specifically delineating all of the land that holds the most potential for reforestation and afforestation, there is consensus surrounding the estimates. All of the land below the 400-meter elevation line can host vegetation, which is about one half of Iceland's total land area. About half of that land is unavailable as it is already protected areas (e.g., farms, urban spaces, wetlands, lava fields), leaving about one quarter of Iceland's total land area, or 2.5 million hectares available to host vegetation. This is the realistic upper limit of land available for reforestation and afforestation projects. Assuming the 30-year average of 10 tons of CO₂ sequestered per year by reforestation and combining it with those 2.5 million hectares of available land, reforestation may present a theoretical upper limit of 25 million tons of CO₂ sequestered per year. This amount, however, would vary depending on species of tree, the stage of growth per tree, and soil condition.

Despite the land potential to sequester a sufficient quantity of CO₂ per year to meet Iceland's 2030 goals, the principal roadblock is a lack of funding. The government is currently the only funding source for these projects, and its budget is often pulled in multiple different directions. Of the over 3,500 active farms in Iceland, 650 participate in the government-backed reforestation and afforestation program.

There are almost 100 applicants still waiting, as the Forestry Service's budget is currently unable to meet demand for these projects, which can cost about 500,000 IKS, or about \$3,400, to reforest one hectare of land (9). In total, the Forest Service estimates that its reforestation projects cover 1,000 hectares per year. This would sequester approximately 10,000 tons of CO₂ per year, significantly less than what would be required to meet the 2030 and 2040 goals. Thus, in order for reforestation and afforestation to have a real impact in preventing emissions and increasing carbon sequestration, a significantly larger allocation of funds must be directed towards these restoration projects.

WETLANDS

Wetland restoration is central to Iceland's ability to meet Paris Agreement targets by 2030 and reach carbon neutrality by 2040. Drained wetlands emit CO₂ and other greenhouse gases; potentially for hundreds of years. In the mid- to late-1900s, wetlands were drained en masse to meet growing agricultural demands. Approximately 47 percent of Iceland's wetlands have been impacted by drainage and there are more than 30,000km of drainage ditches around the country (10). Land use factors, including drained wetlands, account for a significant portion of Iceland's total emissions; some estimates are as high as 70 percent (11).

The majority of drained wetlands are privately owned, which presents a challenge to restoration. But, roughly 80 percent of drained wetlands are also either abandoned or not in use by the landowner. There are plenty of drained wetlands available to restore without encroaching on drained wetlands that are still in use for agricultural purposes (12).



A wetland restoration project should not take more than one year to complete, and the emissions reductions effects are immediate (13). Drained wetlands emit approximately 22 tons of CO₂ per hectare per year, while an undisturbed wetland typically emits 2 tons per hectare of CO₂ equivalent (14). Assuming that wetlands comprise 9 percent of Iceland's total land area and that 47 percent of those wetlands have been drained, there are 418,300 hectares of drained wetlands that can be restored. This estimate does not account for private land ownership, active agricultural lands, and budget constraints. If all hectares are restored, then the restored wetlands will sequester approximately 8.4 million tons of CO₂ per year. A more realistic estimate, based on the plans outlined by the Soil Conservation Service, results in a total restoration of 12,102 hectares by 2040 (15). Following the plan, restored wetlands will sequester 62,000 tons of CO₂ per year by 2025, 122,040 tons of CO₂ per year by 2030, and 242,040 tons of CO₂ per year by 2040. According to the 2019 Inventory Report, total emissions including LULUCF was approximately 14 million tons of CO₂ equivalent (16). If all drained wetlands are restored, it could reduce total emissions by more than half.

Although the cost of wetland restoration varies significantly among each project, an average cost per hectare is approximately 250,000 ISK, approximately \$1,700 (17). This estimate includes the costs of project management, mapping, and monitoring, in addition to the physical restoration. The estimated total cost of the Soil Conservation Service plan from 2016-2040 is approximately 3 billion ISK, or \$21 million. Whereas the cost of restoration for the highest possible sequestration potential would be approximately 100 billion ISK, or \$727 million.

There are many reasons that the highest possible potential is not achievable, aside from the high cost. But this upper bound is valuable in showing how much space there is for wetland restoration to expand, before encroaching on agricultural lands. The Soil Conservation Service's wetland restoration plans, although ambitious, make a much smaller impact in terms of overall sequestration when compared to the possible potential. These estimates illustrate the potential for carbon sequestration through wetland restoration, as well as the potential for current plans to expand and reach a greater impact.

