Landsvirkjun ALCOA

Sustainability Initiative

Measuring Alcoa and Landsvirkjun Performance
on the Fjardaál and Kárahnjúkar Projects

Phase I/II Report

Identification of Sustainability Indicators

APRIL 2005

Sustainability Initiative -
Measuring Alcoa/Landsvirkjun Performance on the Karahnjukar and Fjardaal Projects

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April 2005

The indicators presented herein were developed in consultation with an Advisory Group (see Appendix B of this report for details). Participation by Advisory Group members in this initiative does not imply support for the Karahnjukar and Fjardaal projects or that such members believe the projects are sustainable. Rather, Advisory Group members have contributed to the development of indicators that will be used to measure the performance of the projects relative to sustainability objectives. Alcoa and Landsvirkjun are grateful for the contributions of the Advisory Group members to this initiative and look forward to continued dialogue and coordination on project-related issues in the future.

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1.0 INTRODUCTION

1.1 Overview and Purpose of the Sustainability Initiative

In 2002, the Government of Iceland, Landsvirkjun, and Alcoa executed a Memorandum of Understanding (MOU) regarding the development by Alcoa of the Fjardaal aluminum plant in East Iceland. On 15 March 2003, the Government of Iceland, Landsvirkjun, Alcoa, and the Municipality of Fjardabyggd signed the final agreement for Landsvirkjun to build the Karahnjukar hydroelectric station and the Fljotsdalur transmission lines to bring power to the smelter. For purposes of this document, the smelter, hydroelectric station, and transmission lines[1] are collectively referred to as the "projects". An overview of the projects is included in Appendix A.

The combined projects represent the largest construction projects and private and public sector investments in Icelandic history. The smelter and hydroelectric projects are expected to cost over 2.5 billion dollars (U.S.) to construct. As would be expected for an infrastructure project of this magnitude, the projects have received a mixture of public support and scrutiny from domestic and international stakeholders. The environmental, social, and economic opportunities and challenges in building a new aluminum smelter and hydropower projects are significant. The findings of the Environmental Impact Assessments (EIAs), which have been conducted for each of the projects, have been controversial, specifically with respect to environmental issues. The EIA found that, while the projects impact the environment, those impacts could largely be mitigated through specific measures, as defined in the final authorization for the projects. The EIAs also recognized the predicted social and economic benefits of the projects. These EIA findings have ultimately been upheld by the Icelandic Supreme Court and the projects have been approved. Nevertheless, some groups remain concerned about the projects and their potential adverse environmental, social, and economic impacts.

Alcoa has publicly stated that the Fjardaal smelter is being designed to be one of the most environmentally friendly aluminum production facilities in the world. Similarly, Landsvirkjun's environmental policy for the Karahnjukar station is to develop a state-of-the-art hydroelectric facility while minimizing disturbance of the environment. In addition to these environmental standards, both companies are committed to ensuring that the projects provide social and economic benefits to local communities. Both companies want to demonstrate a long-term commitment to these objectives and to help fulfill that commitment have combined their efforts to establish this Sustainability Initiative.

1.2 Sustainable Development and Sustainability

Sustainable development is a concept that refers to development where emphasis is shifted from short term economic gains to a more long term approach where there is balance between economic, social, and environmental considerations. Sustainable development requires an integrated approach to decision-making linking the economy, the environment, and society rather than a piecemeal approach. Development of this type is a complex process of interaction between public authorities, civil society, and the private sector. Sustainability has

[1] In the beginning of 2005 the operation of Landsvirkjun was divided into production and distribution of energy. A new company, Landsnet, was founded and will be the owner of the transmission lines. At this point it is not clear if the change will have any effects on further work on this initiative.

similar meaning as sustainable development, but is used when the focus is more narrow, such as sustainability within companies or the sustainability of specific projects.

The use of the terms sustainable development and sustainability in this initiative does not attempt to explain whether the development of the Fjardaal and Karahnjukar projects is sustainable (no net loss of resources) but rather reflects Alcoa and Landsvirkjun's commitment to moving towards that goal through responsible construction and operation of the projects.

1.3 Purpose of this Initiative

The purposes of this initiative include the following:

- To support Alcoa and Landsvirkjun's commitment to environmental, social, and economic sustainability;
- To develop and implement a process for both companies to implement sustainability practices during the construction and operation of the Fjardaal and Karahnjukar projects; and
- To develop indicators to measure the performance of Fjardaal and Karahnjukar projects against sustainability objectives.

The companies have adopted the following Sustainability Objectives for the projects[2].

- **Respect and Protect People –** Listen to and respect the views of the workforce and the communities around the projects and preserve their dignity.

- **Build Community Experience and Well-being –** Contribute to improved quality of life, and build skills, knowledge, and experience in Iceland, while respecting the significance and diversity of Iceland culture and heritage.

- **Deliver Long-term Economic Benefit –** Deliver economic benefits to the local communities of East Iceland and the nation of Iceland. Foster economic growth, generate wealth for the communities, provide commercial returns to shareholders, and contribute to long-term economic health.

- **Ensure Efficient Resource Use and Cleaner Production –** Use natural resources wisely and manage our environmental impacts to the benefit of the full range of our stakeholders by employing leading technology and best management practice and by encouraging responsible design, use, and recycling of products and by-products.

- **Maintain or Enhance Ecological Integrity and Biodiversity –** Maintain or enhance biological diversity and the fabric of ecological integrity in the environments in which the projects operate.

- **Meet the Needs of Current and Future Generations –** Take a long-term approach to project activities and work in partnership with communities and governments to meet the needs and desires of today without compromising the ability of future generations to satisfy their own needs.

- **Encourage Stakeholder Involvement –** Work with communities, employees, customers, stakeholders, and suppliers to achieve outcomes and make decisions of mutual benefit. Report regularly to stakeholders on the sustainability performance of our operations.

- **Maintain Accountability and Governance –** Practice ethical business governance, be accountable for actions, continually improve performance and integrate environmental, social, and economic considerations in decision-making.

The indicators developed for this initiative (Section 2.2 of this report) will help measure Alcoa's and Landsvirkjun's performance at achieving these objectives on the Fjardaal and Karahnjukar projects.

[2] These sustainability objectives were developed by Alcoa. Landsvirkjun has adopted these objectives for this initiative, but is in the process of developing their own sustainability objectives.

1.4 Sustainability Initiative Process

Alcoa and Landsvirkjun have developed a process for implementing this sustainability initiative, which is illustrated in Figure 1. Inherent in the process are Alcoa's and Landsvirkjun's company policies (available at http://www.alcoa.com and http://www.lv.is) that reflect environmental, social, and economic performance considerations and the active involvement of local, regional, national, and international stakeholders in all phases of the process (Figure 1).

The process has four sequential phases, each with several tasks.

Phase 1 – Context and Effects

This phase establishes the foundation for the initiative and includes identifying goals, identifying and engaging stakeholders, and identifying issues/risks/opportunities.

Alcoa and Landsvirkjun have completed Phase 1. Thus far, in consultation with the advisory group, the companies have:

- Defined the goals of the initiative (see Section 1.1) and customized the process for this initiative.

- Identified key stakeholders and created an Advisory Group during spring 2004 (see Appendix B for a list of Advisory Group members and a brief summary of activities to date). In forming the Advisory Group, Alcoa and Landsvirkjun attempted to achieve a balance of perspectives (e.g., social, economic, and environmental); appropriate geographic representation (e.g., East Iceland and elsewhere); the involvement of stakeholders both in favor of and concerned with the projects; and a cross section of government, NGO, community, and business representatives. The role of the Advisory Group was to participate in the development of sustainability indicators and potential metrics for measuring the companies' performance.

- Coordinated Advisory Group meetings that focused on identifying issues and concerns and discussing indicators and metrics.

Phase 2 – Indicators and Baseline

Alcoa and Landsvirkjun have completed Phase 2, which is the subject of this report. This phase involved developing the indicators and metrics, determining the types of effects that Alcoa and Landsvirkjun have on each indicator, and gathering existing or collecting new baseline data. Specific details on developing indicators and metrics and determining the types of effects are presented in the Section 2.0 of this report.

Phase 3 – Plan for Implementation.

This phase involves identifying the roles for persons and/or entities responsible for providing data and implementing the process; coordinating with external parties involved in implementing the process, as applicable; establishing targets and monitoring protocols; and preparing an Implementation Plan. This phase will begin upon completion of Phase 2.

Phase 4 – Implementation.

This phase involves implementing the monitoring plan developed in Phase 3; reporting and communicating monitoring results; reviewing and measuring the indicators; and conducting any necessary actions relative to changes in indicator conditions. Alcoa and Landsvirkjun plan to begin this phase in 2005.

Phases 3 and 4 are discussed further in Section 3.0 of this report.

The timing of the four phases of this initiative is anticipated as follows:

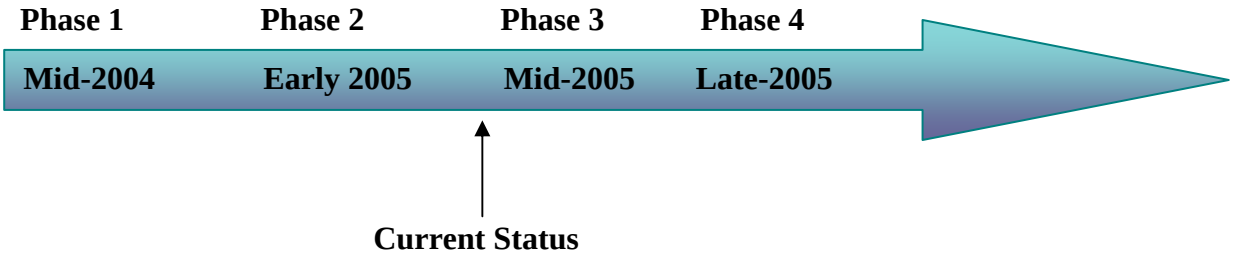
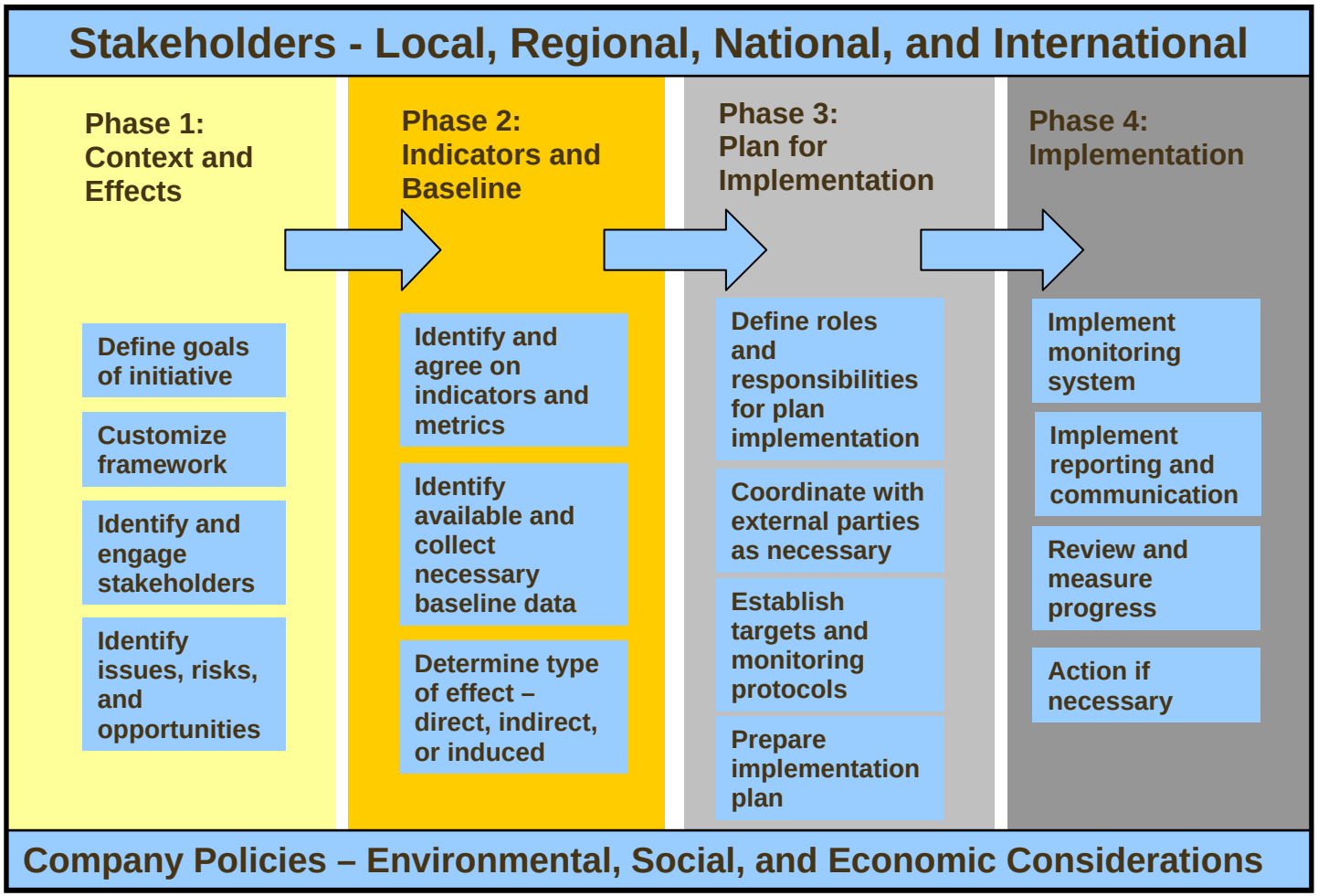


Figure 1. Alcoa/Landsvirkjun Sustainability Process



1.5 Context of the Sustainability Initiative

Sustainability principles can apply at all scales, from international to local. An example of sustainability principles at the national scale is Iceland's Strategy for Sustainable Development 2002-2020 called Welfare for the Future. The term 'welfare' refers to economic aspects but also to a wider definition of the quality of life including social and environmental factors. This strategy identified indicators that Iceland will use to measure performance against sustainable development goals into the future.

While the Sustainability Initiative for the Fjarðaál and Kárahnjúkar projects focuses on the local level, it also has a broader context that coincides with National, Regional, and International sustainable development strategies such as Iceland's Welfare for the Future, the Nordic Strategy, and the principles of Agenda 21. This sustainability initiative has considered, as appropriate, indicators that are used in other international, regional, and national strategies. Table 1 provides examples of how sustainability issues are addressed in the various strategies. The strategies often have similar indicators or goals that differ primarily by scale.

Table 1. Examples of Linkages Among International, Regional, and National Sustainability Strategies

Illustrative General Issues	Agenda 21 Goals	Nordic Strategy Indicators	Welfare for the Future Indicators	Alcoa/Landsvirkjun Sustainability Initiative Indicators
Population demographics	Demographic dynamics	Ageing in Nordic countries	Not applicable	Age distribution in local communities
Biodiversity	Conservation of biological diversity	Number of threatened birds	Breeding pairs of selected bird species	Bird species composition
Climate change	Protection of the atmosphere	Emissions of the greenhouse gases CO_2, CH_4, and N_2O from the Nordic countries	Emissions of the greenhouse gasses CO_2, CH_4, N_20, HFCs, PFCs, and SF_6	Emissions of CO_2 and PFCs from smelter
Waste	Environmentally sound management of solid wastes	Municipal waste – quantity and treatment per capita	Total amount of waste per capita	Amount of by-product landfilled

2.0 MEASURING PERFORMANCE – ISSUES, INDICATORS, AND METRICS

2.1 Approach for Developing Indicators and Metrics

Developing Indicators

The approach for developing indicators involved three steps. The first step involved identifying, in consultation with the Advisory Group, the primary issues of concern relative to the projects. The sustainability triangle below illustrates the integration of environmental, social, and economic issues (Figure 2).

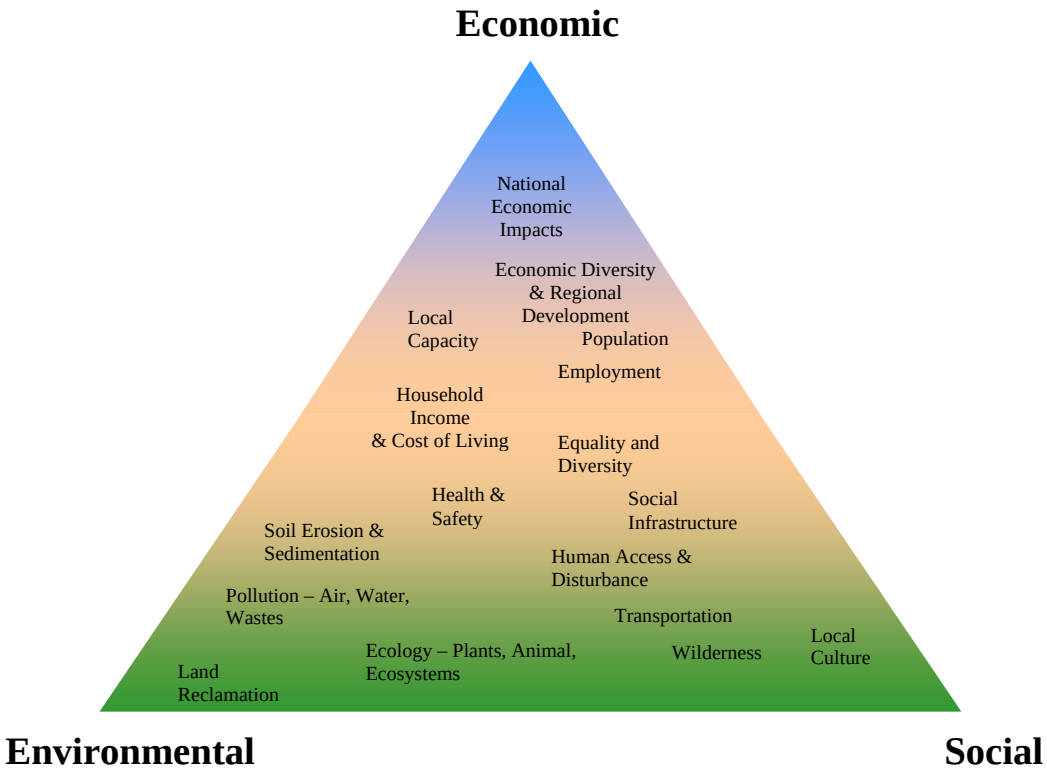


Figure 2. Sustainability Triangle

The second step involved developing preliminary indicators by determining the most effective way to monitor and communicate information about the issues. For example, the issue "Project effects on wildlife" is effectively monitored using populations of specific fauna potentially affected by the projects (i.e., pink-footed goose, reindeer, and breeding birds). Accordingly, these fauna were selected as preliminary indicators for this issue.