TRANSPORTATION

Reducing emissions in the transportation sector is a main focus in the Climate Action Plan. Oil and other fossil fuels power much of the transportation sector, including personal vehicles, heavy duty trucks, and fishing fleets (18). The transportation sector in Iceland has grown substantially, seeing a significant increase in personal vehicles by 78 percent since 1990 (19). However, diesel prices in Iceland are among the highest in the world, and the country's small geographic size makes it suitable for e-mobility (20). The fast rollout of public charging infrastructure and favorable policies and financial incentives have allowed electric vehicles (EVs) to capture 25 percent of the market share in 2019 (21,22).

Electric vehicle adoption has made significant progress in the last few years, making Iceland an international leader. Due to the quick deployment of electric vehicles and charging infrastructure, road transportation is projected to decrease from 992 ktCO₂e in 2020 to nearly 603 ktCO₂ by 2030, as seen in Figure 3. This dramatic decrease was projected in Iceland's Report on Policies and Measures and Projections in 2019, however, the economic landscape of Iceland has drastically changed. The collapse of oil and gas prices from the COVID-19 pandemic is projected to greatly impair the transition to EVs and other alternate forms of transportation. In a recent Wood Mackenzie study, it was projected that EV sales would decrease around 40 percent in 2020 as they had already fallen drastically in China, a leading nation in EV market penetration (23). In general, a looming economic recession will likely mean consumers with diminished cash flow will have less ability to purchase new vehicles, let alone higher priced electric ones (24).

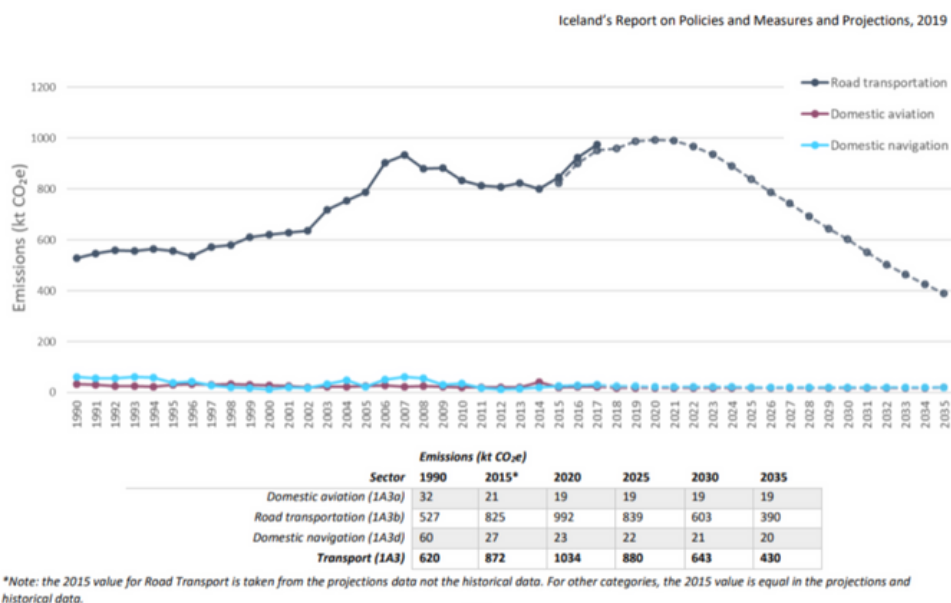


FIGURE 3. TRANSPORT EMISSIONS OF TOTAL GHGS (KT CO₂E), WEM SCENARIO

Biofuels may serve as a legitimate transition fuel in the wake of a likely delayed transition to electric vehicles, especially if Iceland's current efforts are expanded. The northern town of Akureyria has seen strong advancements with local firms like Molta and Orkey that can deliver cooking oil and animal fat-based biodiesel to consumers. The Svartsengi geothermal power plant has been producing methanol out of wastewater in lieu of releasing it into the atmosphere. In 2018, the plant started exporting their methanol to the United Kingdom at a small scale, which could serve as an enticing technology transfer for various European industries. In addition, Biofuels also have applications for the fishing sector. While the fishing sector has already reduced its emissions by 43 percent from 1990 to 2016, fishing vessels can continue to explore the use of biodiesel mixtures to fuel their fleets. As of 2017, the Ministry of Tourism, Industry and Innovation has illustrated an aim for 10 percent renewable energy in domestic fishing trawlers by 2030 (25).