The third step involved screening the preliminary indicators by applying a series of criteria to each (Figure 3). The criteria used to evaluate the preliminary indicators were:

1) Relevant – Indicator had to be reflective of the issue and relevant to the projects and sustainability in some way;

2) Scientifically valid – Indicator had to be quantifiable using metrics that clearly measure status/change;

3) Sensitive to change – Indicator had to be sensitive to change and truly reflective of conditions;

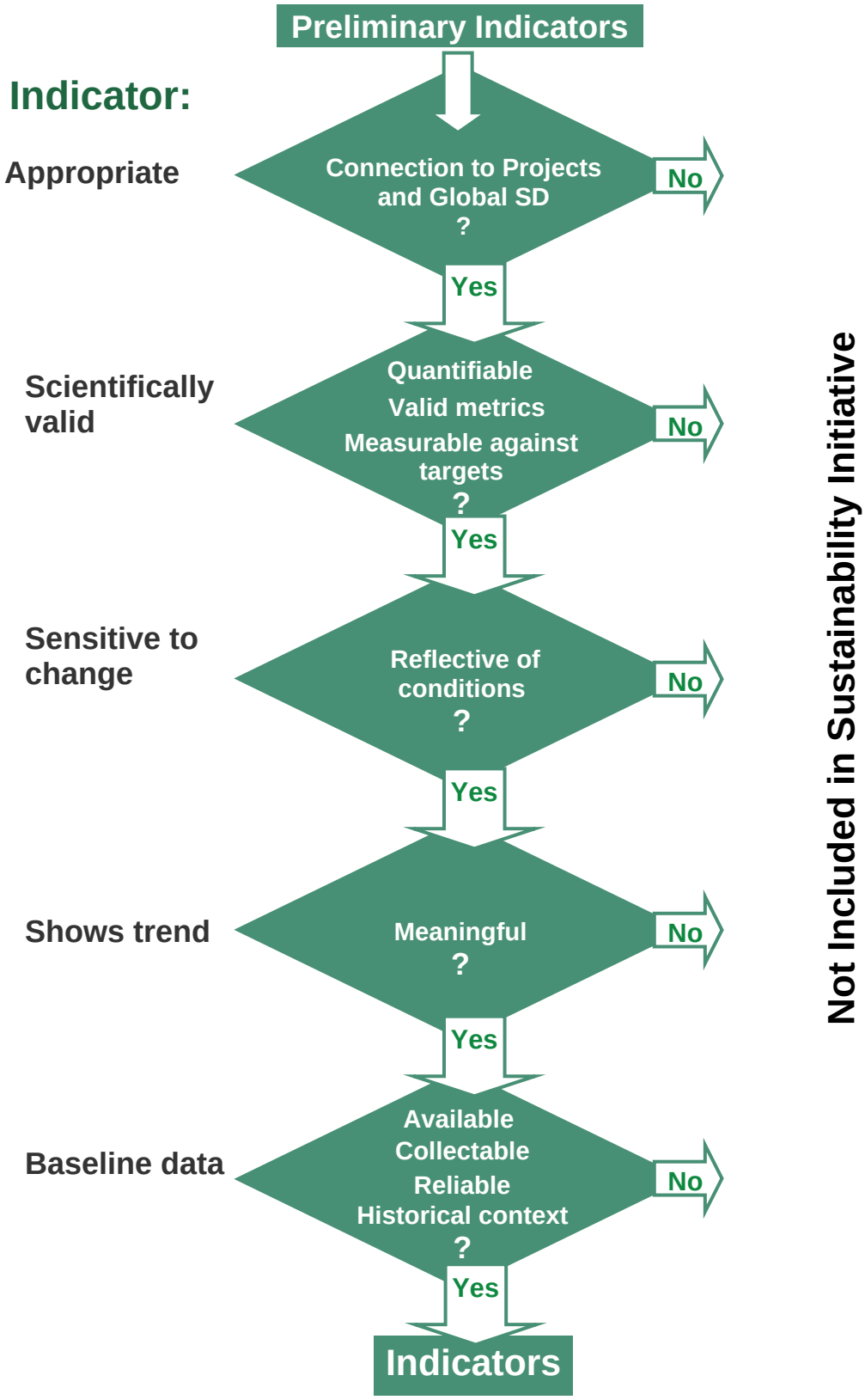
4) Shows trend – Indicator had to show trend that is meaningful relative to the goals of the sustainability process; and

5) Baseline data – Baseline data for the preliminary indicator needed to be available or collectable and have some historical context that would allow for clear interpretation of future trends.

The preliminary indicators that met the five criteria were selected as indicators. Preliminary indicators that did not meet the criteria were not considered further.

This process resulted in the development of 46 indicators for the Alcoa/Landsvirkjun Sustainability Initiative.

Figure 3. Indicator Screening Process



Developing Metrics

Metrics will define how performance is measured relative to each indicator. As such, indicators and metrics are linked and together represent an approach to assess sustainable performance.

Some examples of the relationship between indicators and metrics are:

> Indicator: Marine fauna populations
> Metric: Diversity and density of benthic fauna at selected sampling locations.
>
> Indicator: Alcoa/Landsvirkjun employee turnover rate
> Metric: Alcoa/Landsvirkjun employee attrition rate per year
>
> Indicator: Regional wealth
> Metric: Change in income levels

Because metrics define what is being measured, it was necessary to identify the appropriate geographic area for each metric. Three primary geographic areas were used in the social and economic metrics (and in some cases in the issues and indicators):

1) National – Iceland
2) East Iceland – Defined by election area and the geographic area used by Iceland Statistics until 2003. Includes 12 municipalities. East Iceland covers the local communities that will be most affected by the projects as well as most of the marginal communities that expect to experience some changes related to the projects.
3) Local Communities – Municipalities in East Iceland that are expected to be most influenced by the projects (municipalities vary by metric).

For the environmental indicators and metrics, the geographic areas vary according to the areas of effect.

Metrics for measuring performance relative to indicators were selected after the indicators were established. Where possible, the metrics used similar measurement methods and units to those used in the baseline data collection to ensure comparability between baseline and future monitoring data. Ongoing consultation with experts and collection/evaluation of baseline data could result in adjustment to these metrics, as appropriate.

2.2 Indicators and Metrics

A total of 46 indicators were developed in consultation with the Advisory Group through the process described above. Seventy-eight metrics were developed to measure these indicators. Table 3 presents the issues, the indicators and their metrics, and the baseline data associated with each indicator. The issues and indicators are organized in Table 3 by Alcoa's and Landsvirkjun's Sustainability Objectives (Section 1.1). Alcoa and Landsvirkjun have committed to measuring and reporting the status of these indicators and conducting necessary actions relative to changes in indicator conditions. The companies will periodically review and, if necessary, revise the indicators to ensure they are effective at measuring the projects' performance at meeting sustainability objectives. Through consultation with the Advisory Group, there were several additional indicators that were suggested but not included in this set of indicators because of lack of available information. The companies' are considering some of these indicators (e.g. determining availability of baseline data and relationship to the projects) to determine if they should be included in the future.

2.3 Determining Type of Effect and Associated Roles and Responsibilities for Indicators

Roles and responsibilities for managing the indicators are important because they relate to the actions that Alcoa and Landsvirkjun may take in response to changes in indicators, as reflected by the metrics. Such roles and responsibilities for a particular indicator are linked to the effect that Alcoa, Landsvirkjun, and/or others may have on that indicator. In the context of this initiative, effects can be defined in three categories - direct, indirect, and induced:

- Direct effects are directly attributable to project construction or operation.
- Indirect effects may be the result of the projects, but are also affected by a range of other actions not related to the projects.
- Induced effects are independent of the projects, but may result from actions by others, which may be influenced by the presence of the projects.

Effects are further defined by the metric used to measure performance relative to the indicator. For example, Alcoa/Landsvirkjun could have a direct, indirect, or an induced effect on a particular indicator, depending on the metric. Table 2 provides examples that illustrate how effects are influenced by metrics.

Table 2. Influence of Metrics on Project Effects

Indicator	Metric	Effect	Basis for Effect Determination
Traffic safety	# of traffic accidents per capita	Induced	Influenced primarily by external (non-Alcoa/Landsvirkjun) sources
Traffic safety	# of employees in traffic accidents en route to and from work	Indirect	Alcoa/Landsvirkjun could influence behavior of employees while driving work vehicles (restrict cell phone usage while driving, strictly enforce speed limit)
Traffic safety	# of traffic accidents at projects per year	Direct	Alcoa/Landsvirkjun can manage safety protocols at projects to minimize potential for accidents

Figure 4 illustrates the roles and responsibilities associated with managing the indicators based on the effects that Alcoa and/or Landsvirkjun have on those indicators. Direct effects are those effects that are directly attributable to construction or operation of the projects. Accordingly, Alcoa/Landsvirkjun would manage the issue internally by responding as appropriate. For example, if the percentage of women in project labor forces falls below targets, Alcoa/Landsvirkjun could implement a strategy to attract more women.

Indirect effects are those that may be the result of the projects, but also may be affected by a range of other actions not related to the projects. Accordingly, Alcoa/Landsvirkjun could influence the issue by cooperating with other appropriate stakeholders that also influence the indicator. For example, Alcoa/Landsvirkjun could influence the East Iceland skills pool by cooperating with educational organizations.

Induced effects are independent of the projects, but may result from actions by others, which may be influenced by the projects. Accordingly, Alcoa/Landsvirkjun would work with appropriate stakeholders to monitor the indicator and communicate trends as appropriate. For example, Alcoa/Landsvirkjun may monitor government-collected data on changes to employment in key sectors in the East Iceland economy and communicate these trends to appropriate parties.

Table 3 lists the project effect for each indicator.

Figure 4. Alcoa/Landsvirkjun Roles and Responsibilities for Indicators

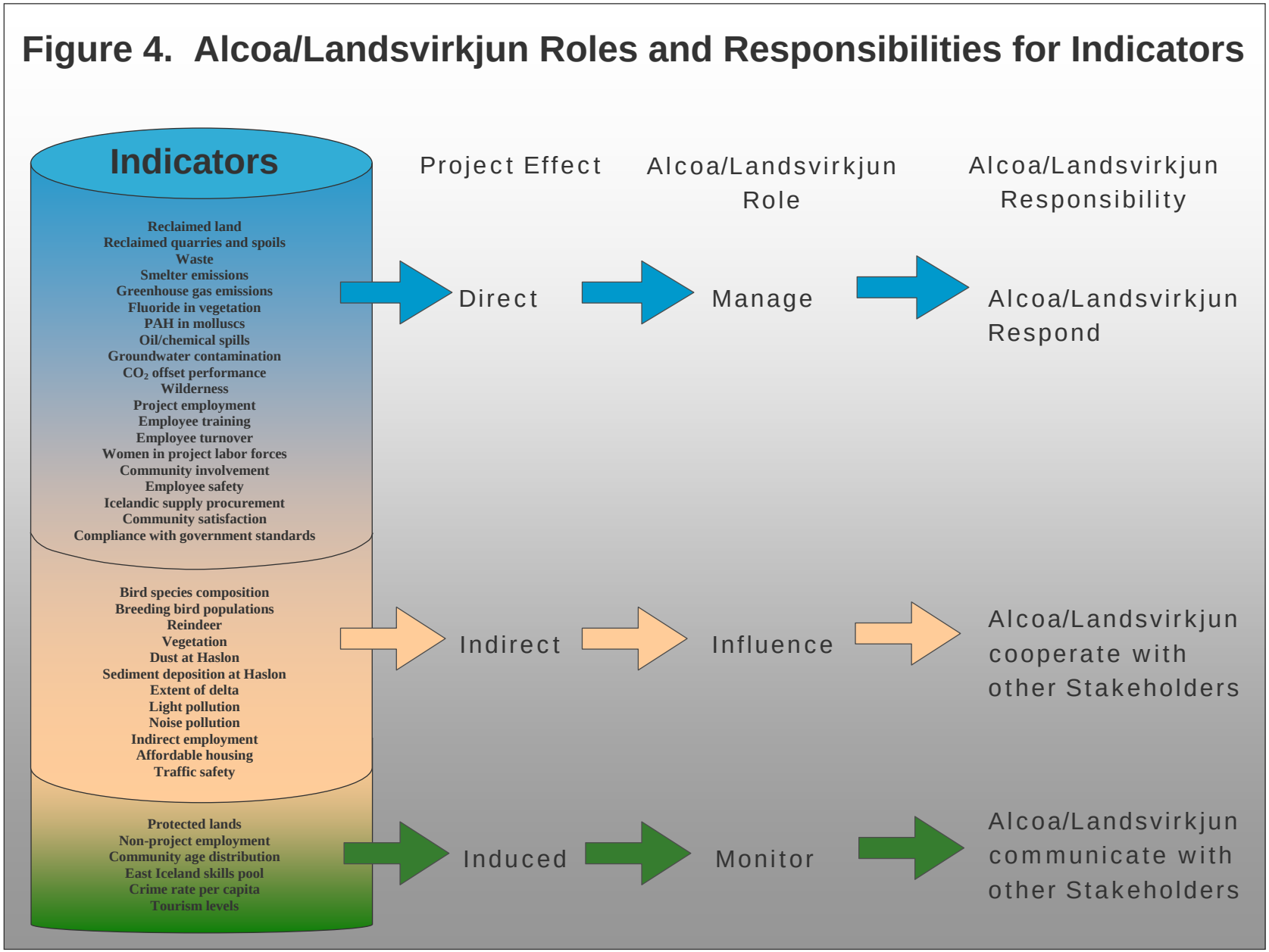


Table 3. Issues, Indicators, Metrics, Project Effect, and Baseline

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
Sustainability Objective: Respect and Protect People				
1. Changes in demographics in local community	1.1 Demographics in East Iceland	Gender and age distribution in East Iceland populations compared to National population Total population in East Iceland	Induced	BD: Data from Statistics Iceland DP: Statistics Iceland
2. Equality in workforce	2.1 Gender balance in Alcoa/ Landsvirkjun workforce	Proportion of men and women employed by projects compared with the National workforce proportion in: • Management • Clerical/administrative staff • Industrial/manual workers • Engineering/technical staff • Total employees Ratio of male to female employee salary by job classification	Direct Direct	BD: Statistics Iceland DP: Employee data to be collected by Statistics Iceland and Alcoa/Landsvirkjun
3. Satisfaction with workplace	3.1 Alcoa/ Landsvirkjun employee job satisfaction	Alcoa/Landsvirkjun employee survey on workplace and job satisfaction	Direct	BD: Gallup and union surveys DP: Alcoa/Landsvirkjun
4. Number of accidents and health of Alcoa/Landsvirkjun employees and subcontractors	4.1 Alcoa/ Landsvirkjun employee safety	Number of reportable accidents at projects per year Lost time injury rates per year as reported by Alcoa/ Landsvirkjun and sub-contractors	Direct Direct	BD: Alcoa/Landsvirkjun and subcontractors DP: Alcoa/ Landsvirkjun and subcontractors

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
Sustainability Objective: Building Community Experience and Well Being				
5. Enhance levels of education and training	5.1 Alcoa/ Landsvirkjun employee training and education level	Percent of hours Alcoa/ Landsvirkjun employees spend in work-related training per year Education levels of employees within smelter (by gender) compared to rural Iceland (non-Reykjavik) and National level (5-yr survey): • Percent with university degree • Percent with vocational examination • Percent who have finished matriculation examination	Direct Indirect	BD: Alcoa/ Landsvirkjun and Statistics Iceland DP: Alcoa/ Landsvirkjun Statistics Iceland, periodic surveys of employees and East Iceland and National population
6. Financial welfare of local area (cost of living, household debt)	6.1 Income levels	Average salary levels in East Iceland compared to National average Average salary for Alcoa/Landsvirkjun employees compared with other sources of employment in East Iceland and Nationally	Induced Induced	BD: Iceland Statistics DP: Iceland Statistics, Alcoa/Landsvirkjun
	6.2 Cost of living	Average house price in East Iceland and Nationally compared to average income	Indirect	BD and DP: Government institute Fasteignamat rikisins, Iceland Statistics
7. Investment in/provision of community infrastructure needs to keep pace with development and increase in population	7.1 Levels of health care service provision in local communities	Survey regarding availability and quality of health care services in East Iceland	Induced	BD and DP: Directorate of Health

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
	7.2 Quality of schools	Results of standardized tests for primary students (10th grade) in East Iceland vs. Nationally Results of standardized tests for secondary schools in East Iceland vs. Nationally Percent of teachers without certification in primary schools in East Iceland vs. Nationally	Induced Induced Induced	BD: Namsmatsstofnun and Iceland Statistics DP: Iceland Statistics
8. Social stress and safety (crime rate, drug use, physical and mental well being)	8.1 Safety in the community	Number of crimes for financial gains, assaults and vandalism per capita in East Iceland and Nationally. Number of accidents per km on selected roads: • Road between Egilsstadir and Reydarfjodur • Road between Faskrudsfjordur and Reydarfjordur • Road from Egilsstadir to Hallormsstadaskogur	Induced Induced	BD and DP: Police files and the Public Roads Administration
	8.2 Social stress	Number of drug violations per capita in East Iceland compared with National average	Induced	BD and DP: Police files
9. Active participation in community and social cohesion	9.1 Involvement in local community	Hours Alcoa employees participate in Alcoa foundation activities (Action and Bravo) per year	Direct	BD: Not applicable (Alcoa employees) DP: Alcoa data (periodic survey of employees)
10. Availability of cultural opportunities in region	10.1 Cultural opportunities	Number of cultural events per year in East Iceland	Induced	BD: Report on Cultural Policy in East Iceland, Business and Regional Development Center of East Iceland. November 2001. DP: Collected from local newspapers/advertisements

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
Sustainability Objective: Long Term Economic Benefits				
11. Contribution to national export-derived income	11.1 Alcoa annual exports	Net exported products from Fjardaal as a percent of annual exports from Iceland (ISK/year)	Direct	BD: Not applicable DP: Iceland Statistics
12. Preserve / enhance economic diversity in local communities and East Iceland	12.1 Employment	Percentage of new Alcoa/Landsvirkjun employees who are: • East Iceland residents • East Iceland returnees • Other Iceland residents • Foreign nationals living outside Iceland Number and proportion of jobs in key economic sectors in East Iceland and Nationally: • Agriculture • Fishing • Fish processing • Manufacturing • Electricity & water supply • Construction • Wholesale, retail trade, repairs • Hotels, restaurants • Transport, communication • Financial intermediation • Real estate & business activities • Public administration • Education • Health services, social work Proportion of total Alcoa/Landsvirkjun project employment compared to total East Iceland employment	Direct Indirect Indirect	BD: Alcoa/Landsvirkjun personnel data, non-Alcoa/Landsvirkjun employment data from Directorate of Labor or municipalities, data collected by the Regional Development Institute or Social Science Research Institute DP: Alcoa/Landsvirkjun, Directorate of Labor, municipalities, Regional Development Institute, Social Science Research Institute