Another way to reduce transportation emissions in an increasingly uncertain economy is the development of public transportation projects. One of the most notable projects is a high-class public transport system (Borgarlína) in Reykjavik Capital Area. This project is a collaboration measure between the government and the municipalities in the capital area but was not directly included in the Climate Action Plan (26). Although Iceland's Minister of Transport, Sigurður Ingi Jóhannsson, says that the transportation plan is a "fully funded agreement," many still question how 50 percent of the project will be funded (27). Construction for Phase 1 was set to take place in March 2020, however, due to COVID-19, plans were pushed back to 2021. Projections for this project are still unclear, considering the environmental impact assessments are still taking place.

Lastly, it should be noted that Iceland has also become a hotspot for hydrogen testing due to its access to vast quantities of natural energy, and has garnered the political support of the government for further research and deployment (28). Hydrogen vehicles are much lighter than electric vehicles, and so many be ideal in reducing emissions in the heavy-duty trucking sector. Financial incentives such as a waiver of the value-added tax on electric or hydrogen vehicles up to a certain maximum, have been helpful in making these technologies accessible (29). However the nascency of this technology makes it unlikely like hydrogen vehicles will significantly contribute to Iceland's 2030 climate goals. Hydrogen vehicles could contribute to Iceland's 2040 climate neutrality pledge, but currently remains too uncertain to conclude definitively.



AGRICULTURE

Agricultural practices constitute 11 percent of global greenhouse gas emissions. Given most of Iceland's agricultural land is dedicated to livestock rearing and grazing, soil erosion and manure management are especially pertinent to greenhouse gas emissions reduction discussions. Iceland can mitigate the impact of agricultural emissions with policy-driven application of new technologies and techniques. The agricultural sector has generally embraced steps to reduce their carbon footprint and is currently emitting slightly fewer tons of CO₂ per year than in 1990 by improving the productivity of their sheep and subsequently reducing the total livestock quantity.

Iceland has endeavored to cut its current agricultural emissions of approximately 600,000 tons of CO₂ equivalent by 10 percent, or 60,000 tons, by 2030. It is important to distinguish that over 90 percent of agriculture emissions are methane from livestock and manure management and nitrous oxide from artificial fertilizers; in that light, most carbon sequestration efforts would not capture agricultural CO₂, and would instead offset methane and nitrous oxide. Methane comprises the vast majority of those emissions due to enteric fermentation from sheep and other livestock.

The agricultural sector has generally embraced steps to reduce their carbon footprint and is currently emitting slightly fewer tons of CO₂ per year than in 1990 by improving the productivity of their sheep and subsequently reducing the total livestock quantity. Additionally, the agricultural sector has been working with the government and identified a few primary steps to directly reduce their emissions. These include:

- Reducing artificial fertilizer and replacing it with organic substitutes,
- Improving animal manure management, and
- Creating "carbon-neutral sheep" by offsetting emissions with land use changes.

While all three steps have abatement potential, sheep and other livestock emissions are the largest source, and thus have the most room to cut. However, reducing enteric fermentation emissions per sheep faces an abatement ceiling, where steps such as improving feed can only reduce emissions by a limited amount. The difficulty in reducing a sheep's greenhouse gas intensity makes a reduction in the total number of sheep the most viable option to reach the agricultural sector's goals.

Faced with that reality, farmers are turning to land use practices to offset their emissions, with approximately 60 percent expressing interest in cultivating forests on their land to sequester carbon. According to the Farmer's Association of Iceland, the plan for the average farm would be to annually plant 10 hectares of forest (2.1 tCO₂/ha per year) and reclaim 30 hectares and two hectares of land (2.1 tCO₂) and wetland (19.5 tCO₂), respectively. With those efforts, they believe they can sequester enough CO₂ to offset emissions by at least 20 percent, or 120,000 tons, in 2030, and achieve carbon neutrality in 2040.