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
	12.2 Unemployment	Unemployment rate in East Iceland and Nationally	Induced	BD: Iceland Statistics DP: Iceland Statistics
13. Changes in tourism and business travel	13.1 Tourism	Proportion of jobs per year in tourism industry in East Iceland vs. Nationally Number of bed nights in hotels/guest houses in East Iceland Number of passengers on flights to Egilstadir Number of visits to smelter and Karahnjukar projects	Induced Induced Induced Direct	BD: Iceland Statistics and Air Iceland DP: Iceland Statistics, Air Iceland, Alcoa and Landsvirkjun
14. Supply chain effects: contribution of Alcoa/Landsvirkjun to local economy through procurement of goods and services from local and National companies	14.1 Retained value added	ISK retained in Iceland through Alcoa and Landsvirkjun salaries, payments to public authorities, supplies procured in Iceland and profits that stay domestically.	Direct	BD: Not applicable DP: To be determined
	14.2 Quantity of goods and services procured in East Iceland and Nationally	Percent of total goods and services (value in ISK) procured by Alcoa and Landsvirkjun and subcontractors in East Iceland and Iceland	Direct	BD: Not applicable DP: Alcoa/Landsvirkjun and subcontractors
15. Effects of projects on municipalities	15.1 Financial status of municipalities	Contribution of the projects to municipal revenues as a percentage of the total municipal revenue Municipal revenue/expenditure ratio	Direct Induced	BD: The Association of Icelandic Municipalities DP: The Association of Icelandic Municipalities and local municipalities

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
Sustainability Objective: Efficient Resource Use and Cleaner Production				
16. Noise effects of smelter	16.1 Noise in Reyðarfjörður	Average Noise Level (DnL) at established monitoring stations at the smelter site and in Reyðarfjörður	Indirect	BD: Noise study from EIA DP: Alcoa
17. Air quality	17.1 Dust pollution	Average monthly concentration and origin of air particulates measured at designated sample locations at Halslon and Fljotsdalsherad.	Indirect	BD and DP: Landsvirkjun subcontractors, Icelandic Meteorological Office
	17.2 Air emissions	Dust, sulphur dioxide (SO_2), fluoride (F), and polycyclic aromatic hydrocarbons (PAH) emissions (in kg) per ton of aluminium produced (kg/metric ton) Concentrations of SO_2, F, and PAH at established monitoring station in Reyðarfjörður ($\mu g/m^3$)	Direct Direct	BD and DP: Alcoa
18. River bank erosion	18.1 Erosion of river bank at Jokusla a Flotsdal and Lagarfljot	Location of riverbank in selected areas as measured by riverbank profiles	Indirect	BD: April 2001 report by VST on erosion of river banks DP: VST, Landsvirkjun
19. Storage capacity of Halslon Reservoir	19.1 Sediment deposition in Halslon Reservoir	Volume (m^3) of sedimentation in a 5 – 10 year period Grain size distribution of sediments in the reservoir bed	Direct	BD: Sedimentation studies conducted by Landsvirkjun subcontractors DP: Landsvirkjun
20. Land reclamation	20.1 Mine and spoil reclamation	Proportion of disturbed land that is reclaimed to pre-project conditions	Direct	BD and DP: Alcoa and Landsvirkjun
21. Human health	21.1 Fluoride in vegetation	Concentration of F (µg/kg-DW) in vegetation (ruminant forage and berries) at designated sample plots within a specified radius of smelter	Direct	BD: Baseline data collection from EIA DP: Alcoa
22. Water quality	22.1 Contaminant levels in molluscs	Concentration of PAH (µg/g) and heavy metals (ppm) in mollusks at established survey points in the Fjord	Indirect	BD: Baseline data collection from EIA DP: Alcoa

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
	22.2 Groundwater and surface water quality at smelter	Concentrations (mg/l) of phosphorous (P), F, chlorine (Cl), and sulphate (SO_4) in groundwater and surface water at established sample locations at smelter site and near outfall	Indirect	BD: Baseline data collection from EIA DP: Alcoa
	22.3 Project-related oil/chemical spills	Number of spills over 20 liters and 2,000 liters per year on land (Fjardaal and Karahnjukar) and from ships at berth (Fjardaal)	Direct	BD: Not applicable DP: Environment and Food Agency , Alcoa/Landsvirkjun
23. Solid waste	23.1 Quantity and treatment of solid waste from construction and operation	Total wastes landfilled annually (metric tons) Percent of wastes sold or recycled annually (metric tons) Total amount of spent pot lining per ton of aluminum produced annually (kg/metric ton)	Direct Direct Direct	BD: Not applicable DP: Alcoa and Landsvirkjun
Sustainability Objective: Ecological Integrity and Biodiversity				
24. Project effects on wildlife	24.1 Pink-footed goose	Number of breeding birds in selected sample plots close to Jokulsa a Dal and Fljotdsalur valley. Number of geese in moulting in Snaefellsoraefi	Indirect Indirect	BD: Icelandic Institute for Natural History (IINH) - report on the impact of the dam on the pink footed goose, population data DP: IINH
	24.2 Reindeer	The number of reindeer in Vesturoraefi, Muli, and Hraun east of Snaefell	Indirect	BD: East Iceland Environmental Research (EIER) Institute reindeer population monitoring (aerial surveys conducted by University of Iceland) DP: EIER

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
	24.3 Breeding birds	Feeding site use (#feeds/hour) by Red-throated Divers at Lagarfljot and the ocean	Indirect	BD: IINH breeding bird population monitoring at Utherad Important Bird Area
		Distribution of breeding Long-tailed Duck in Utherad	Indirect	DP: IINH
		Number of moulting Greylag Goose in areas adjacent to Jokulsa a Dal	Indirect	
		Number of nesting Great Skuas in areas adjacent to Jokulsa a Dal	Indirect	
25. Changes in surface water and groundwater levels	25.1 Hydrology	Water levels and discharge at gauging stations in rivers	Indirect	BD and DP: IINH
		Ground water levels in depressions located in Jokulsa a Fljotsdal and Jokulsa a Dal basins	Indirect	
26. Change in terrestrial ecosystem	26.1 Vegetation in Vesturoraefi	Vegetation cover and species composition	Indirect	BD and DP: IINH and Agricultural University
	26.2 Blowing sand from Halslon Reservoir	Volume of soil in sand piles east of the reservoir	Direct	BD: Landsvirkjun
		Estimated volume of soil that deposits on vegetation	Direct	DP: Landsvirkjun
	26.3 Vegetation change caused by land reclamation	Area (ha) of reclaimed land at Nordur Herad and Fljotsdal, recorded every five years	Direct	BD and DP: Soil Conservation Service and Landsvirkjun

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
27. Changes in freshwater ecosystems	27.1 Freshwater aquatic fauna in Jokulsa a Dal and Lagarfljot	Changes in small fauna species composition and fish spawning in select sampling locations in Jokulsa in Dal and tributary streams Changes in small fauna species composition and fish spawning in selected sampling locations the rivers Keldua and Lagarfljoti Fishing (number of fish) in the rivers Lagarfljot, Keldua, Jokulsa in Dal and tributary streams	Indirect Indirect Indirect	BD: Data from Iceland Freshwater Fish Agency and National Energy Authority and Landsvirkjun DP: Data from Iceland Freshwater Fish Agency and National Energy Authority
28. Changes in marine ecosystem	28.1 Marine benthic fauna	Grain size and distribution of sediment in selected sample plots Diversity and density of benthic fauna at selected sampling spots	Indirect Indirect	BD: Marine Research Institute (MRI) data DP: MRI
29. Movement of Heradsfloi shoreline and change in delta	29.1 Movement of coastline and vegetation changes on delta	Location of shoreline as measured by aerial photographs and bathymetric profiles Vegetation cover and species composition on delta	Indirect Indirect	BD: Coastal erosion studies, aerial photography DP: Landsvirkjun subcontractor
Sustainability Objective: Meeting the Needs of Current and Future Generations				
30. Loss of waterfalls	30.1 Flow in Waterfalls	Number of days specific waterfalls downstream of Halslon reservoir are flowing with normal discharge (i.e., within the historic range).	Indirect	BD: Not applicable DP: Landsvirkjun
31. Loss of wilderness	31.1 Extent of Wilderness	Total area (km^2) of wilderness, as defined by Icelandic law for nature conservation.	Indirect	BD: Landsvirkjun DP: Landsvirkjun

Issue	Indicator	Metric	Project Effect	Baseline Data Availability (BD)/ Possible Data Provider (DP)
32. Climate change	32.1 Greenhouse gas emissions	Total emissions of carbon dioxide (CO_2) and perfluorocarbon (PFCs) from smelter per ton of aluminum produced (CO_2 equivalents/metric ton of aluminum produced)	Direct	BD: Baseline data collection from EIA DP: Alcoa/Landsvirkjun
		Total leakage of SF_6 from transmission lines (total CO_2 equivalents)	Direct	
		CO_2 emissions (total CO_2 equivalents) calculated from the amount of gas and diesel fuel used by Alcoa and Landsvirkjun and contractors for transport vehicles.	Direct	
		Carbon sequestration (total CO_2 equivalents) achieved by Alcoa/Landsvirkjun carbon sequestration projects in Iceland, accounting for creation of Halslon (area of Halslon subtracted from area of reforestation projects)	Direct	
Sustainability Objective: Stakeholder Involvement				
33. Community relations between Alcoa/Landsvirkjunand local community	33.1 Community rating of Alcoa/Landsvirkjun performance	Survey of community attitudes - percent of survey respondents rating company performance on community relations, communications, and presence of the projects as good or very good	Direct	BD: Gallup survey data DP: Annual survey of East Iceland communities carried out by independent survey company, University survey data
Sustainability Objective: Accountability and Governance				
34. Regulatory compliance	34.1 Compliance with Icelandic Standards and Legislation	Number of non-compliances per year	Direct	BD: Not applicable DP: Alcoa/Landsvirkjun, National government

2.4 Indicator Summaries

This section includes a brief summary of each indicator and their associated metrics, and a review of the existing baseline, where applicable. In most cases, baseline information is provided for one year to document the status of the indicators before construction of the projects. Where warranted, additional historical data is included to document trends.

Sustainability Indicator 1.1.

Demographics in East-Iceland

Project effect: Induced

Rationale for Selection as a Sustainability Indicator

Gender and age balanced communities are an indicator of a stable society. The gender and age structure of many communities in East Iceland has been affected by the "pull" effect of economic growth and associated employment opportunities in the Capital Region in and around Reykjavik. The report on the socio-economic impact of the Fjardaál project links this to a limited range of employment opportunities and high proportions of low-paying jobs in East Iceland. The development of the Kárahnjúkar and Fjardaál projects is likely to lead to changes in the demographic structure of East Iceland and individual communities during the construction and operation phases. Some of these effects will be direct, for instance, the in-migration to East Iceland of employees and their families. Indirect effects include the spin-off effects of the projects in terms of employment opportunities in companies providing goods and services to the projects and opportunities arising from the economic development of the East.

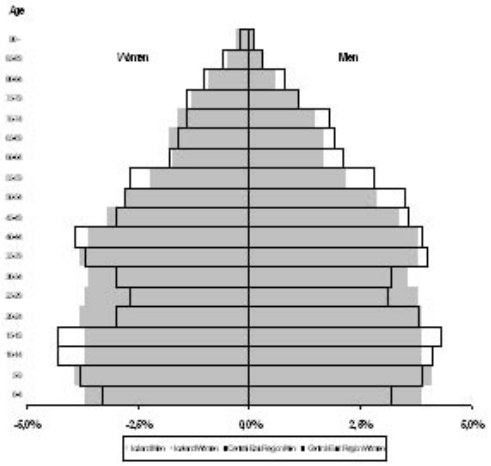
Metric

i. Gender and age structure in East Iceland compared to national population (project effect: induced)
ii. Total population in East Iceland (project effect: induced).

Baseline

i. The Institute for Regional Development publishes data showing demographic trends in East Iceland (Central East Region) and in Iceland. These show persistently higher levels of out-migration from East Iceland, especially for young women. This has led to an unbalanced age structure and sex ratio in local communities. The proportion of women 20-34 years old and men 25-34 years old in East Iceland is lower than for Iceland as a whole. The proportion of children in East Iceland is also lower than the National average.

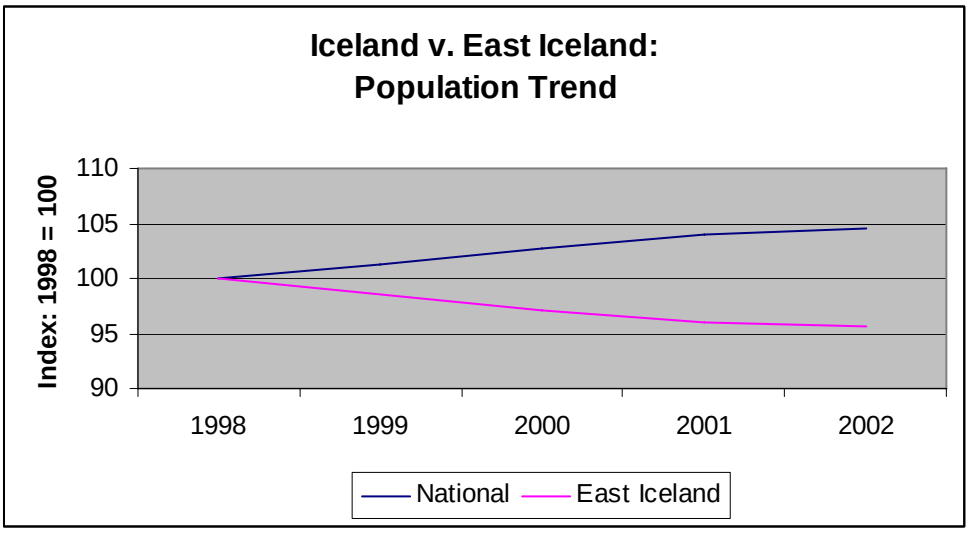
Age Distribution of Men and Women in the Central East Region and in Iceland 2001:



ii. Total Population Data

Population in East Iceland

	1998	1999	2000	2001	2002
Total population in East Iceland	12,285	12,117	11,930	11,798	11,758
Share of national population	4.4%	4.3%	4.2%	4.1%	4.0%



Source: Iceland Statistics

Sustainability Indicator 2.1

Gender Balance in Alcoa and Landsvirkjun Workforce

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

Sustainability Indicator 2.1 aims for a gender-balanced workforce. The Central East Region has suffered from out-migration of younger members of the community who are drawn to the 'pull' of educational and employment opportunities offered by the Capital Region. Additionally, young workers, particularly females, are influenced by the 'push' of low paying jobs in traditionally male-dominated sectors such as agriculture, fishing, and fish processing. Such an imbalance in gender is not indicative of a stable community. The establishment of the Kárahnjúkar and Fjardaál projects may assist in reducing the 'push' from the Central East region and is likely to attract individuals to the area for its work opportunities.

Metric

i. The proportion of men and women employed by Alcoa and Landsvirkjun at the projects compared with National proportions in (project effect: direct):

- Management roles
- As clerical/administrative staff
- As industrial/manual workers
- As engineering/technical staff

ii. The ratio of male to female employee salary by job classification (project effect: direct).

Baseline

i. Alcoa and Landsvirkjun Workforce Gender Balance at Various Employment Levels

Employment Level Source: Statistics Iceland	**Alcoa Male/Female Employee Ratio**	**Landsvirkjun Male/Female Employee Ratio**	**2002 National Male/Female Ratio**
Management Roles	N/A	N/A	71/29
Clerical/administrative staff	N/A	N/A	13/87
Industrial/manual workers	N/A	N/A	87/13
Engineering/technical staff	N/A	N/A	44/56
Total	**N/A**	**N/A**	**56%/47%**

Source: Statistics Iceland

ii. Baseline gender balance data will be collected and summarized in 2007

Sustainability Indicator 3.1

Alcoa and Landsvirkjun Employee Job Satisfaction

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
Alcoa and Landsvirkjun will have a direct effect on their employees' welfare. A workforce that is content with its workplace and that experiences high job satisfaction will have a higher retention rate than a discontented group of employees. The long term retention of Alcoa and Landsvirkjun employees will increase the economic stability of the Karahnjukur and Fjardaál areas. By conducting an annual employee survey on workplace and job satisfaction Alcoa and Landsvirkjun will be able to monitor employee attitudes and, where necessary, implement changes to working practice as necessary.

Metric
Annual Alcoa and Landsvirkjun employee survey on workplace and job satisfaction (project effect: direct).

Baseline
Baseline employee satisfaction data will be collected and summarized in 2007.

Sustainability Indicator 4.1.

Alcoa and Landsvirkjun Employee Safety and Health

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

Alcoa and Landsvirkjun will have a direct influence on their employees' health and safety. The companies can, therefore, directly influence and manage the risk of accidents through implementation of an Environment, Health & Safety (EHS) program. Assessing and mitigating the risk of accidents during construction and operation of the projects should reduce the likelihood of accidents and forced injury related time off.

Metric

i. Number of reportable accidents at the Kárahnjúkar and Fjardaál projects per year (project effect: direct).

ii. Time lost due to injury per year as reported by Alcoa, Landsvirkjun, and their sub-contractors (project effect: direct).

Baseline

Construction work has recently started on both the projects. Baseline data for the metrics will be collected and summarized in the first annual report in 2006.

Sustainability Indicator 5.1.

Alcoa and Landsvirkjun Employee Training and Education Levels

Project effect: Direct and indirect

Rationale for Selection as a Sustainability Indicator

Increasing the education and training levels of a workforce provides the local economy with the potential for increased productivity and economic development. Alcoa and Landsvirkjun have the opportunity to invest in their employees through a comprehensive training program. Educated, trained employees can command higher salaries and, hence, employees' families can enjoy a higher standard of living.

Metric

i. Percent of hours Alcoa and Landsvirkjun employees spend in work-related training per year (project effect: direct).

ii. Education levels of employees within the smelter (by gender) compared to rural Iceland and National level (5-yr survey) (project effect: indirect):
   - Percent with university degree
   - Percent with vocational examination
   - Percent who have finished matriculation examination

Baseline

i. Baseline employee training and education data will be collected and summarized in 2007.

ii. Workforce (25-64 year olds) by Education Levels in 2002

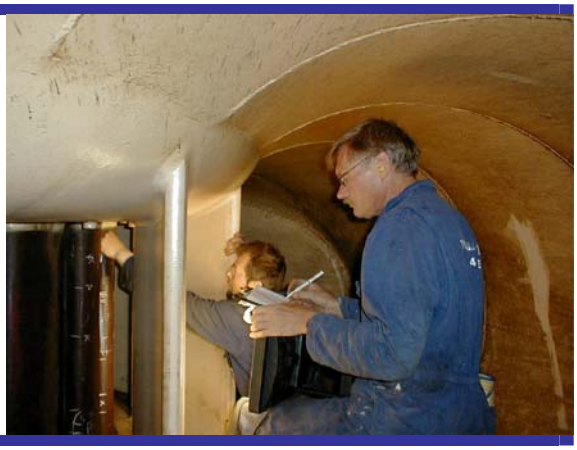
Education Level	Rural Iceland (% of total)	Iceland (% of total)
Compulsory Education	43	33
Matriculation Exam	30	29
Vocational Training	14	17
University Education	13	21
Total	**100**	**100**

Source: Statistics Iceland - Icelandic Labor Market Report, 2002.

Sustainability Indicator 6.1.

Income Levels

Project effect: Induced



Rationale for Selection as a Sustainability Indicator

Average income level is a useful indicator of an area's comparative financial welfare and prosperity. The development of the Kárahnjúkar and Fjardaál projects is likely to have an impact on per capita income levels for the area. The development will provide direct income effects to employees and their families as well as supporting indirect income effects through firms supplying goods and services and the additional employees in the region.