One of the most effective ways to change land use at the necessary scale is to convert privately owned, marginal farmland into sequestration lands. A significant portion of agricultural land is not actively cultivated. This land should be targeted for land use change efforts. The primary challenge in this, however, is reluctance by farmers to affect potential grazing land, constrain fence-averse sheep with physical barriers, and convert land back to wetland. While overcoming these challenges will not necessarily be easy, the government should offer financial incentives to farmers to convert these lands, as well as improve access to education and training as to how improving land practices can benefit their business and how to do so.

Iceland can mitigate the impact of agricultural emissions with policy-driven application of new technologies and techniques. In Iceland, as in the rest of the world, livestock manure contains important nutrients and is recycled as fertilizer. Manure contains high amounts of nitrogen, which reacts with the carbon and water present in the manure to form N₂O and CH₄. This reaction occurs at every step in manure processing, including storing, spreading, and treating manure. Studies have shown that manure from livestock production systems are estimated to contribute 30 to 50 percent to the global N₂O emissions from agriculture. Manure management mitigation techniques include changing manure application timing, diet optimization, and farm manure accounting systems which can precisely target emission mitigation efforts (30).



KEY FINDINGS

Finding 1. After completing our research, our team finds that Iceland's 2040 carbon neutrality goal is achievable. We are less certain about Iceland's 2030 goals due to several significant implementation and execution issues.

Finding 2. Iceland's goals are ambitious and multi-faceted. Increased collaboration, interest alignment, and knowledge sharing among key stakeholders would greatly increase the country's chances of meeting its goals. This finding is especially relevant when considering stakeholder groups involved in LULUCF changes.

Finding 3. Emission reductions through LULUCF will be vital to reaching Iceland's 2040 goals. Because of the time and resources required to implement them, LULUCF measures will have a smaller impact on the 2030 goals, but early action will prove most effective for 2040.

Finding 4. Although significant funding has been allocated to support land use changes, more funding may be needed to utilize these measures to reach carbon neutrality by 2040. Insufficient funding to implement these emissions reduction measures was a consistent theme throughout all of our stakeholder interviews. In hopes to remedy this issue, a few potential innovative financing solutions are listed below.

Finding 5. Closing the 10 percent gap in non-ETS emissions could be accomplished through more targeted efforts in high-emissions sectors, such as transportation (including commercial and heavy-duty trucking), fishing, and agriculture. The remaining 10 percent gap in emissions comes out to a ~300kt/year reduction, after LULUCF measures are considered. No sector can close this gap alone.

Finding 6. Data gaps prevent a realistic assessment of whether emission reduction goals are achievable, and whether resources are being properly allocated. Some of these data gaps include the following:

- Additional research is needed to support efforts related to wetlands. Our team noted that research regarding afforestation is more robust. Data gaps related to wetlands could potentially influence allocation of resources.
- Mapping of soil type and determination of upper bound sequestration potential makes it difficult to assess feasibility of reduction goals. Specifically, mapping of soil type and hectares of land that could be restored or reforested.
- LULUCF: geographic data identifying types of land across the island + stocks of carbon and fluxes of emissions for each of the types of land. In addition to the projections of LULUCF emissions in the next PaM report

POLICY RECOMMENDATIONS

The government of Iceland, like many governments, has many budgetary demands, especially given the challenges of protecting its citizens against the COVID-19 pandemic. However, our team recommends the exploration of innovative financing solutions to enhance the utilization of land use measures to reach emissions reduction targets.

1. The Ministry of Environment could provide grants to landowners to restore drained wetlands or adopt emissions reducing agricultural practices. A grant program was utilized, in the mid-late 1900s, to encourage landowners to drain wetlands to meet growing agricultural demands. Now, the opposite action is needed. A grant program to incentivize implementation of natural emissions reduction measures would truly bring this process full circle.
2. In order to attract private investment in carbon sequestration through land use changes, the government should create or facilitate a carbon sequestration marketplace. Such a system could require farmers who wish to sequester CO₂ to receive sustainability certification and undergo carbon auditing in order to receive private funds to sequester carbon and sell the credits.

We recommend a more focused action plan for the 10 percent reduction needed by 2030. Contributions from the agricultural sector and transportation sector could be significant.