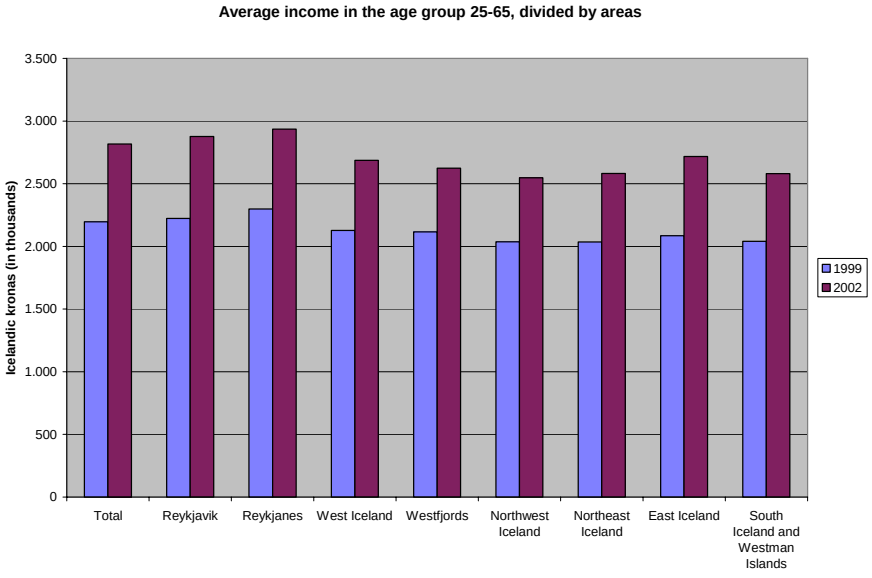
Metric

i. Average annual salary in East Iceland compared to national average (project effect: induced).

ii. Average salary for Alcoa and Landsvirkjun employees compared with other sources of employment in East Iceland and Nationally (project effect: induced).

Baseline

i. Statistics Iceland collects annual average income data. The baseline for this initiative includes average income for the age group 25 to 65 years old for both 1999 and 2002 to highlight the significant income growth during this period. Compared to the Capital region, incomes in East Iceland (Austurland) are somewhat lower. This is not unusual for areas outside of Reykjavik, however, and income levels in East Iceland are actually higher than all the other non-Capital region areas.



Source: Iceland Statistics

ii. Baseline Alcoa and Landsvirkjun employee salary data will be collected and summarized in 2007

Sustainability Indicator 6.2.

Cost of Living

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

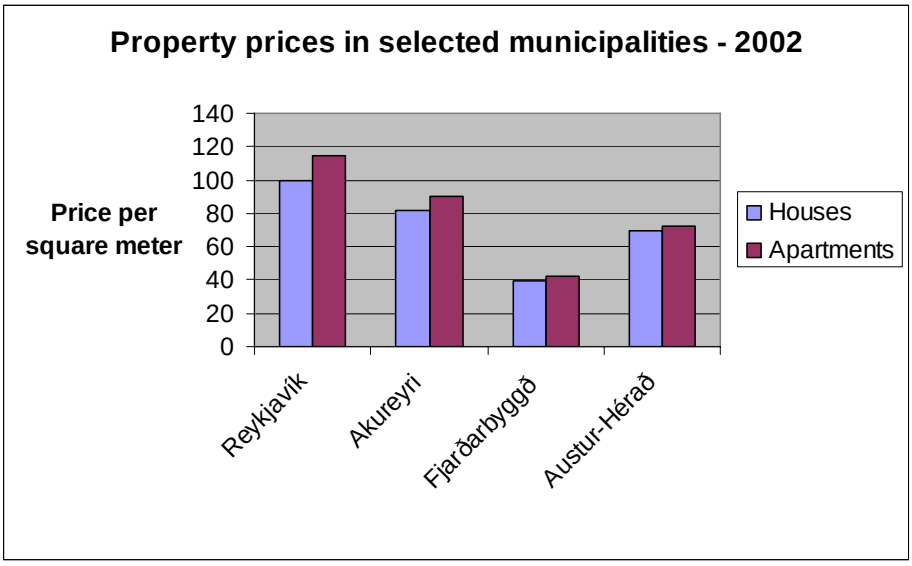
While the Kárahnjúkar and Fjardaál projects will create employment opportunities in the region and raise incomes, the increase in demand for property, goods, and services may raise prices. Housing is a major cost factor for most households and is a good indicator of overall cost of living in a region. Migration from the region has resulted in a serious stagnation in the real estate market. An initial increase in property prices might therefore be considered positive, but in the long term it is preferable that housing prices will not increase more rapidly than average income in the region.

Metric

Average house price in East Iceland and Nationally compared to changes in average income (project effect: indirect).

Baseline

Property Prices in Selected Municipalities



Source: Government institute of Real Estate (Fasteignamat rikisins)

Sustainability Indicator 7.1.

Level of Health Care Services

Project effect: Induced

Rationale for Selection as a Sustainability Indicator

The Kárahnjúkar and Fjardaál projects are likely to influence the demand for services provided by the national government and municipalities in East Iceland. The increased number of people living in local communities during both the construction and operational phases of the projects will increase demand for various services such as health care, waste management, schools, and day care. The increase in population will be both a direct effect of employees and contractors, as well as an indirect effect of people moving to the area in association with businesses providing goods and services to the projects. Access to health care and the quality of the service is an example of services that need to keep pace with the increase in population.

Metric

Survey regarding availability and quality of health care services in East Iceland (project effect: induced).

Baseline

The Directorate of Health conducts surveys in health care centers around Iceland every two or three years to collect information about the quality of services. Below are the results from two questions in the survey. These results are calculated from adding answers from all health care centers in East Iceland, but were not available broken down by individual health care centers.

Survey of Health Care Services in East Iceland:

	Was your concern adequately addressed during your visit?	Were you happy with how your concern was addressed?
Yes	77.7%	83.5%
Partly	20.8%	13.5%
No	1.5%	3.1%

Sustainability Indicator 7.2

Quality of Schools

Project effect: Induced

Rationale for Selection as a Sustainability Indicator

The Kárahnjúkar and Fjardaál projects are likely to affect the education system in East Iceland. The increased numbers of people living in local communities during both the construction and operational phases of the projects will increase the demand on local school systems. This includes both the direct effects of employees and contractors, as well as the indirect demand generated by people moving to the project area in association with businesses providing goods and services to the projects. The schools in the project area will therefore need to maintain the current quality of education to an increasing and possibly a more culturally diverse student population.

Metric

i. Results of standardized tests for primary students (10th grade) in East Iceland vs. Nationally (project effect: induced).
ii. Results of standardized tests for secondary schools in East Iceland vs. Nationally (project effect: induced).
iii. Percent of teachers without certification in primary schools in East Iceland vs. Nationally (project effect: induced).

Baseline

i. 10th Grade Comprehensive Exam Results for various regions in 2002

Icelandic Language	
Region	*Average grade*
Reykjavík	5.3
Capital area other than Reykjavík	5.1
Southwest Iceland	4.2
West Iceland	4.8
West Fjords	4.7
Northwest Iceland	4.9
Northeast Iceland	4.8
East Iceland	4.9
South Iceland	4.5

Mathematics	
Region	*Average grade*
Reykjavík	5.2
Capital area other than Reykjavík	5.3
Southwest Iceland	4.4
West Iceland	4.9
West Fjords	4.7
Northwest Iceland	4.7
Northeast Iceland	4.8
East Iceland	4.6
South Iceland	4.5

Source: Námsmatsstofnun (independent research institute on education and test results)

ii. Standardized tests for Icelandic, English, and mathematics will be conducted in the spring of

2005. Results will be published when available.

iii. Percent of unlicenced teachers in cumpulsory schools in Iceland categorized by geographic areas (2003)

Geographic Areas	Percent of unlicenced teachers
Iceland	18%
Capital region	9%
Southwest Iceland	27%
West Iceland	25%
Westfjords	44%
Northwest Iceland	36%
Northeast Iceland	27%
East Iceland	35%
South Iceland	24%

Source: Iceland Statistics

Sustainability Indicator 8.1

Safety in the Community

Project effect: Induced

Rationale for Selection as a Sustainability Indicator

Crime is often the result of a society that is unstable and not socially cohesive. Crime rate, measured by crimes per capita, can be a useful indicator for measuring the social well being and safety of a community. Inhabitants of a community with a low crime rate will experience higher quality of life and social cohesion than a community experiencing high crime rates. The Alcoa and Landsvirkjun projects will have a social impact on the region by attracting new workers and inhabitants to the area. Monitoring levels of crime will help indicate the degree of long-term stability in the areas.

The Alcoa and Landsvirkjun projects will increase the numbers of cars in the Kárahnjúkar and Fjardaál areas due to employees driving to/from the sites as well as commercial traffic delivering supplies and raw materials to the projects. Monitoring the occurrence of traffic accidents on specific roads associated with the projects will help indicate overall traffic safety so accident mitigation measures could be implemented, if necessary.

Metric

i. Number of crimes for financial gains, assaults and vandalism per capita in East Iceland and Nationally (project effect: induced).
ii. Number of accidents per km on selected roads (project effect: induced):
   - Road between Egilsstadir and Reydarfjordur
   - Road between Fáskrúdsfjordur and Reydarfjordur
   - Road from Egilsstadir to Hallormsstadaskogur

Baseline

i. Crime Rate Per Capita in Iceland in 2002

Crime	Number of crimes (Iceland)	Crime rate per 10,000 inhabitants (Iceland)	Crime rate per 10,000 inhabitants (Seydisfjordur districts)	Crime rate per 10,000 inhabitants (Eskifjordur district)
Crime for financial gains	11,330	395.8	125.9	136.2
Assaults	1330	46.5	23.5	31.4
Vandalism	4141	144.7	59.7	85.9

Source: The National Commissioner of Police (www.logreglan.is)

ii. Number of Traffic Accidents on Selected Roads from 2000 – 2002

Road	Accident rate (per million km)
Egilstaðir – Reyðarfjörður	0.9
Reyðarfjörður – Fáskrúðsfjörður	4.9
Egilstaður – Hallormsstaðaskógur	0.4

Source: Public Roads Authority

Sustainability Indicator 8.2

Social Stress

Project effect: Induced

Rationale for Selection as a Sustainability Indicator

The well being of a society is greatly affected by the health of its citizens. Individual's behavior, including drug use, is a major factor in determining social well being. Drug use correlates with societal problems such as unemployment and crime that ultimately undermine long term social wellbeing.

Metric

Number of drug violations per capita in local communities compared with National average (project effect: induced).

Baseline

Drug Violations Per Capita in Iceland and East Iceland in 2002

Drug Violations	Per 10,000 inhabitants
Iceland	34.7
Seyðisfjörður District	10.7
Eskifjörður Distirct	37.7

Source: The National Commissionar of Police (www.logreglan.is)

Sustainability Indicator 9.1

Involvement in Local Community

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
The Kárahnjúkar and Fjardaál projects will result in a significant increase in local populations both from employees and from businesses supporting the projects. It will be important to help new inhabitants integrate into existing communities. Alcoa can assist this process by encouraging active employee participation in local community activities.

Metric
Hours Alcoa employees participate in Alcoa foundation activities (project effect: direct).

Baseline
Baseline data on employee participation in Alcoa foundation activities will be collected once the projects are operational and summarized when available.

Sustainability Indicator 10.1

Cultural Opportunities

Project effect: Induced

Rationale for Selection as a Sustainability Indicator

Access to cultural opportunities contributes significantly to a resident's quality of life. Being able to take advantage of cultural opportunities will encourage employees and their families to build an attachment to the area. This is important for the social well being of current residents and new residents that move into the area.

Metric

The number of cultural events per year in East Iceland (project effect: induced).

Baseline

Cultural Events in East Iceland in 1999 (counted by advertisements in local media):

Geography	Number of Cultural Events in 1999
East Iceland	417

Source: Report on Cultural Policy in East Iceland, The Business and Regional Development Center of East Iceland. November 2001.

Sustainability Indicator 11.1

Alcoa Annual Exports

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

The Fjardaál aluminium smelter is anticipated to produce 322 thousand tons of primary aluminium a year with the market for production being primarily based in Europe and, to some degree, North America. The impact of the smelter on Iceland's exports and balance of trade is likely to be significant. Monitoring the degree of influence of Alcoa's exports on Iceland's balance of payments will help assess the long term economic situation of Iceland's balance of trade.

Metric

Net exported products from Fjardaál as a percent of annual exports from Iceland (ISK/year).

Baseline

In 2003, Iceland ran a negative balance of trade as it has done since 1996.

Annual External Trade for 2003

	Exports (Million ISK)	% of Exports from Alcoa	Imports (Million ISK)	Balance of Trade (Million ISK)
2003	182,580	0	216,525	- 33,945

Source: Statistics Iceland, 2003

Sustainability Indicator 12.1

Employment

Project effect: Direct and indirect

Rationale for Selection as a Sustainability Indicator

There is a need to preserve and enhance economic diversity in East Iceland. A diverse economy, without over-reliance on one employment sector, is more likely to be stable for the long term. Both employment directly resulting from Alcoa and Landsvirkjun operations, as well as employment indirectly affected by Alcoa and Landsvirkjun, will be monitored. The ratio of Alcoa and Landsvirkjun employment to total local employment will be measured to help indicate the degree to which the local communities rely on the projects for economic and employment diversity.

Metric

i. Percentage of new Alcoa and Landsvirkjun employees who are (project effect: direct):
   - East Iceland residents;
   - East Iceland returnees;
   - Other Icelanders; and
   - Foreign nationals living outside Iceland

ii. Number and proportion of jobs in key economic sectors in East Iceland and Nationally (project effect: indirect).

iii. Proportion of total Alcoa and Landsvirkjun project employment to total East Iceland employment (project effect: indirect).

Baseline

i. Baseline data on the place of residence for Alcoa and Landsvirkjun employees will be collected and summarized in 2007.

ii. The East Region suffers from a limited range of employment opportunities and a high proportion of those jobs are low paying. The economy of Iceland as a whole is very different from the economy of East Iceland. The principal difference is the lack of emphasis on agriculture, fishing, and fish processing in Iceland as a whole (approximately 10%) compared to East Iceland, where the same sectors comprise almost a third of all employment.

Employment Structure of Iceland and East Iceland

	Iceland	% of Iceland Total	East Iceland	% of East Iceland Total
Agriculture	4230	2.72%	410	6.18%
Fishing	5480	3.52%	530	7.99%
Fish processing	6360	4.09%	1,110	16.74%
Manufacturing except fish processing (excluding Alcoa and Landsvirkjun projects)	17000	10.92%	520	7.84%
Electricity & water supply (excluding Alcoa and Landsvirkjun projects)	1520	0.98%	60	0.90%
Construction	10580	6.80%	420	6.33%
Wholesale, retail trade, repairs	21140	13.58%	590	8.90%
Hotels, restaurants	5540	3.56%	200	3.02%
Transport, communication	10510	6.75%	360	5.43%
Financial intermediation	5900	3.79%	130	1.96%
Real estate & business activities	12030	7.73%	240	3.62%
Public administration	10810	6.94%	580	8.75%
Education	10880	6.99%	360	5.43%
Health services, social work	22980	14.76%	740	11.16%
Other services and n.s.	10720	6.89%	380	5.73%
Total (excluding Alcoa and Landsvirkjun projects)	155,680	100%	6,630	100%
Alcoa and Landsvirkjun Projects employment	0	0	0	0
Ratio of Alcoa and Landsvirkjun employment to local employment			0	

Source – Statistics Iceland 2003

iii. Baseline employment data will be collected and summarized in 2007.

Sustainability Indicator 12.2

Unemployment

Project effect: Induced

Rationale for Selection as a Sustainability Indicator

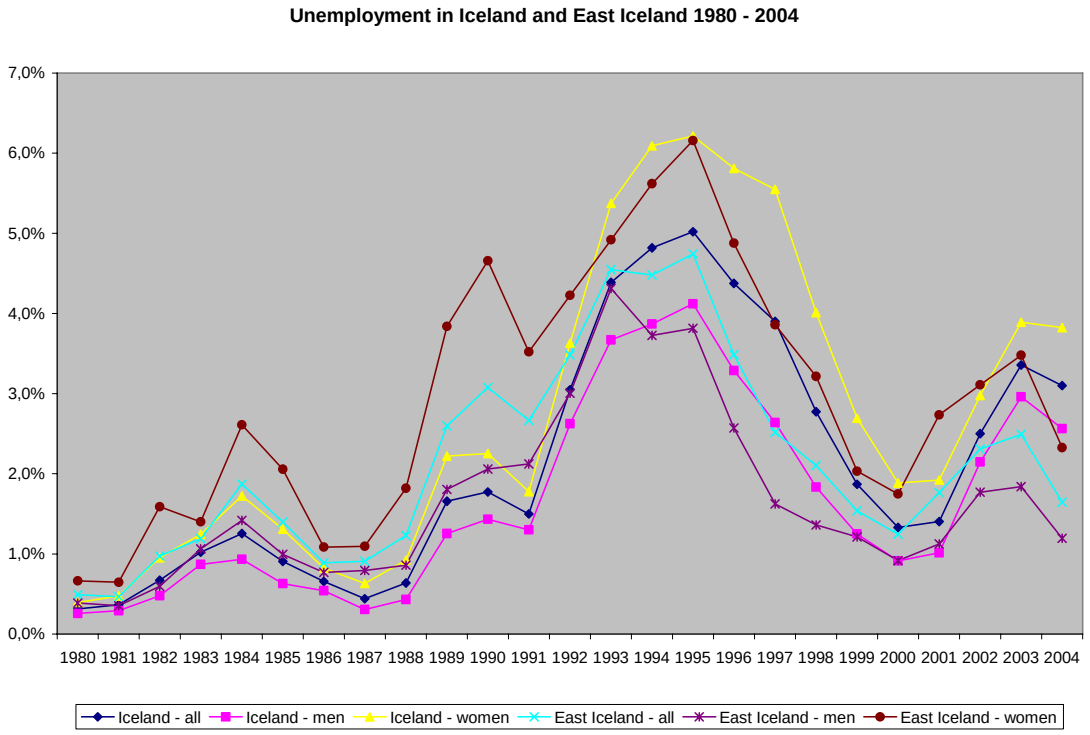
Long term unemployment can create various social and economic problems. Therefore, communities try to avoid long periods with high unemployment rates since such conditions are not sustainable. The new jobs created by the projects will change the employment market in East Iceland and could influence unemployment rates in the area. However, it is not obvious what the effects will be since more jobs will not automatically lead to a lower unemployment rate. In the past, a stagnant job market in East Iceland has resulted in people moving away to areas where there were more jobs, rather than staying unemployed. Also, a gender imbalance in the types of jobs created by the projects (both direct and indirect jobs) could result in an increase in unemployment rates.

Metric

Unemployment rate in East Iceland and nationally (project effect: induced).

Baseline

The following graph shows that the unemployment rate in East Iceland has been less than average compared to the national level since 1992. Conversely, before that time, the unemployment rate was higher in East Iceland.