1. Funding remains the main barrier to the completion of public transportation projects is funding, which have been further delayed by COVID-19. During this delay, a focus on biofuels could serve as an intermediate solution for reducing emissions in combustion vehicles, as well as provide a local source of fuel while energy insecurity is accentuated due to COVID-19. While the fishing sector has already reduced its emissions by 43 percent from 1990 to 2016, fishing vessels can continue to explore the use of biodiesel mixtures to fuel their fleets.
2. Additionally, improved soil and manure management strategies to reduce methane and nitrous oxide emission release should be implemented in the agriculture sector. Although global adoption of such agricultural practices is low, financial incentives, such as linking subsidies to land conditions and improvements could help achieve this goal for Iceland.

CONCLUSIONS

As stated, we believe the 2040 carbon neutrality goal is achievable, but the 2030 Paris Agreement goal is less certain. We recommend a more focused action plan specifically for the 10 percent reduction needed by 2030. This will need to include numerical targets for specific sectors and innovative solutions to increase participation. In addition, filling the aforementioned data gaps will clarify the most useful options to reach these goals. Our research and interviews showed us that many major stakeholders are supportive of emission reduction actions, but may need more funding to do so. An increase in stakeholder collaboration will also prove extremely helpful to reaching these goals across all sectors. We recommend the creation of a Land Use Emissions Reduction Summit to unite all relevant stakeholders and coordinate efforts. Overall, Iceland has the motivation and resources to execute these goals. Timely implementation and coordination will be the ultimate key to reaching these goals.

Due to the increasing global uncertainty due to COVID-19, there is a unique opportunity in the changing economy to shift job creation to green jobs. Specifically, green infrastructure development and data collection of geographic land types for wetland restoration could create jobs while simultaneously reducing emissions. To address funding, we propose a grant program that would promote rehabilitation of wetlands, replacing and reversing the grant program that was used to drain those lands during the 20th century. This could be implemented in concert with the creation or facilitation of a carbon sequestration marketplace for landowners to undergo carbon auditing to receive private funds, and then sell the credits. Lastly, we recommend exploration and expansion of biofuels to reduce emissions while the current vehicle fleet ages.