Source: Directorate of Labour

Sustainability Indicator 13.1

Tourism Levels

Project effect: Direct and Induced

Rationale for Selection as a Sustainability Indicator

East Iceland attracts many tourists to see the area's wilderness, fjords, waterfalls, tundra, and landscapes. The projects will likely influence the number of tourists in the region through tourist interests in the projects, increased access to the area, and business travel. It is also possible that the projects will make the area less interesting to some tourists that feel the construction of the dam will have a negative impact on wilderness in the highlands. Tourists can access East Iceland by car, on tour buses, or via plane. Egilsstadir is the location of the region's principal airport, supporting local and international flights. The airport is well connected with good roads allowing access to many parts of East Iceland.

Metric

i. Proportion of jobs in hotels and restaurants in East Iceland and Nationally (project effect: induced).

ii. Number of bed nights/year in hotels and guesthouses in East Iceland (project effect: induced).

iii. Number of passengers on flights to Egilsstadir (project effect: induced).

iv. Number of visits to smelter and Kárahnjúkar projects (project effect: direct).

Baseline

i. **Jobs in Hotels and Restaurants in 2003**

	East Iceland	Capital Region	All Iceland
Number of Jobs	200	3,620	5,540
% of total	3.02%	3.77%	3.56%

Source: Statistics Iceland

ii. **Number of Overnight Stays in Hotels and Guesthouses in 2000 and 2003**

	East Iceland	Capital Region	All Iceland
Number of stays 2000	94,196	647,228	1,186,455
Number of stays 2003	118,424	706,261	1,368,728
% change	+ 26%	+ 9%	+ 15%

Source: Statistics Iceland

iii. **Passengers on Flights to and from Egilsstadir**

	2000	2003
Flights to and from Egilsstadir	65,271	81,677

Source: Air Iceland, 2003

Baseline data for visits to the smelter and Kárahnjúkar will be summarized once collected.

Sustainability Indicator 14.1

Retained Value Added

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
Long-term economic benefits from the projects are important for sustainability. This does not only apply to economic benefits for the private companies involved in the projects, but also for East Iceland and for Iceland as a whole. The retained value added from the smelter and dam will include salaries, payments to public authorities, supplies procured in Iceland and profits that remain in Iceland.

Metric
ISK retained in Iceland through Alcoa and Landsvirkjun salaries, payments to public authorities, supplies procured in Iceland and profits that remain in Iceland (project effect: direct)

Baseline
Information will be collected for the first yearly report to be published in 2006. The retained value added will be calculated using methods comparable to those which Iceland Statistics uses when finding the retained value added for specific sectors.

Sustainability Indicator 14.2

Quantity of Goods and Services Procured in East-Iceland and Nationally

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

The Fjardaál and Karankujar projects have the opportunity to have a significant positive effect on the Icelandic economy through procurement of goods and services from local and National companies. Many supporting industries could experience growth through the development of the projects both during the construction and the operation phases. A stable economy will be one that does not have an over-reliance on one source for income. Monitoring the extent to which the projects contribute to the local and National economy will be useful in assessing the degree of reliance of supporting business on Alcoa and Landsvirkjun.

Metric

Annual statistics on percent of total goods and services (in terms of value in ISK) procured by Alcoa and Landsvirkjun in East Iceland and percent procured in Iceland (project effect: direct).

Baseline

Baseline data will be collected and summarized in 2007.

Sustainability Indicator 15.1

Financial Status of Municipalities

Project effect: Direct and induced

Rationale for Selection as a Sustainability Indicator

The Fjardaál and Kárahnjúkar projects will likely increase revenues from municipalities through increased income and property taxes from direct and indirect employment in the area. The municipalities' expenditure, however, will also likely increase as the additional employees, their families, and others attracted to the local area require municipal services. The main services which must be discharged by the municipalities according to Icelandic law are:

- Social services
- Technical services
- Education, culture, sports and recreation
- Infrastructure, environment, and planning
- Operation of harbors (where appropriate)
- Water works, district heating systems, and other utilities

Metric

i. Contribution of the Alcoa and Landsvirkjun projects to municipal revenues as a percentage of the total municipal revenue (project effect: direct).

ii. Municipal income/expenditure ratio (project effect: induced).

Baseline

i. Baseline data on the contribution of Alcoa and Landsvirkjun projects to municipality revenues will be collected and summarized in 2007.

ii. The following tables display the income to expenditure ratios of East Iceland. Presently, without any influence from the Alcoa and Landsvirkjun projects, only three municipalities out of fifteen have a ratio of above one, i.e. income received is greater than expenditure.

(View table overleaf)

Municipalities of East Iceland - Income and Expenditure 2002

Municipalities Local	Income (000s ISK)	Expenditure (000s ISK)	Income/ Expenditure ratio
Austur-Hérað	894,708	910,107	0.983
Norður-Hérað	109,820	111,838	0.982
Fellahreppur[1]	168,986	181,159	0.933
Austurbyggð	431,413	477,795	0.903
Fáskrúðsfjarðarhreppur	20,269	19,638	1.032
Fjarðarbyggð	1,407,409	1,419,177	0.992
Fljótsdalshreppur	38,530	39,158	0.984
Borgarfjarðarhreppur	61,371	58,737	1.045
Breiðdalshreppur	107,225	128,387	0.835
Djúpavogshreppur	209,948	228,598	0.918
Mjóafjarðarhreppur	10,807	11,560	0.935
Seyðisfjarðarkaupstaður	404,161	424,244	0.953
Skeggjastaðahreppur	51,933	50,079	1.037
Sveitarfélagið Hornafjörður	958,469	1,031,925	0.929
Vopnafjarðarhreppur	320,146	366,972	0.872

Source: The Association of Icelandic Municipalities, Yearbook of Municipalities 2003.

(1) [1] Austur-Hérað, Norður-Hérað and Fellahreppur were united in one municipality on 1 November 2004.

Sustainability Indicator 16.1

Noise in Reydarfjordur

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

Ambient noise levels influence the quality of life in a community. The presence of consistent, loud noise detracts from the appeal of an area and may be detrimental to the long-term sustainability of the community. Local community residents are concerned that the Fjardaál smelter near Reydarfjordur could have a negative effect on noise levels in the village. Noise levels will be driven primarily by the transportation of materials, equipment, and personnel to the plant, as well as plant operations.

Metric

Average Noise Level (DnL) at established monitoring stations at the smelter site and in Reydarfjordur (project effect: indirect).

Baseline

Base noise levels in the village of Reydarfjordur are approximately 40-50 decibels. Construction work has recently started on the smelter. Construction-related noise level is expected to be within the limits defined in Iceland regulation (no. 933/1999) concerning allowable maximum noise levels for residential housing areas in Iceland (smelter EIA, 2002).

Sustainability Indicator 17.1

Dust Pollution

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

Dust from Halslon Reservoir is a direct project effect that will be monitored in this initiative. However, it could prove difficult to distinguish dust from the reservoir from dust originating from other sources, unrelated to the project. Every year some of the sedimentation that currently moves to the shoreline with Jokulsá a Dal will fall to the bottom of Halslon Reservoir. The surface level in Halslon Reservoir is lowest in the springtime, particularly in May. In June, the water level begins to rise and the reservoir should be filled by early August in an average year. In an average year, the difference between lowest and highest surface level is 35 meters but can be as much as 55 meters in dry years. During the first few decades of the project, the suspended sediments will fall to the bottom of the reservoir closest to the glacier. The smallest particles will move around and end up in the parts of the reservoir that will be dry the first half of summer. Small particles can also be released from the bottom because of wave action when the surface water level is low. These small particles can blow away from the reservoir when the weather is dry and windy. This can lead to dust pollution that can affect surrounding communities and settlements. At the same time, dust pollution caused by small particles from the river banks of Jokulsá a Dal will stop since sedimentation in the river will be greatly reduced once the dam starts operating.

Metric

Average monthly concentration of air particulates measured at designated sample locations at Halslon and Fljotsdalsherad. Wind measurements from the Icelandic Meteorological Office will also be used to help estimate where the particulates originate from.

Baseline

When weather is dry and wind is blowing from the southwest, dust from the highlands north of Vatnajokull glacier and from the river banks of Jokulsá a Dal is carried down to the lowlands. Baseline does not currently exist but will be collected starting 2005.

Sustainability Indicator 17.2

Air Emissions

Project effect: Direct and indirect

Rationale for Selection as a Sustainability Indicator

Air quality is an important human health issue. Local residents are concerned that the smelter will adversely affect the local air quality and detract from the quality of life in Reydarfjordur. The sustainability of the local communities is, in part, dependent on desirable living conditions and the quality of the local environment. Emissions from the smelter will have a direct effect on the air quality in East Iceland.

Metric

i. Particulate matter, sulphur dioxide (SO_2), fluoride (F), and polycyclic aromatic hydrocarbons (PAH) emissions (in kg) per ton of aluminium produced (kg/metric ton) (project effect: direct).

ii. Concentrations of particulate matter, SO_2, F, and PAH at established monitoring stations in Reydarfjordur ($\mu g/m^3$) (project effect: indirect).

Baseline

Baseline air emissions data will be collected and reported once the smelter is operational.

Sustainability Indicator 18.1

Erosion of the River Bank at Jokulsá a Flotsdal and Lagarfljot

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

The Kárahnjúkar dam will increase the flow of the rivers Jokulsá í Fljotsdal and Lagarfljot which in turn will increase the potential for erosion of riverbanks. The mean annual discharge of the two rivers will increase by slightly less than 90 m^3/s. This increase will roughly double the mean annual discharge at Egilsstadir. The increase in discharge will be significantly less during floods. Flow velocity will increase, which can lead to increased erosion of the riverbanks. This erosion will mainly take place during floods, when the impact of Karahnjúkar is relatively small and flow speeds are only slightly increased. Considerable erosion of riverbanks already exists, particularly in certain areas downstream from Lagarfoss waterfall, but also to a certain degree in Jokulsá í Fljotsdal.

Increased discharge will cause a rise in the water level, which also can cause increased erosion, especially where the flow velocity is low and erosion due to waves becomes the dominating factor. This is the case in Lagarfljot, upstream from Egilsstadir, and to a certain amount downstream from Lagarfoss.

Ice can also cause riverbank erosion. Kárahnjúkar is not expected to have much impact on formation of ice on Lagarfljot. The impact of the power station will indirectly affect ice-related riverbank erosion due to the rise in the water level during winter, which can cause erosion by the presence of ice higher on the river banks. This only applies to the area downriver from Lagarfoss. Conversely, the water level will be lower in the area between Lagarfoss and Egilsstadir, so the effect there will be opposite.

Metric

Location of riverbank in selected areas as measured by riverbank profiles (project effect: indirect).

Baseline

In Lagarfljot, upriver from Lagarfoss, erosion of the riverbanks has been monitored by RARIK since the construction of Lagarfoss Hydroelectric Plant. Baseline information from this area is well documented. This monitoring has taken place by measuring the distance between the riverbank and 13 vegetation study plots that are located in 7 areas by the river Lagarfljot. Erosion differs considerably between areas and it is heaviest north of Egilsstadir, especially at Dagverðargerdi and Rangá River 1.

No direct measurements of erosion exist in Jokulsá í Fljotsdal or in Lagarfljot downriver from Lagarfoss except from aerial photographs that provide a rough indication of the changes in the river channel. In these areas, sample locations will be established and baseline profiles measured in winter 2004/2005 and again in spring 2007 before the start of the hydropower station.

Sustainability Indicator 19.1

Sediment Deposition in Hálslón Reservoir

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

Sediment deposition in Halslon Reservoir can influence how long the power plant will be in operation and is therefore an important sustainability issue. The construction of the Kárahnjúkar power plant will create the 57 km^2 Halslon Reservoir. The reservoir will be around 24 km long and less than 3 km wide in most places. Total storage in the reservoir will be around 2340 gigaliters, with usable storage around 2100 gigaliters.

The sediment transport of Jokulsá in Dal is the highest of all Icelandic rivers estimated conservatively as 7 – 8 million tons per year of which 90 percent is suspended load and around 10 percent bed load. Most of this sediment, around 6.5 – 7.0 million tons per year, will settle in the reservoir and, according to models, the reservoir will fill up in a few centuries.

The sedimentation will be mainly at the top end of the reservoir where a delta will form where the river Jokulsá in Dal runs into it. In around 25 years, these deltas will extend some 1.5 km into the reservoir and after 100 years the delta will extend about 6 km into the reservoir.

Metric

i. Volume (m^3) of sedimentation in a 5 – 10 year period (project effect: direct).

ii. Grain size distribution of sediments in the reservoir bed (project effect: direct).

Baseline

The area of the proposed reservoir has been mapped and studied extensively: vegetation, geology, animal life, and archaeological remains have been studied. Terraces from the end of the ice age have been, or will be, studied along with other geological features. The sediment transport of Jokulsá in Dal has been monitored from 1964 when the National Energy Authority started measurement of sediment in the river water. Monitoring of bed load has been ongoing since 2000. Models have been made to predict sedimentation and grain size gradient.

Data for the metrics will be collected and reported once the Kárahnjúkar power station becomes operational.

Sustainability Indicator 20.1

Mine and Spoil Reclamation

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
Large construction projects call for a large amount of material. Limiting disturbance of land and vegetation, as well as reclaiming the areas used for mines and spoils that are not inundated by the reservoir or become part of the construction, is a sustainability issue. Material used to build dams and roads, as well as material used for other project related purposes, will be taken from mines that are carefully chosen based on research and environmental considerations. To make land reclamation more successful, organic soil that is removed from disturbed areas will be kept and used to cover disturbed areas. Vegetation will also be restored where appropriate.

Earth material from tunnels, sections, and other digging related to the projects will be used for construction or placed in areas chosen after reserch and environmental considerations. Spoil areas that are not inundated by Halslon Reservoir or otherwise affected by the projects will be shaped so they become a part of the current landscape. Organic soil from spoil areas will be stored until construction is completed. Then the disturbed areas will be covered with the soil and vegetation reclaimed where appropriate.

Metric
Proportion of disturbed land that is reclaimed to a comparable status as before construction (project effect: direct).

Baseline
Landscape and vegetation cover at the start of construction will be used as the baseline. The proportion of disturbed land that is reclaimed will be calculated by comparing pre-project landscape and vegetation cover in relevant areas after construction is finished and then every five years. This will be conducted in consultation with the Food and Environment Protection Agency.

Sustainability Indicator 21.1

Fluoride in Vegetation

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

Fluoride can adversely affect the growth and vitality of vegetation. Fluoride emitted from the Fjardaál smelter could accumulate in vegetation in the immediate vicinity of the smelter. Communities in East Iceland are concerned about the changes in their ecosystem if fluoride emissions exceed the tolerance threshold of local plants. Fluoride can directly impact vegetation and could cause the localized extirpation of sensitive floral species. Fluoride accumulation is also hazardous to grazing mammals. Vegetation could accumulate fluorides in concentrations that are hazardous to herbivorous mammals, and this in turn could influence humans if they eat those mammals.

Metric

Concentration of F (µg/kg-DW) in vegetation (ruminant forage and berries) at designated sample plots within a specified radius of the smelter (Project effect: direct).

Baseline

Baseline fluoride levels in vegetation will be collected in 2007.

Sustainability Indicator 22.1

Contaminant Levels in Molluscs

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator
Iceland's marine ecosystem is unique and bountiful. Aluminum smelting operations require wastewater discharges into the Icelandic waterways that could indirectly affect aquatic fauna through changes in water chemistry. East Iceland's economy is heavily dependent upon aquatic fauna (i.e., fishing) and adverse changes to the aquatic communities could be economically damaging to the region.

Metric
Concentration of PAH (µg/g) and heavy metals (ppm) in mollusks at established survey points in Fjord near smelter (project effect: indirect).

Baseline
Baseline data is presented in the MRI Sea Benthos Study, 2000.

Sustainability Indicator 22.2

Groundwater and Surface Water Quality at the Smelter

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

Currently, 95% of the freshwater used in Iceland is untreated groundwater. The remaining freshwater is a combination of treated and untreated surface water. Because the majority of the Icelandic population uses untreated potable water, maintenance of acceptable water quality standards are vital to the sustainability of the local communities. The presence of industrial facilities creates the potential for direct contamination of local groundwater. All facility discharges (solid, liquid, gaseous) have the potential to influence water quality.

Metric

Concentrations (mg/l) of phosphorous (P), fluoride (F), chlorine (Cl), and suphate (SO_4) in groundwater and surface water at established sample locations at the smelter site and near the smelter outfall (project effect: indirect).

Baseline

Baseline data for groundwater and surface water will be collected in 2007.

Sustainability Indicator 22.3

Project-related Oil/Chemical Spills

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
Oil and chemical spills can cause significant ecological damage. The long-term sustainability of the East Iceland ecosystem is, in part, dependent upon preventing large-scale oil and chemical releases to the lands and waters surrounding the smelter and berthing area. The economic vitality of East Iceland, for non-Alcoa employees, is largely reliant on the maintenance of the local marine ecosystem.

Metric
Number of spills over 20 liters and 2,000 liters per year on land (facility) and from ships at berth at smelter (project effect: direct).

Baseline
Baseline data for this indicator will be collected in 2007.

Sustainability Indicator 23.1

Quantity and Treatment of Solid Waste

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
Icelandic laws and regulations are the foundation of Icelandic policy for waste management. Most of these laws are based on EU directives. The main objectives of this policy include decreasing the total quantity of waste generated, increasing recycling and recovery, and reducing the quantity of waste deposited in landfills. Alcoa has direct control over the solid waste at their facility and can therefore control the generation and waste disposal so that it complies with government policy.

Metric

i. Total wastes landfilled annually, in metric tons (project effect: direct).

ii. Percent of wastes sold or recycled annually, in metric tons (project effect: direct).

iii. Total amount of spent pot lining per ton of aluminum produced annually, in kg/metric ton (project effect: direct).

Baseline
Baseline data for this indicator will be collected once the smelter is operational.

Sustainability Indicator 24.1

Pink-footed Goose

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

The Kárahnjúkar project will impact the pink-footed goose. There will be three types of effects. First, some breeding sites and grazing land will be inundated by Halslon Reservoir. Second, more traffic in the area during construction, and later because of better access to the area, can disturb the birds. Third, construction work in Glumsstadadal valley will damage some of the breeding site located there.

In 2000, a total of 2,200 nesting pairs of pink-footed geese occured within the impact area of the dam. Nesting sites for a total of 500 to 600 breeding pairs will be inundated by Halslon Reservoir. This accounts for rouhgly 33 percent of all nests in Bruardalir and Vesturoraefi, seven percent of breeding pairs in East Iceland, and 1-2 percent of the total number of breeding pairs in the Icelandic-Greenlandic stock. The land that will dissappear under Halslon Reservoir is considered an internationally important breeding site for the pink-footed goose according to criteria in the Ramsar Convention and the International Bird Committee. In addition, grazing land for non-nesting geese will be interrupted during construction, which will reduce habitat availability.

Neither Halslon Reservoir nor other smaller reservoirs created for the dam are likely to influence moulting sites for the pink footed goose except perhaps in Kringilsarrani.

Metric

i. Number of breeding birds in selected sites in the river basins of Jokulsá in Dal and Jokulsá in Fljotdalur valley (project effect: indirect)

ii. Number of geese in molding in Snaefellsoraefi (project effect: indirect)

Baseline

The number of geese has increased in East Iceland since 1960, with geese expanding into new habitats. This increase has been similar proportionally to the total increase in the Icelandic-Greenlandic stock. The number of breeding pairs in East Iceland quadrupled in the period from 1980 to 2000. In 1981, 2,000 pairs were estimated to nest in the area, 4,000 pairs in 1988 and 7,300 pairs in the year 2000. This number accounts for roughly 15-20 percent of the breeding pairs of the Icelandic-Greenlandic stock. The Icelandic-Greenlandic stock accounts for 85 percent of pink footed geese in the world.

Almost 50 percent of all breeding pairs in East Iceland (3,300 pairs) nest in 40 sites that are located in the river basins of Jokulsá in Dal. The largest sites are in Kringilsarrani (300-400 pairs), along the river upstream of Sandfell (i.e. the area that will be inundated by Halslon Reservoir, 330 pairs), in Hafrahvammagljufur (206), between Holknar and Merkis (435), by Hnefla (407) and in Glumsstadadal valley (293). Roughly 500 pairs are thought to nest in the river basin of Jokulsá in Fljotsdal and the largest site is located between Kleifar and Laugara (96 pairs).

In some of the breeding sites in the river basin of Jokulsá in Dal the number of nests has remained stable during the last 20 years or grown very slowly (by less than 3 percent per year). Other sites have grown rapidly, even up to 10-15 percent per year. Overall, the breeding stock of the pink-footed goose in East Iceland has been growing at a similar rate as the Icelandic-Greenlandic stock that showed high growth rates from 1980 to 1995.

Breeding sites for the pink-footed goose that may disappear or be damaged because of the Kárahnjúkar project.

Sites	# of breeding paris	Nests that disappear
Saudá, Vesturröraefi	96	66
Kringilsárrani	300	50
Jokulsá, upstream of Sandfell	330	330
Saudá, Brúardolum	50	40
Jokulsá downstream of Eyjabakkar	5	5
Glúmsstadadalur	193	40
TOTAL	**994**	**531**

Source: IINH

Sustainability Indicator 24.2

Reindeer

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator
Kárahnjúkar will have have some effects on reindeer habitats but it is not clear if the project will influence the size of the stock or only change reideer migration patterns. Reindeer were imported to Iceland early in the 17th century. They are important to East Icelanders because they generate income from hunting licences. Also, reindeer are beautiful animals and characteristic of the area.

The Kárahnjúkar power plant will effect reindeer habitats since the reindeer typically use some of the land that will be inundated by the Halson Reservoir once the power plant starts to operate. This will interrupt the spring and autumn migration of reindeer across the river Jokulsá in Dal close to Karahnjukar. New roads and increased traffic also could disturb the reindeer and change migration patterns. Jokulsá in Dal runs through the middle of where Halslon Reservoir will be located. About 19 km^2 of land east of the river and 13km^2 west of the river will be inundated by Halslon Reservoir. A total of 6 km^2 of vegetative land will be inundated by smaller reservoirs in Muli and Hraun.

Metric
The number of reindeer in Vesturoraefi, Muli, and Hraun east of Snaefell (project effect: indirect)

Baseline
The reindeer stock is managed so that by the end of each hunting season the size of the stock is around 3,000 animals. The Snaefells herd, located north of Vatnajokull glacier, is about half of the Icelandic stock. About 1,000 animals use the habitat in Vesturoraefi during the summers. The stock has been growing in recent years but this has been dealt with by increasing hunting quotas. The hunting quota was 574 animals in 2002 but was up to 800 animals in 2003 and 2004.

The Engineering Institute of the University of Iceland has counted reindeer north of Bruarjokull glacier from 1993 until present. Their work demonstrates that during years when there is much snow, the number of reindeer in Vesturoraefi varies from 38 adults and 22 calves (1995) up to 170 adults and 60 calves (2001) during the spring when calves are born. During years when there is little snow, the number of reindeer is greater. Numbers peaked in 2002 with 410 adults and 190 calves in Vesturoraefi. In June, the number of animals in the area increases. An overview is presented in the following table.

The area of Vesturoraefi is around 300 km^2, of which 200 km^2 are vegetated. Vegetation has been increasing in the area, although land is in poor condition in some areas. Landsvirkjun finances land reclamation initiatives in this area close to the Kárahnjúkar power plant where emphasis is on reclaiming vegetation in the highlands above Jokuldal valley. One or two km^2 will be revegetated and those areas will not be fenced. The initiative began in the summer of 2003.

No baseline information exists for migration patterns of reindeers across Jokulsá in Dal close to Karahnjukar.

Reindeer counting north of Brúarjokull Glacier, from aerial photos

Year	Date	Number of animals		Snow	# of adult animals within the reservoir area	% of adult animals within the reservoir area
		adults	calves			
1993	25.5	150	60	Some snow		
1994	26.5	60	30-40	Much snow	42	70%
1995	7.6	38	22	Very much snow	24	64%
	27.6	220	100	No snow	134	61%
1996	14.5	77	0	Some snow	45	58%
	18.6	410	180	No snow	376	92%
1997	20.5	110	60	Little snow	3	2%
	30.6	510	190	No snow	0	0%
1998	20.5	205	60-70	Little snow	16	8%
	3.6	400	250	No snow	133	32%
	18.6	640	370	No snow	5	1%
1999	28.5	50	20	Much snow	40	79%
	9.6	290	160	Little snow	63	22%
	22.6	630	340	No snow	475	75%
2000	31.5	250-300	100	No snow	64	23%
	17.6	610	280	No snow	16	3%
	30.6	890	370	No snow	0	0%
2001	23.5	170	60	Much snow	9	5%
	7.6	190	120	Some snow	133	70%
	21.6	640	360	Little snow	325	51%
2002	5.6	420	190	Little snow	266	63%
	22.6	540	270	Little snow	51	9%
	3.7	510	200	No snow	0	0%
2003	22.6	700	250	No snow	29	4%
2004	27.5	550	200	No snow	5	1%
	5.7	113	28	No snow	75	67%

Reindeer counting east of Snaefell, from aerial photos

Year	Date	Number of animals		Snow
		Adults	Calves	
2003	22.6	20	0	No snow
2004	27.5	460	160	No snow
		105	46	No snow

Sustainability Indicator 24.3

Breeding Birds at Úthérad

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

Changes in hydrology will lead to less discharge in Jokulsá in Dal, but more discharge in Lagarfljot River, which will result in more sedimentation in the Lagarfljot. Changes in hydrology are not expected to have great impact on vegetation. Therefore, changes of habitats for birds at Utherad are not likely. For these reasons, this indicator focuses on bird species that are either dependent on Lagarfljot river for food or species whose habitat could be influenced because of changes in river basins at Jokulsá in Dal. For example it is possible that increased access to the mudflats close to Jokulsá in Dal could have negative impact on moulting sites for the Greylag Goose and nesting sites for the Great Skua that are currently located close to Jokulsá in Dal.

Metric

i. Feeding site use (e.g. #feeds/hour) by Red-throated Divers at Lagarfljot and the ocean (project impact: indirect).

ii. Distribution of Long-tailed Duck in Utherad and the number of birds that stop by Lagarfljot River during spring and summer (project impact: indirect).

iii. Number of moulting Greylag Goose in Utherad and close to Lagarfljot River (project impact: indirect).

iv. Number of nesting Great Skuas in areas adjacent to Jokulsá in Dal delta (project impact: indirect).

Baseline

Data for the metrics listed above will be reported when available.

i. Research on feeding sites used by Red-throated Divers was conducted in 2004 and results indicate that the ocean is the primary feeding site for this species. This study will be repeated in 2005 and 2015 for comparison.

ii. The distribution of breeding Long-tailed Duck in Utherad will be monitored in 2006 and again in 2016.

iii. Moulting sites for Greylag Goose in areas adjacent to Jokulsá a Dal will be monitored in 2006 and again in 2016..

iv. The number of nesting Great Skuas in areas adjacent to Jokulsá a Dal delta will be counted in 2006, 2007, 2008, and 2009 and compared to the number of birds in Axarfjordur and Breidarmerkursandur.

Sustainability Indicator 25.1

Changes in Hydrology

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

With the construction of Kárahnjúkar power station, the river Jokulsá in Dal will be diverted from Halslon Reservoir into Jokulsá in Fljotsdal and Lagarfljot. Water from Jokulsá in Fljotsdal and from rivers in the Hraun area will also be diverted to the power plant. This will cause substantial changes in the hydrology of the area. Water discharge will increase in some areas but decrease in others. Water level changes, which in turn can affect ground water level, sediment transport, changes in erosion and so on, will also occur.

The discharge of the rivers Jokulsá in Fljotsdal, downstream of the tailrace canal, and Lagarfljot will increase considerably, on average just less than 90 m^3/s. The mean annual discharge at Egilsstadir will increase by about half with the construction of the power plant. The increase in discharge differs within the year. It is highest in winter (around 100 m^3/s increase), but much less during the period of maximum discharge in summer when the power plant is mainly utilizing water from Jokulsá in Fljotsdal and rivers in the Hraun area. Increased discharge in floods will be proportionally much less. At worst case scenarios in floods (all reservoirs full), the discharge of Jokulsá in Fljotsdal and Lagarfljot will increase by about 60 m^3/s. In the largest recorded floods in Lagarfljot (October and November 2002), the maximum discharge was estimated about 1,650 – 1,700 m^3/s. Maximum discharge at the Lagarfoss waterfall in the same floods was measured at 950 m^3/s. The increase in maximum discharge into Lagarfljot in these floods was therefore 3 – 4 percent, with the maximum discharge at Lagarfoss increased by six percent.

Just as discharge increases in the rivers Jokulsá in Fljotsdal and Lagarfljot, it is considerably reduced in the river Jokulsá á Dal. The mean discharge is reduced for most of the year, although least during summer and into the autumn when it is likely that water will be discharged over the spillway of Kárahnjúkar dam. Floods due to glacial melt during summer are significantly reduced until August when the Halslon Reservoir fills up. Typical autumn-, winter- and spring-floods in the lower part of the river are only minimally reduced, as these originate mainly from the river catchment's area below Kárahnjúkar dam. Mean discharge in the river from the Hraun area (Kelduá, Sauðá and Grjótá) is considerably reduced due to redirection of the discharge to the power plant. The same applies to the Jokulsá in Fljotsdal upstream of the tailrace canal.

Metric

i. Water levels and discharge at gauging stations in rivers (project effect: indirect).

ii. Ground water levels in holes (project effect: indirect).

Baseline

Measurements of surface water levels and discharge at gauging stations and ground water levels exist, but from different time periods at different locations. The water discharge for the whole area has been modelled in a hydrological model over a 51 year period from 1950 – 2001. Data for surface and ground water levels using the metrics listed above will be collected and reported when available.

Sustainability Indicator 26.1

Vegetation in Vesturoraefi

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

The Kárahnjúkar power project will impact vegetation in the highlands, most notebly vegetation in Vesturoraefi. The area is valuable since vegetated areas located high above sea level are not very common. Several species use Vesturoraefi for grazing (sheep, goose, and reindeer). The Halslon Reservoir will remove some of the vegetated land but erosion on the shore of Halslon Reservoir could also result in sand blowing to the vegetated areas closest to the reservoir. Landsvirkjun will take on several measures to prevent sand blowing to the surrounding areas. Regardless, monitoring vegetation in the area is considered important in case those preventive measures will not be sufficient. An indicator monitoring changes in vegetation will signal if vegetation is detoriorating and this will help determine the need for restoration of vegetation. The Agricultural University of Iceland is already doing extensive research in the area whose aim is to find ways to improve the vegetation in the area as necessary.

Metric

Vegetation cover and composition of species (project effect: indirect).

Baseline

Vesturoraefi covers approximately 300 km^2, of which 200 km^2 are covered with vegetation. Baseline on the current status of vegetation cover will be collected in 2005 and 2006. Earlier research on vegetation in the area will also be used to establish the baseline.

Sustainability Indicator 26.2

Blowing Sand from Halslon Reservoir

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

The area that will be inundated once Halslon Reservoir is created has relatively thick volcanic soil beneath the vegetation. With time, the vegetation by the reservoir shoreline will disappear and this will leave the soil unprotected from wind and wave erosion. The soil could be flushed into the reservoir or blown to surrounding areas, causing the thickening of the soil or even destruction of vegetation. The smallest particles create dust but do not have negative effect on vegetation. The larger particles that move on the surface in sand piles pose a greater threat since they can suffocate vegetation closest to the reservoir.

When wind is strong, it usually blows from the southwest. Soil from west of the reservoir will therefore blow into the water but soil from the east side could blow over the vegetation on Vesturoraefi if no mitigation measures are taken. This danger is greatest in the first half of summer once the surface has dried up from spring thaws and the reservoir has not yet filled. Wetlands are less affected by wind erosion since groundwater keeps the soil wet.

Part of the soil that creates the wind erosion threat will slide into the reservoir with time. This will happen first in areas where slopes are greater than seven percent. Landsvirkjun plans to remove the soil from the flattest areas by pumping it into the deepest part of the reservoir. If those plans succeed, the soil on the east shoreline of the reservoir should be gone about 10 or 15 years after the dam starts to operate because of erosion or pumping

During the time soil erosion and creation of sand piles are still an issue, several mitigation measures are planned to prevent sand from piling up and destroying vegetated areas on Vesturoreafi. These measures include special protection walls, sand traps, fences, and sand erosion banks. Measures to strengthen vegetation east of the reservoir, in case of damage, are also being considered.

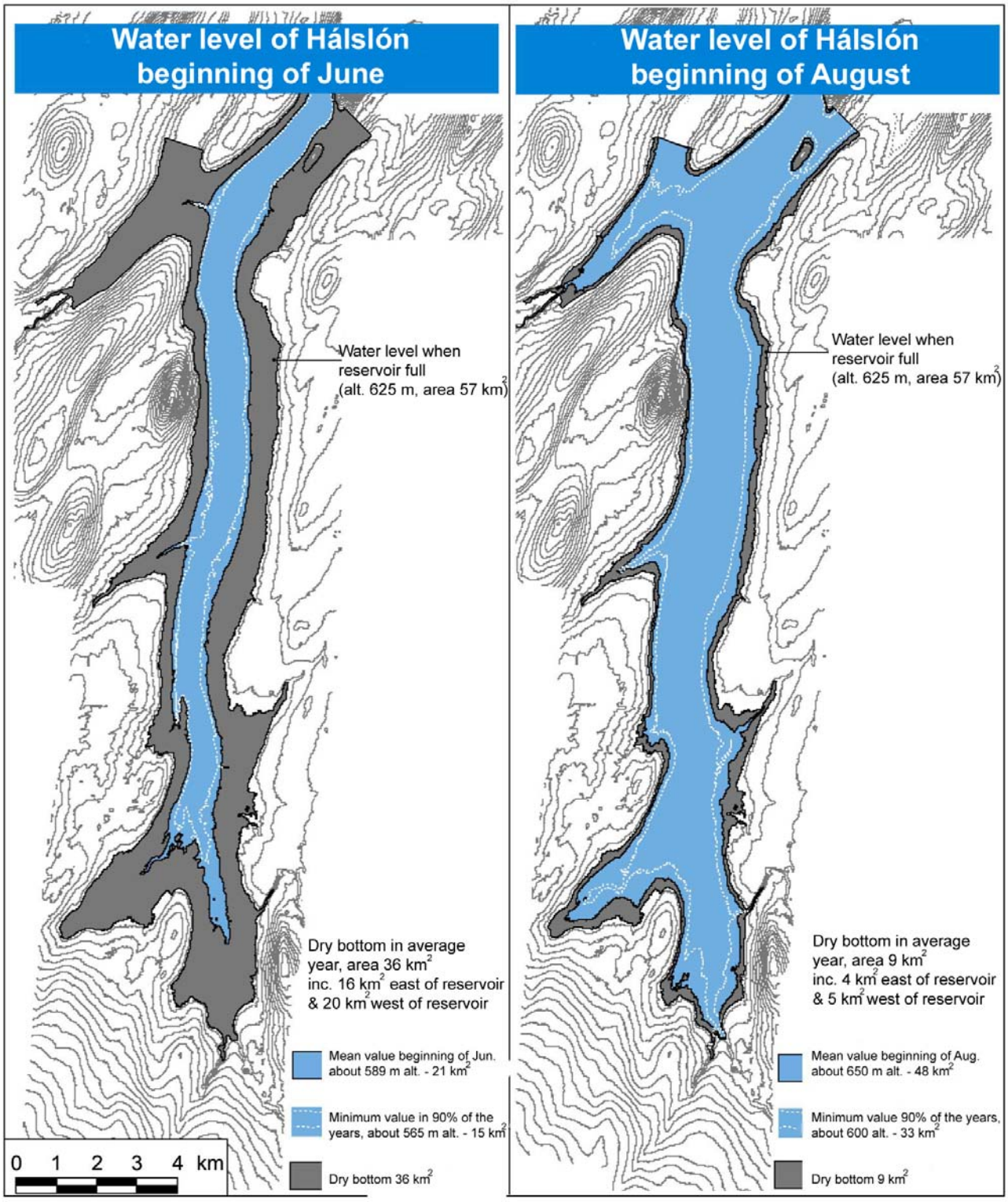
Metric

i. Volume of soil in sand piles east of the reservoir (project effect: direct).

ii. Estimation of the volume of soil that deposits on vegetation (project effect: direct).

Baseline

The map that follows this page is a rendering of the reservoir during June of an average year. The surface level of the reservoir is 580 meters above sea level, or 45 meters lower than when the surface level is at its highest peak. During this period, 16 km^2 of the bottom of the reservoir on the east side are above water. The picture on the right side shows the placement of the reservoir in August during an average year. The surface level is then 615 meters above sea level or 10 meters below the highest surface level. During this period, 4 km^2 of the bottom of the reservoir in the east side are left above water and the potential for wind erosion has decreased.