APPENDIX

ACRONYMS

BRT: Bus Rapid Transport

EA: Environmental Agency

EEA: European Economic Area

ESD: Effort-Sharing Directive, otherwise known as non-ETS

ETS: Emissions Trading System

EU: European Union

EV: Electric Vehicle

GHG: Greenhouse gases

LULUCF: Land Use, Land-Use Change, and Forestry

NIR: National Inventory Report

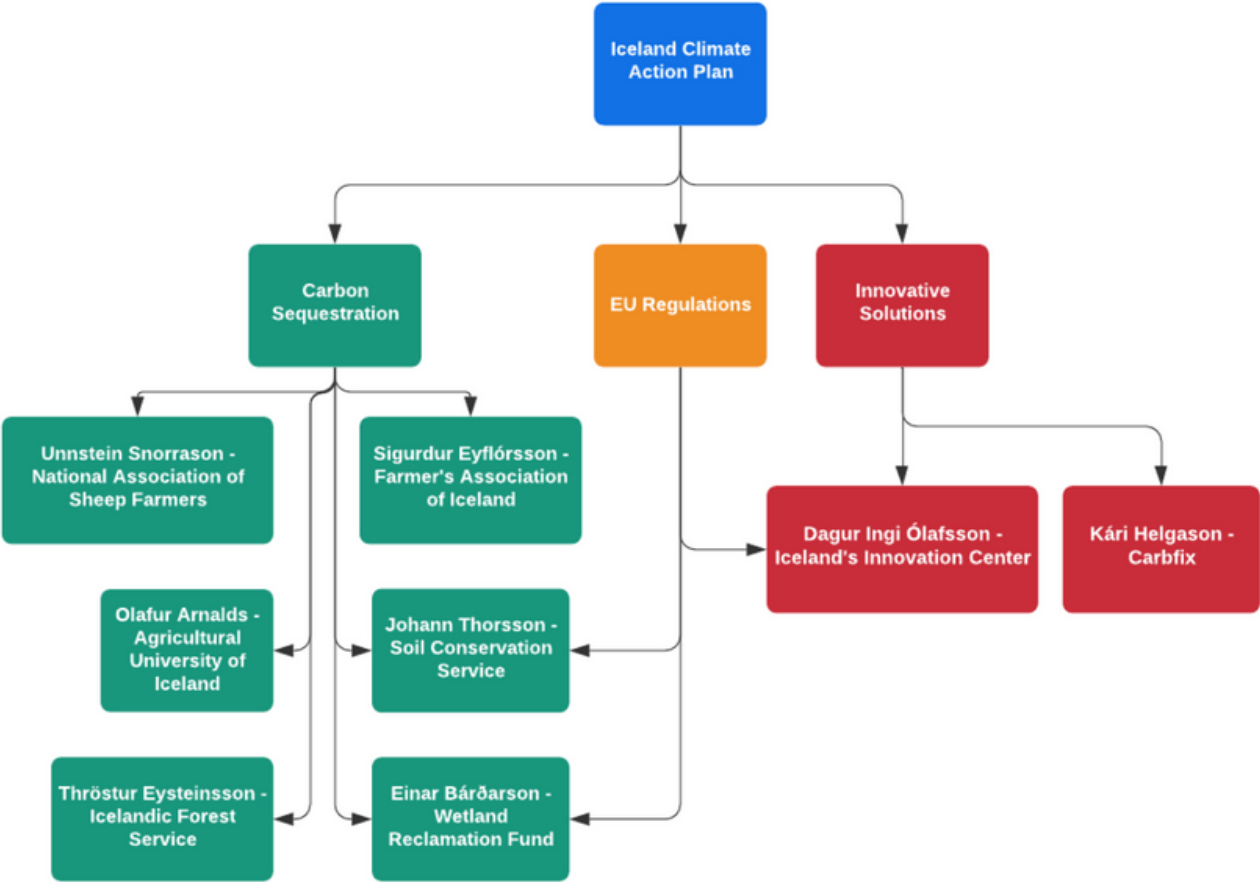
PaM: Policies and Measures

UN: United Nations

UNFCCC: United Nations Framework Convention on Climate Change

WEM: With Existing Measures Scenario

STAKEHOLDER MAP



INTERVIEW GUIDE

- Were you born and raised in Iceland?
- Can you tell me a little bit about your career and what led you to your current role?
- What was your role in the government's Climate Change Action Plan for 2018-2030? Iceland's goal of carbon neutrality is set 10 years before other EU countries. What do you think is the main learning that can be applied from Iceland to EU countries?
- Are other countries pursuing specific climate solutions—either policies or technologies—that Iceland should consider?
- Given that transportation and fisheries account for a high percentage of greenhouse gas emissions, what are your views on how these sectors should be tackled?
- How do you think private companies and non-profit organizations can best support the government's efforts? How can average citizens support the effort?
- Many countries, including the US, announce goals and then have a difficult time meeting them for political or other reasons. What do you think is the biggest barrier for Iceland in meeting the EU climate targets? What about meeting Iceland's 2040 goal of carbon neutrality?
- We've heard that politics is not a major barrier in accomplishing the climate goals. What are your thoughts about the political feasibility of the 2030 and 2040 goals?
- What adaptation strategies is Iceland considering to respond to the threats of climate change?
- Looking ahead, beyond 2040, what do you see for the future of Iceland?

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TO: ICELANDIC MINISTRY OF ENVIRONMENT
FROM: COLUMBIA UNIVERSITY'S ENVIRONMENTAL SCIENCE AND POLICY CAPSTONE CLASS
SUBJECT: AN INDEPENDENT ASSESSMENT OF ICELAND'S CLIMATE ACTION PLAN 2018-2030
DATE: MAY 6, 2020

INTRODUCTION

In partial fulfillment of the requirements for Columbia University's MPA degree in Environmental Science and Policy, students must successfully complete a Capstone course, in which they work as consultants to provide clients in the public or nonprofit sectors with analysis and policy solutions regarding important sustainability issues. This semester, we have had the honor and privilege to conduct an independent assessment of Iceland's 2018-2030 Climate Action Plan (Aðgerðaáætlun í loftslagsmálum 2018 - 2030), on behalf of the Minister of the Environment, Guðmundur Ingi Guðbrandsson. We would like to thank our client contacts at the University of Iceland, Brynhildur Davíðsdóttir and Ingunn Gunnarsdóttir, for providing the team this opportunity. We applaud their openness to an independent assessment, and their dedication to mitigating the impact of climate change.