Water level of Hálslón
beginning of June
Water level when
reservoir full
(alt. 625 m, area 57 km2)
Dry bottom in average
year, area 36 km2
inc. 16 km2 east of reservoir
& 20 km2 west of reservoir
Mean value beginning of Jun.
about 589 m alt. - 21 km2
Minimum value in 90% of the
years, about 565 m alt. - 15 km2
Dry bottom 36 km2
0 1 2 3 4 km
Water level of Hálslón
beginning of August
Water level when
reservoir full
(alt. 625 m, area 57 km2)
Dry bottom in average
year, area 9 km2
inc. 4 km2 east of reservoir
& 5 km2 west of reservoir
Mean value beginning of Aug.
about 650 m alt. - 48 km2
Minimum value 90% of the years,
about 600 alt. - 33 km2
Dry bottom 9 km2

Sustainability Indicator 26.3

Vegetation Change Caused by Land Reclamation

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
The Kárahnjúkar power project will lead to distruction of vegetated land. Landvirkjun will initiate revegitation projects as one of the mitigation measures for the loss of vegetation. An agreement has been reached with local authorities in the municipality Nordur-Herad (now Fljotsdalsherad) that Landsvirkjun will finance the revegetation and land improvement projects but the municipality will be in charge of implementation. A special committee with representatives from the municipality, the Soil Conservation Service, and Landsvirkjun will choose areas and monitor the work. The objectives of those mitigation measures are the following:

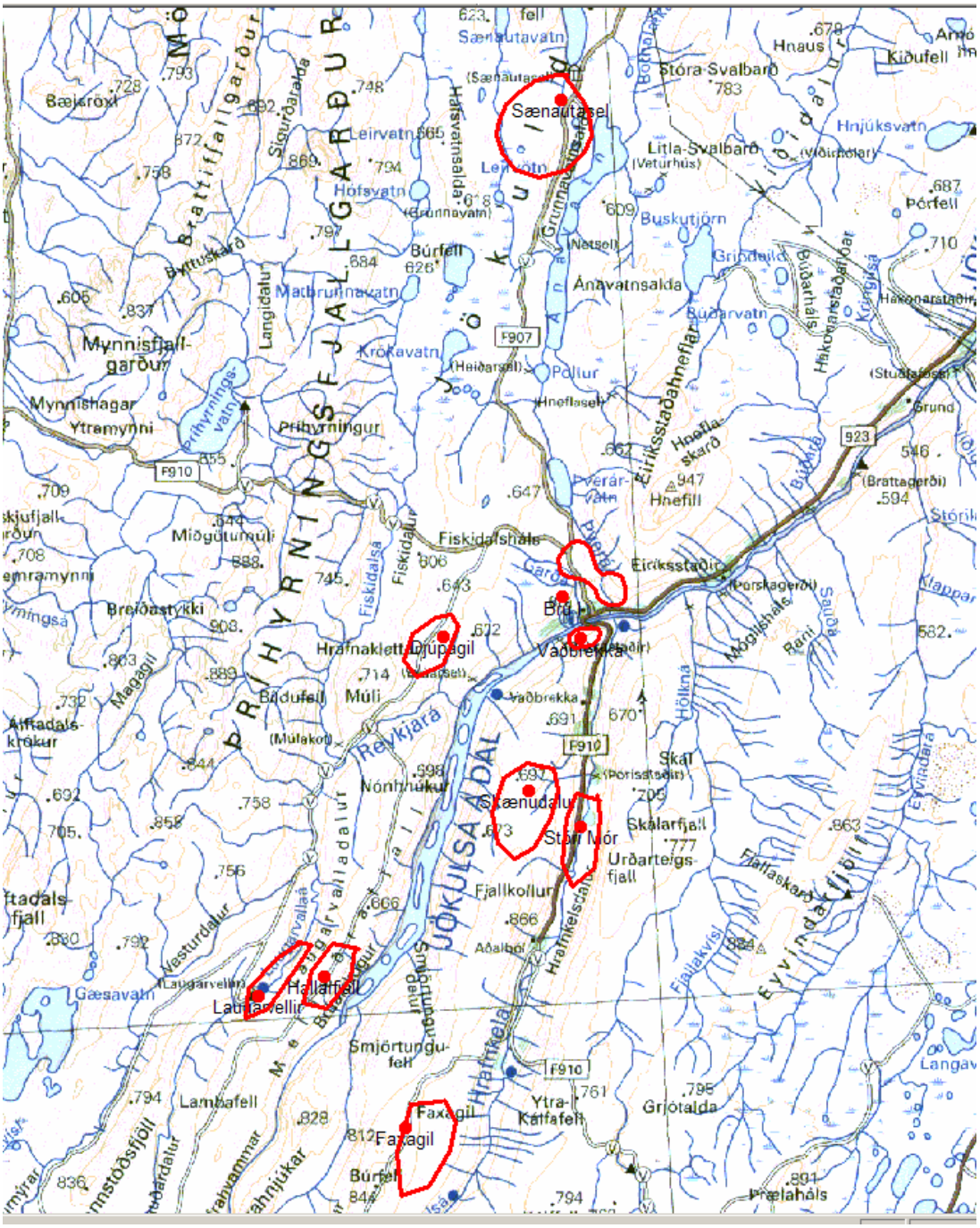
1) Decrease soil erosion and strengthen vegetation in the impact area of the Karahnnjukar project.
2) Reconstruct ecosystems in eroded land.
3) Create grazing areas for birds, reindeer, and sheep to make up for the areas that will be lost because of the power project.

A similar agreement has been reached with the municipality Fljotsdalshreppur but in that case the municipality is solely responsible for implementation and sends a report to Landsvirkjun about allocation of funds.

Metric
Area (ha) of reclaimed land at Nordur-Hérad and Fljótsdalur (project effect: direct).

Baseline
Revegetation will be attempted in areas that are currently characterized by gravel plain with small vegetated spots in an otherwise barren land. Sides of the mountains also have little vegetation, and the little vegetation that is there is decreasing because of erosion. The primary areas where revegetation will take place are shown on the map overleaf.

Land reclamation areas in Jokuldalur:



Sustainability Indicator 27.1

Freshwater Aquatic Fauna

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

The Kárahnjúkar project will have great impact on hydrology. However, this will not automatically lead to changes in freshwater aquatic fauna since the cold temperature in the two glacial rivers, Jokulsá in Fljotsdal and Jokulsá in Dal, limits biological activity. The fauna in Jokulsá in Dal and its tributary streams in Jokulsárhlid, Lagarfljot and Keldua is not very diverse and the rivers a not been used much for fishing. The impact of the dam will depend largely on changes in discharge of the rivers and an increase or decrease in sedimentation. It is possible that the effects in Jokulsá in Dal will to some degree be positive, i.e. biological productivity could increase.

Metric

i. Changes in small fauna species composition and fish spawning in select sampling locations in Jokulsá in Dal and tributary streams.

ii. Changes in small fauna species composition and fish spawning in selected sampling locations the rivers Kelduá and Lagarfljót.

iii. Fishing (no. of fish) in relevant rivers as registered by the Institute of Fresh Water Fisheries.

Baseline

The cold temperature of the two glacial rivers, Jokulsá in Fljotsdal and Jokulsá in Dal, provide good conditions for aquatic life. Jokulsá in Dal contains the highest sediment load of the glacial rivers in Iceland. Fish can swim into Jokulsá in Fljotsdal 25 km further than Logurinn but biological productivity is low because of floods and low concentration of dissolved chemicals. Suspended sediment in Lagarfljot river limits biological productivity to the top layers of the water. The impacts of the glacier are greatest closest to Jokulsá in Fljotsdal and are less closer to the shore. Both mountain trout and brown trout can be found in the Lagarfljot River. Net fishing in the river has yielded up to 1,000 kg of fish per year in recent years. Salmon fishing with nets in Lagarfljot River downstream from Lagarfoss and annual catch in the period 1985 to 1999 was 87 salmon.

Biological productivity in Jokulsá in Dal is also limited. Conditions for fish are poor because of the amount of suspended sediment, changes in discharge, and unsuitable substrate for fish spawning. It is unknown how far upriver fish can swim. This has resulted in very little fishing in Jokulsá in Dal. However, the projects are expected to have positive effects on biological productivity in the river. It is not clear if this change will lead to an increase in number of spawning areas since the bottom of the river is currently mostly rock or mud that is not suitable for spawning.

The tributary streams usually join the main rivers in canyons which makes it difficult or impossible for fish to swim up those streams. Four rivers are in Jokulsárhlid and three of those join Jokulsá in Dal, including Kalda, Fossa and Laxa. Some recreational fishing takes place in Keldua, mainly for mountain trout. Average annual fishing catches in Keldua in the period 1997 – 2001 was 138 mountain trout, 27 brown trout, and 1 salmon.

Sustainability Indicator 28.1

Marine Benthic Fauna

Project effect: Indirect and induced

Rationale for Selection as a Sustainability Indicator

Changes in the flow of water and sedimentation in rivers are the two factors related to the projects that are most likely to affect the marine ecosystem in Heradsfloi Bay. Karahnjuka power plant will greatly impact the flow of fresh water into the Bay, especially in late summers when discharge is expected to be about 200 to 300 m^3 per second instead of 600 to 700 m^3 per second as it is currently. The fresh water that enters the Bay floats on top of salty sea water. Limited monitoring on the salt levels in the Bay indicates that the changes in fresh water flows will not influence the benthic fauna.

Sedimentation is expected to decrease by 7 to 8 million tons per year once the power plant is in operation. The large sediment particles will remain in the reservoir and the rivers will continue carrying some of the finer grains into the Bay. Research has shown that the benthic fauna is closely related to the grain size in the sea bottom. Changes in sedimentation could therefore influence the composition of the sediment of the sea bottom, which could lead to changes in the benthic fauna.

Metric

i. Grain size and distribution of sediment in selected sample plots (project effect: indirect)
ii. Diversity and density of benthic fauna at selected sampling spots (project effect: induced).

Baseline

Little information is available about the sea bottom and the benthic fauna in Heradsfloi Bay. Two samples of benthic fauna were taken in 1992 as part of the BIOICE research project. One of the samples was taken where the sea bottom is 100 meters below sea level, up north in the Bay where the bottom is harder than in most other places in the Bay.

The main groups of fauna in these samples were Polychaeta (28%) and Foraminifera (20%), with fewer individuals were from other groups (Chart A).

The other sample was also taken where the sea bottom is 100 meters below sea level but the location was north of the middle of the Bay where the sea bottom was softer (muddy bottom). In this sample, the majority of the fauna belonged to the group Polychaeta (74%), with the rest belonging to various other groups (Chart B). It should be noted that different sampling equipment was used for the two samples.

Chart A: Sample from marine benthic fauna from Heradsfloi Bay (BIOICE – 2043). Proportions of individuals belonging to different groups. Source: Sigmar A. Steingrímsson, unpublished data):

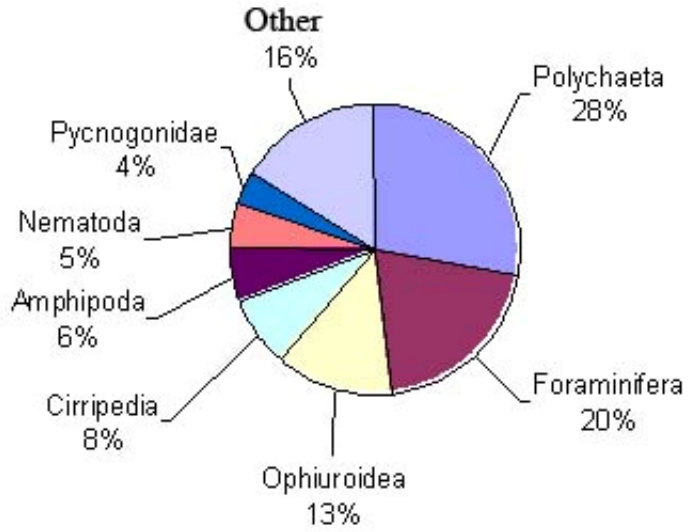
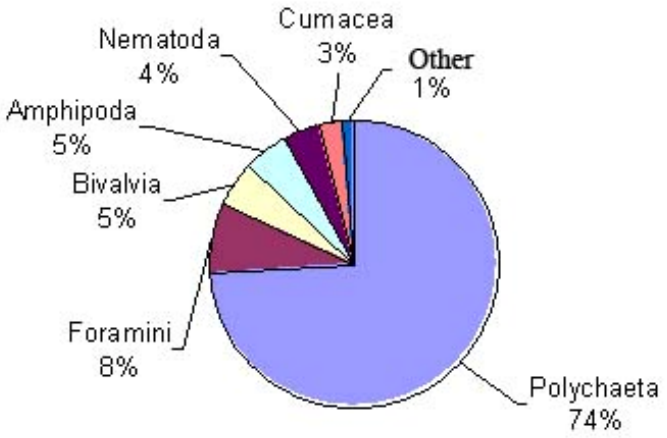


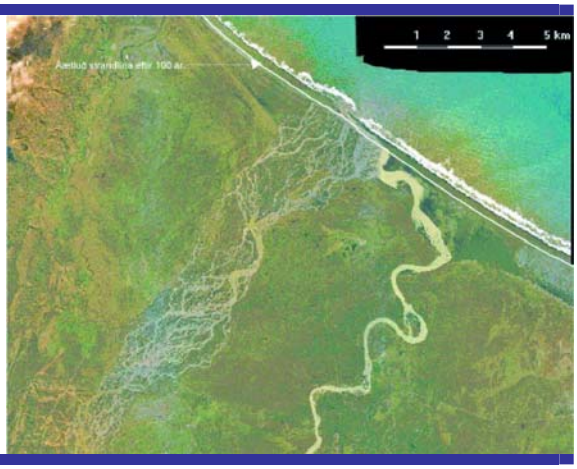
Chart A: Sample from marine benthic fauna from Heradsfloi Bay (BIOICE – 2043). Proportions of individuals belonging to different groups. Source: Sigmar A. Steingrímsson, unpublished data):



Sustainability Indicator 29.1

Movement of Coastline

Project effect: Indirect



Rationale for Selection as a Sustainability Indicator

With the Kárahnjúkar power plant, the two glacial rivers will carry much less sedimentation to the shore than under current conditions and this could influence the location of the shoreline and vegetation composition and cover close to the shoreline. The lowlands of Utherad are largely formed by the two glacial rivers running there, Jokulsá in Dal and Lagarfljot. Of those, Jokulsá in Dal carries considerably more sediment and the sediment transport is conservatively estimated to be around 7 – 8 million tons per year. The sediment transport of Lagarfljot is much less. Most of this sediment is carried by the rivers to the sea. The two rivers share the same river mouth at the shore of Herdasfloi Bay. The shoreline of the bay is affected by the sediment transport of the two rivers and the erosive forces of the ocean waves. At present, it can be assumed that the shoreline is advancing.

With the harnessing of Jokulsá in Dal, the bulk of the sediment, around 6.5 – 7.0 million tons per year, will settle in the Halslon Reservoir. With the sediment transport of the rivers so largely decreased, the present balance of the coastline will be disturbed and it is projected that the shoreline will retreat. Global sea level rise will add to and accelerate the erosion of the shoreline.

According to erosion models, it is predicted that the shoreline will retreat around 280 meters in the first 100 years of operation of the dam, primarily driven by rough seas and surf during storms and other situations such as rise in sea level. Destruction of vegetation on the shoreline is expected to be proportionally less than the area of land that will be eroded.

Metric

i. Location of shoreline as measured by aerial photographs and bathymetric profiles (project effect: indirect).

ii. Vegetation cover and species composition on delta (project effect: indirect).

Baseline

In conjunction with the environmental impact assessment of the Kárahnjúkar project, geological and vegetative maps of the shoreline have been produced. Depth profiles from the shoreline out to sea, onshore and offshore fauna, and human use of marine resources have been surveyed. The results of these surveys are presented in the environmental impact assessment and/or associated documents.

Aerial photographs and other photographs showing the past changes of the coastline exist. Further depth profiles from the shoreline out to sea will be made before the start of operation of the Kárahnjúkar Power Plant.

Sustainability Indicator 30.1

Flow in Waterfalls

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

A number of waterfalls will be affected by the Kárahnjúkar Hydroelectric Plant. In the river Jokulsá in Fljotsdal, there are many waterfalls along a 30 km stretch from Eyjabakkar to Nordurdalur where the river drops by 600 meters. Amongst them are the waterfalls Eyjabakkafoss, Tungufoss, Kirkjufoss, Faxafoss and Gjögurfoss. On a 20 km stretch from Eyjabakkar to Kleif in Fljotsdalur, there are 15 waterfalls more than 30 m high. There are also waterfalls in the river Keldua and other rivers in the Hraun area from which water will be diverted to the power plant. In the river Jokulsá in Dal there are no waterfalls but in some of its tributaries there are waterfalls such as Sauðárfoss in the river Sauðá and Kringilsárfoss (alias Töfrafoss) in the river Kringilsá.

The Kárahnjúkar Hydroelectric Plant will impact waterfalls in several ways. Some waterfalls will disappear, e.g. Sauðárfoss and Kringilsárfoss that will be submerged in the reservoir formed by the damming of Jokulsá in Dal. Other waterfalls that are not submerged will change due to control of discharge and storage of water in reservoirs. This applies to the majority of waterfalls in the rivers Jokulsá in Fljotsdal and Kelduá. Those waterfalls will have reduced water flow while the reservoirs are filling. After the filling of Halslon (before mid August in an average year), the operation of the power plant will be managed so that the discharge in the waterfalls in Jokulsá in Fljotsdal and Kelduá will resemble natural conditions.

Metric

Number of days specific waterfalls downstream of Halslon Reservoir are flowing with normal discharge, i.e. within the historic range (project effect: indirect).

Baseline

The rivers in the area affected by the Kárahnjúkar Hydroelectric Plant have been mapped and the waterfalls photographed and registered. Discharge in all rivers in the area of the Kárahnjúkar Hydroelectric Plant has been modelled on a daily basis in a hydrological runoff model over a 51 year period from 1950 – 2001.

Sustainability Indicator 31.1

Extent of Wilderness

Project effect: Indirect

Rationale for Selection as a Sustainability Indicator

The landscape and visual impact of the Kárahnjúkar power project was an issue discussed in the environmental impact assessment. This included the loss of wilderness in the highlands, an issue often cited in public discussion about the dam.

Finding an appropriate definition for wilderness is not simple because human settlement has impacted most parts of the highlands in some way. Roads, bridges, and trails provide access to the highlands for motor vehicles and those vehicles influence wilderness areas so they can not be viewed as untouched. Several tourist huts and farmers searching for sheep also impact the land. Finally, one could argue that none of the highlands can be categorized as wilderness because of the changes in vegetation and soil erosion caused by overgrazing.

The Kárahnjúkar EIA used a definition of Wilderness developed by a working group of the Ministry for the Environment, but this working group was created after a decision in the parliament on May 12th, 1997, about the protection of wilderness areas. The working group definition found its way into new laws on nature conservation that were passed in 1999. Wilderness is defined as:

> *An area of land, at least 25 km2 or large enough so that solitude and nature can be enjoyed without disturbance from human structures or traffic from motor vehicles driving on land. The area should be at least 5 km away from human structures or other technical signs such as transmission lines, power plants, reservoirs and roads. There should be no direct human influence and nature should be allowed to develop without pressure from human activities.*

Once the Kárahnjúkar power station will be operational, further loss of wilderness will mainly depend on changes in travel routes and tourism since no changes are foreseen on facilities related to the power plant.