SUMMARY

Our task this past semester was to assess whether the steps outlined in Iceland's Climate Action Plan are sufficient to meet the country's 2030 and 2040 climate goals, which are ambitious and multi-faceted. Our team finds that Iceland's 2040 carbon neutrality goal is achievable. We are less certain about Iceland's 2030 goals due to several significant implementation and execution issues. Increased collaboration, interest alignment, and knowledge sharing among key stakeholders would greatly improve the country's chances of meeting its goals. This finding is especially pertinent to stakeholder groups involved in land use changes.

2030 PARIS AGREEMENT TARGET. Iceland's 2030 Paris Agreement Target aims for a 29 percent reduction in non-ETS carbon emissions by 2030. Iceland is on track to achieve a 19 percent reduction in non-ETS emissions by 2030, falling short of its goal by 10 percent. Closing the 10 percent gap in non-ETS emissions could be accomplished through more targeted efforts in high-emissions sectors, such as transportation and agriculture. The remaining 10 percent gap would necessitate a ~300/kt/year reduction, after land use measures are considered. No one sector can close this gap.

2040 CARBON NEUTRALITY TARGET. Our team finds that this goal is achievable. However, land use initiatives necessary to achieve this goal will require immediate attention given the timeframe required to realize their impact. Additionally, more funding may be needed across several sectors to reach carbon neutrality by 2040. Insufficient funding to implement these emissions reduction measures was a consistent theme throughout our stakeholder interviews.

This policy brief ends with some other recommendations to consider as you progress toward meeting climate targets. We realize that Iceland's economy, like other economies, will change to meet the challenges of COVID-19. However, these challenges also present opportunities to the government to restructure sections of its economy to incorporate green jobs related to a more sustainable infrastructure, ecosystem rehabilitation, and data collection.

METHODOLOGY

Our research focused on the carbon sequestration potential of land use changes and clearly defining the European Union regulations related to the Paris Agreement goals. Our research was informed by stakeholder interviews, which were virtual due to COVID-19.

Throughout our research, we discovered several data gaps that must be addressed to ensure a deeper understanding of Iceland's potential for emissions reduction. These data gaps include in-depth research on wetland sequestration and rehabilitation, a map of soil types and determination of upper bound sequestration potential across the country, and an inventory of carbon and fluxes of emissions for the types of land across the country.

FINDINGS

Three sectors will have the most potential to meet Iceland's climate goals: reforestation/afforestation, wetland restoration, and road transportation. Reforestation and afforestation will require additional funding to reach the sector's full potential. Wetland restoration has significant potential to reduce emissions through sequestration, however the aforementioned data gaps prohibited us from making a concrete estimate. Although projects aimed at reducing emissions from the transport sector are already underway, accelerated construction of public transportation projects and accelerated electric vehicle deployment and accompanying infrastructure will be essential to meeting the country's climate goals. Building such infrastructure will certainly pose a financial challenge, however given the reality of a weakening tourism industry due to COVID-19, the timing may be opportune. Agriculture has less potential than the aforementioned sectors, however it can still play a critical role in emissions reduction. With large scale sequestration efforts, the agricultural sector can be carbon neutral by 2040.

CONCLUSION

As stated, we believe the 2040 carbon neutrality goal is achievable, but the 2030 Paris Agreement goal is less certain. We recommend a more focused action plan specifically for the 10 percent reduction needed by 2030. This will need to include numerical targets for specific sectors and innovative solutions to increase participation. In addition, filling the aforementioned data gaps will clarify the most useful options to reach these goals. Our research and interviews showed us that many major stakeholders are supportive of emission reduction actions, but may need more funding to do so. An increase in stakeholder collaboration will also prove extremely helpful to reaching these goals across all sectors. We recommend the creation of a Land Use Emissions Reduction Summit to unite all relevant stakeholders and coordinate efforts. Overall, Iceland has the motivation and resources to execute these goals. Timely implementation and coordination will be the ultimate key to reaching these goals.

Due to the increasing global uncertainty due to COVID-19, there is a unique opportunity in the changing economy to shift job creation to green jobs. Specifically, green infrastructure development and data collection of geographic land types for wetland restoration could create jobs while simultaneously reducing emissions. To address funding, we propose a grant program that would promote rehabilitation of wetlands, replacing and reversing the grant program that was used to drain those lands during the 20th century. This could be implemented in concert with the creation or facilitation of a carbon sequestration marketplace for landowners to undergo carbon auditing to receive private funds, and then sell the credits. Lastly, we recommend exploration and expansion of biofuels to reduce emissions while the current vehicle fleet ages.