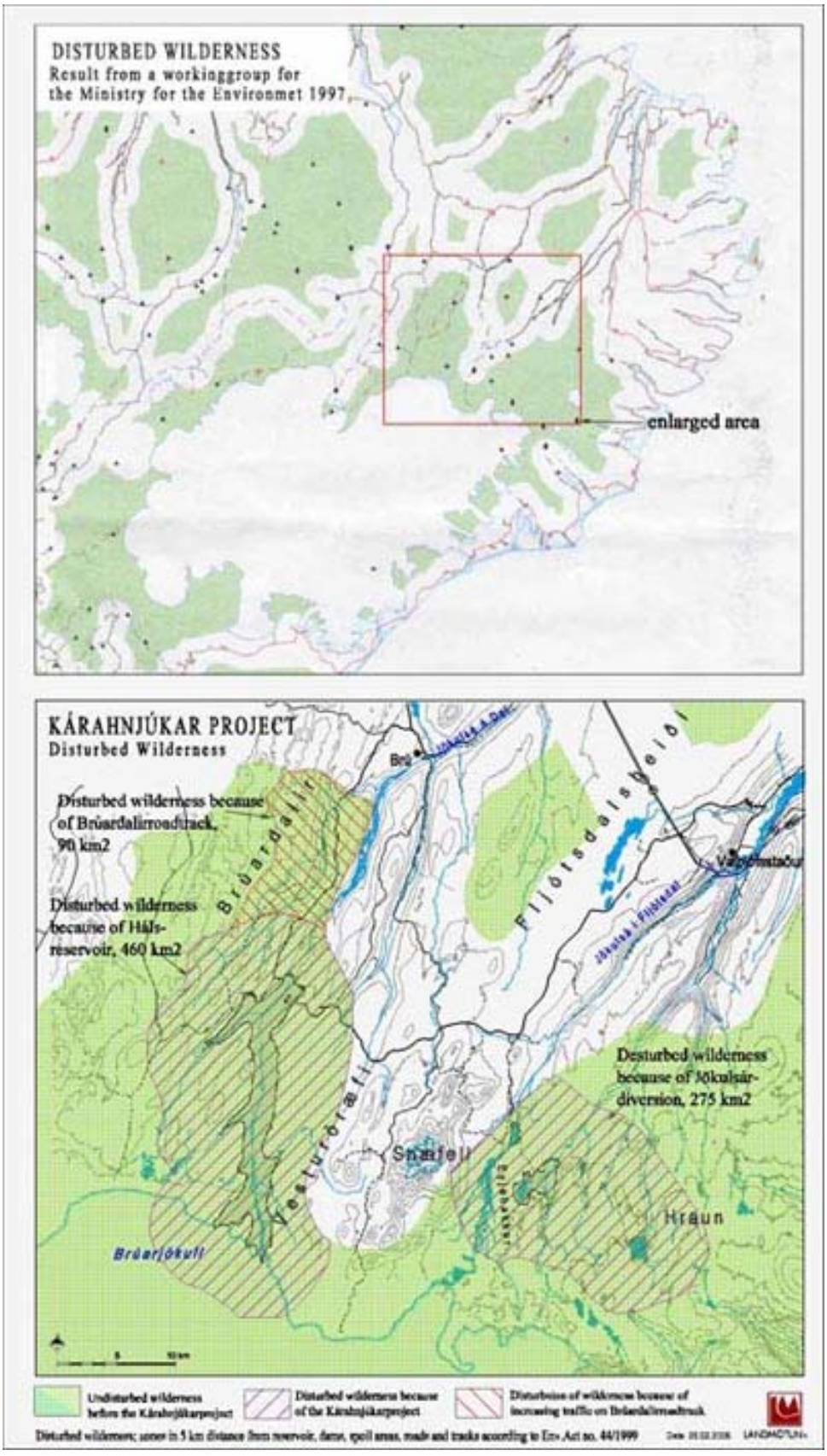
Metric

Loss of wilderness (km^2) according to the definition in Icelandic law for nature conservation.

Baseline

The map that follows this page (top picture) shows the results from a working group of the Ministry for the Environment about which areas close to Vatnajokull glacier should be defined as wilderness areas. The green areas represent wilderness areas. Travel routes and huts are located in the area north of the glacier and this decreases the area north of the glacier that is defined as wilderness. Obviously, some subjective estimation must take place to decide which travel routes can be accepted within wilderness areas and which can not. The route to Snaefells hut and to Sigurdar hut in Kverfjoll mountains are labeled as non-wilderness which leaves the mountain Snaefell and surrounding area outside defined as wilderness areas. According to this map, Vatnajokull glacier and surrounding wilderness areas are 14,500 km^2. The bottom picture shows loss of wilderness because of the Kárahnjúkar power station. Part of the loss is because of Halslon Reservoir, around 460 km^2, but the rest is because of the Jokula river diversion and facilities that will be built at Muli and Hraun, a total area of 275 km^2. Total loss of wilderness because of the power plant is 735 km^2.

Traffic on the Bruardal route has increased during the summers after construction work began and it became possible to drive a circle from Fljotsdalur and Jokuldalur, over the highlands and across a bridge to Karahnjukar. This road improvement and increased traffic adds an extra 90 km^2 to the total loss of wilderness in the area.



Sustainability Indicator 32.1

Greenhouse Gas Emissions

Project effect: Direct

Rationale for Selection as a Sustainability Indicator

Climate change is a global issue that calls for attention from governments, businesses, and civil society. Alcoa and Landsvirkjun are committed to limiting greenhouse gas (GHG) emissions from their operations. Aluminium production is energy intensive. The decision to use hydropower instead of energy from fossil fuels therefore greatly reduces GHG emission compared to what it would have been otherwise. Nevertheless, GHG emission (CO_2 and PFCs) is considerable from industrial processes that take place during aluminium production. GHG emission from the operation of the dam is minimal. However, some emission might take place due to leakage of SF_6 from substations in the transmission system.

Iceland's obligations under the Kyoto Protocol are to limit GHG emission to a 10% increase compared to 1990 emissions. However, the CO_2 emissions from industrial processes fall under a special decision (Decision 14/CP.7) and do not need to be included in total emissions. The Icelandic government does not put any formal restrictions on GHG emissions from aluminium production but cooperates with companies to encourage reduction on voluntary basis.

Metric

i. Total emissions of CO_2 and PFCs from smelter per ton of aluminium produced (CO_2 equivalents/metric ton of aluminium produced).

ii. Total SF_6 emissions from leakage from substations in the transmission system.

iii. CO_2 emissions calculated from the amount of gas and diesel fuel[2] used by Alcoa and Landsvirkjun and contractors for transport vehicles.

iv. Carbon sequestration (CO_2 equivalents/metric ton /yr) achieved by Alcoa and Landsvirkjun carbon sequestration projects in Iceland (accounting for vegetation loss caused by creation of Halson).

Baseline

i, ii, iv. Baseline data for these metrics will be collected when the projects become operational.

iii. The baseline project-related vehicular CO_2 emissions is zero.

[2] Gasoline – 3070 g/kg of fuel. Diesel – 3180 g/kg of fuel (Same emission factors as used in national GHG inventories)

Sustainability Indicator 33.1

Community Rating of Alcoa and Landsvirkjun Performance

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
It is important for Alcoa and Landvirkjun to be a good member of the East Iceland community in addition to a good steward of the environment. By accepting responsibility as a community steward, Alcoa can foster continued local support.

Metric
Survey of community attitudes – percent of survey respondents rating Alcoa performance on community relations, communications, and presence of the projects as good or better (Project effect: direct).

Baseline
Baseline data for this metric will be collected in 2007.

Sustainability Indicator 34.1

Compliance with Icelandic Standards and Legislation

Project effect: Direct

Rationale for Selection as a Sustainability Indicator
As a condition of EIA approval, Alcoa and Landsvirkjun agree to comply with and follow all Icelandic Standards and legislation associated with the construction, operation, and maintenance of their facilities.

Metric
Number of non-compliances per year (project effect: direct).

Baseline
Not applicable.

NEXT STEPS

Alcoa and Landsvirkjun are committed to ongoing communication and periodic meetings with stakeholders throughout the life of the projects. The companies anticipate ongoing dialogue regarding issues, indicators, and potential actions to address changes in indicators, as appropriate. Section 3.4 of this report lists the projected timeline and content of the future communications with stakeholders.

As indicated in Section 1.4, Alcoa and Landsvirkjun have completed Phase 2 of the Sustainability Process – the selection of the sustainability indicators and metrics. Next, Alcoa and Landsvirkjun will focus on planning for implementation and implementing the process (Phases 3 and 4 as described below).

3.1 Phase 3 of the Sustainability Process - Plan for Implementation

Planning for implementation involves the following steps:

- identify the roles for persons and/or entities responsible for implementation of the process;
- communicate with data providers on indicators with indirect and induced project effects;
- establish performance targets and monitoring protocols (including consultation with experts); and
- prepare an Implementation Plan to document the above steps.

The Implementation Plan is expected to be prepared by mid-2005. Alcoa and Landsvirkjun will host a meeting to present the Draft Implementation Plan to Advisory Group members and other interested stakeholders in fall 2005.

3.2 Phase 4 of the Sustainability Process - Implementation

The implementation phase of the initiative involves implementing the plan developed in Phase 3; reviewing and measuring the indicators; reporting and communicating monitoring results; and conducting any necessary actions relative to changes in indicator conditions. Alcoa and Landsvirkjun plan to begin this phase in 2005.

3.3 Ongoing Role of Advisory Group

The Advisory Group has fulfilled its role of identifying the indicators that will be used to help address Alcoa's and Landsvirkjun's performance at meeting sustainability objectives for the Kárahnjúkar and Fjardaál projects. The next phase of this initiative will be documented in an Implementation Plan. As previously stated, Alcoa and Landsvirkjun will host a meeting to present the Draft Implementation Plan to the Advisory Group and other interested stakeholders in fall 2005.

3.4 Summary of Future Communications

Alcoa and Landsvirkun will report on the progress of the initiative beginning in 2005. In 2005, the companies will provide at least quarterly email updates to interested stakeholders describing noteworthy issues, progress on construction of the projects, and progress on Phases 3 and 4 of this initiative.

In 2006, Alcoa and Landsvirkjun will publish the first annual report to reflect 2005 progress in the initiative, including:

- monitoring results for construction-related indicators;
- status of performance relative to the indicators;
- descriptions of any actions to address trends; and
- other noteworthy project-related issues.

This report will be available on the sustainability website http://www.sustainability.is.

From 2007 through the life of projects, Alcoa and Landsvirkjun will publish annual reports on the sustainability initiative, which will contain similar content to that described for the 2006 annual report except that operation-phase indicators will be measured and reported on as the projects become operational.

Alcoa and Landsvirkjun have corporate reporting requirements that are separate from this initiative. Accordingly, additional information about the projects may be presented in their annual corporate reports, which can be found on the companies' respective websites.

Throughout the life of the projects, Alcoa and Landsvirkjun will regularly update the sustainability initiative website http://www.sustainability.is with project-related news and reports.

4.0 CONCLUSIONS

This sustainability initiative supports Alcoa's and Landsvirkjun's long-term commitment to measure their performance against sustainability objectives defined for the Fjardaál and Kárahnjúkar projects. The objectives, indicators, and metrics developed in this initiative will assist both companies in their efforts toward integrating sustainability practices into construction and operation of the projects. The sustainability objectives outline Alcoa's and Landsvirkjun's vision for the projects and the indicators and metrics provide tools to measure progress against these objectives.

While this initiative focuses on the sustainability issues related to the projects in East Iceland, the importance of the initiative reaches beyond the Kárahnjúkar and Fjardaál projects. The sustainability initiative is a pilot project that may be used as a model for other sustainability initiatives that both companies will pursue in the future.

Alcoa and Landsvirkjun are grateful for the contributions of the Advisory Group members to this initiative and look forward to continued dialogue and coordination on project-related issues in the future.

APPENDIX A. BRIEF DESCRIPTION OF EAST ICELAND AND THE FJARDAÁL AND KÁRAHNJÚKAR PROJECTS

DESCRIPTION OF EAST ICELAND

The East Region and the Central East Region

The East Region is defined as the electoral district of East Iceland, extending from Langanes in the north to Skeiðarársandur in the south (Figure A-1). The Central East Region is defined as the region extending from Fljótsdalshérað in the north to Breiðdalur in south. It excludes four municipalities in the East Region: Bakkafjörður, Vopnafjörður, Djúpivogur and Hornafjörður (Figure A-1).[3]

There were 11,889 inhabitants in the East Region in December 2003. This is about 4.1% of the national population. There were 525, or 8.0% more men than women in the region.

On the same date, 8,959 people, or about 3.0% of Iceland´s population, lived in the Central East Region. There were 369, or nearly 8.0% more men than women in the region. The largest municipalities in the Central East Region are Fjarðabyggð (Eskifjörður, Reyðarfjörður and Norðfjörður) Egilsstaðir, Seyðisfjörður and Austurbyggð (Fáskrúðsfjörður and Stöðvarfjörður). About 1,139 people live in the adjacent villages of Breiðdalsvík, Vopnafjörður and Borgarfjörður eystri.

Health Service

The social protection system in Iceland is a residence-based system that includes:

- Health Insurance
- Maternity/Paternity Insurance and Benefits
- Occupational Injury Insurance and Occupational Diseases
- Invalidity Pensions and Allowances (benefits)
- Old-age Pensions, Death Grants and Child Pensions

Education

A fundamental principle of Icelandic education is that everyone should have equal opportunities to acquire an education, irrespective of sex, economic status, residential location, religion, possible handicaps, and cultural, social or ethnic background.

The Parliament (Althingi), and the Ministry of Education, Science and Culture (Menntamálaráduneytid), are legally and politically responsible for the education system and determine its basic objectives and administrative framework. The elementary school system has recently been decentralized and since 1996 local municipalities manage the schools. The municipalities are therefore responsible for providing access to pre-school and compulsory school facilities and also for all financial support of these facilities. However, the government is directly responsible for secondary and post-secondary education in Iceland. Three secondary schools are

(1) [3] This definition fits approximately to the geographical boundaries used in the report where local communities are the ones that are part of Central East Iceland.

located in East Iceland, thereoff one in Egilsstaðir and one in Fjarðarbyggð (Neskaupsstaður). East Iceland has no college or university. In the past it was necessary to go to Reykjavík, Akureyri or abroad to get university educatin but in recent years new opportunities have emerged with distance education.

Figure A-1. Map of Central East Iceland

Employment

The East Region has a limited range of employment opportunities that offer lower wages than the Capital Region. Seasonal jobs in fish processing, tourism, construction, and slaughtering are available. Many young people, especially young women, consider these jobs unattractive and are therefore moving in large numbers to the Capital Region, attracted by the opportunities it presents for study and work.

Recreation and Culture

Recreational facilities such as community halls, sport halls, swimming pools and sport fields, are found in most communities. Outdoor recreational opportunities in the region include skiing, hiking, angling, hunting, horse riding, berry picking, and golfing, among others.

The local culture is strong and resilient with many active amateur cultural groups including theatre groups, choirs, bands, and various clubs. Professional artist and groups visit the region to perform, with Egilsstaðir hosting an annual international jazz festival. The Lutheran state church is active in the region with eight or nine clergymen, each serving one to three churches.

Travel and Transportation

The Public Roads Administration has a regional branch in Reyðarfjörður that is responsible for all road construction and maintenance in the entire East Region. Egilsstaðir airport is served by several flights a day from Reykjavík. This is an international airport, acting as back up for the airport in Keflavik. There are also small airfields in Neskaupsstaður, Fáskrúðsfjörður, Breiðdalsvík and Borgarfjörður, used mainly in the case of emergency. Two bus companies are located in Fjarðabyggð that offer transportation between Norðfjörður and Reyðarfjörður on regular basis and carry passangers to the airport from Fjarðabyggð, Breiðdalsvík, and Austurbyggð.

Taxes

The taxation system in Iceland is the PAYE system – Pay-As-You-Earn. Taxes are deducted from all taxable incomes and consist of income taxes and municipal taxes. Any individual staying in Iceland for six months or longer is considered a resident.

Land Use and Resources

The fishing grounds off the east coast of Iceland form the basis of a strong fishing industry in the region. Fishing for capelin and herring is especially good off the east coast, while fishing for blue whiting is common in deeper waters. Cod and other demersal species also are plentiful. Some of the fjords offer suitable conditions for fish farming and there are plans to start salmon farming there.

Farming practices in the east region include sheep, dairy and beef cattle, and organic vegetables. Forestry has become widespread in Fljótsdalshérað. The highlands are valuable for tourism and are used for hiking and hunting of reindeer, geese and ptarmigan. In lowland areas, fishing for trout and salmon is popular.

Public Safety

All municipalities operate fire services. Only the largest municipalities (i.e. Egilsstadir and Fjardabyggð) have professional firechiefs. The firemen are either volunteers or they receive a small remuneration. The cost of operating the fire services is paid by the municipal funds.

The regional health authority is responsible for ambulance services in the region. The chief of police, which are located in Seyðisfjörður and Eskifjörður, are responsible for police services in the area as well as civil defence, customs, and some emergency services. Voluntary search and rescue associations are in most communities in the region.

DESCRIPTION OF THE FJARDAÁL AND KÁRAHNJÚKAR PROJECTS

In 2002, the Government of Iceland, Landsvirkjun, and Alcoa executed a Memorandum of Understanding (MOU) regarding the development of an aluminum reduction plant in East Iceland. On 15 March 2003, the Government of Iceland, Landsvirkjun, Alcoa, and the Municipality of Fjardabyggd signed the final agreement for Landsvirkjun to build the Kárahnjúkar hydroelectric station and the Fljotsdalur transmission lines to bring power to the smelter. Under the agreement, the projects consist of three major components:

- The Fjardaál Aluminum Smelter,
- The Kárahnjúkar Hydropower Project, and
- The Fljotsdalur Transmission Lines.

Fjardaál Aluminum Smelter

Alcoa is building a 322,000 metric tons per year aluminum smelter at an industrial site approximately 4 kilometers outside of the town of Reydarfjordur. Planning and design of the plant began in 2003, construction began in 2005, and the plant should be operational by 2007. The Fjardabyggd municipality will build a port at the site for public use and for Alcoa to import raw materials and export aluminum products and other materials.

The Alcoa Fjardaál smelter site in Reydarfjordur

Karahnjúkar Hydropower Project

Landsvirkjun is developing the Kárahnjúkar Hydropower Project by harnessing the glacial rivers Jokulsá a Dal and Jokulsá í Fljotsdal. These rivers originate in the Vatnjokull ice cap and flow into Heradsfloi Bay. The hydropower project will have an installed capacity of 690 megawatts (MW) and an annual generating capacity of about 4,600 gigawatt-hours (GWh).

The hydropower project involves the construction of three dams to impound the river Jokulsá a Dal and the creation of the 57 km^2 water storage reservoir Halslon. From the Halslon reservoir, water is conveyed through an underground tunnel and pipes to the powerhouse, and then into the river Jokulsá i Fljotsdal.

Preparatory work began in 2002 and water will begin filling the reservoir in 2006. The project will begin generating power in 2007 and all construction is scheduled to be completed by 2009.

Figure A-2. Graphic Representation of Kárahnjúkar Hydropower Project

Fljotsdalur Transmission Lines

The electricity generated by the Kárahnjúkar hydropower plant will be carried 50 km to the Alcoa aluminium smelter adjacent to the port of Reyðarfjörður by two sets of 220 kV transmission lines known as Flótsdalslínur 3 & 4. Running alongside each other for most of their route, they will pass through three of East Iceland's principal municipalities - Fljótsdalshreppur, Fljótsdalsherad, and Fjardabyggð.

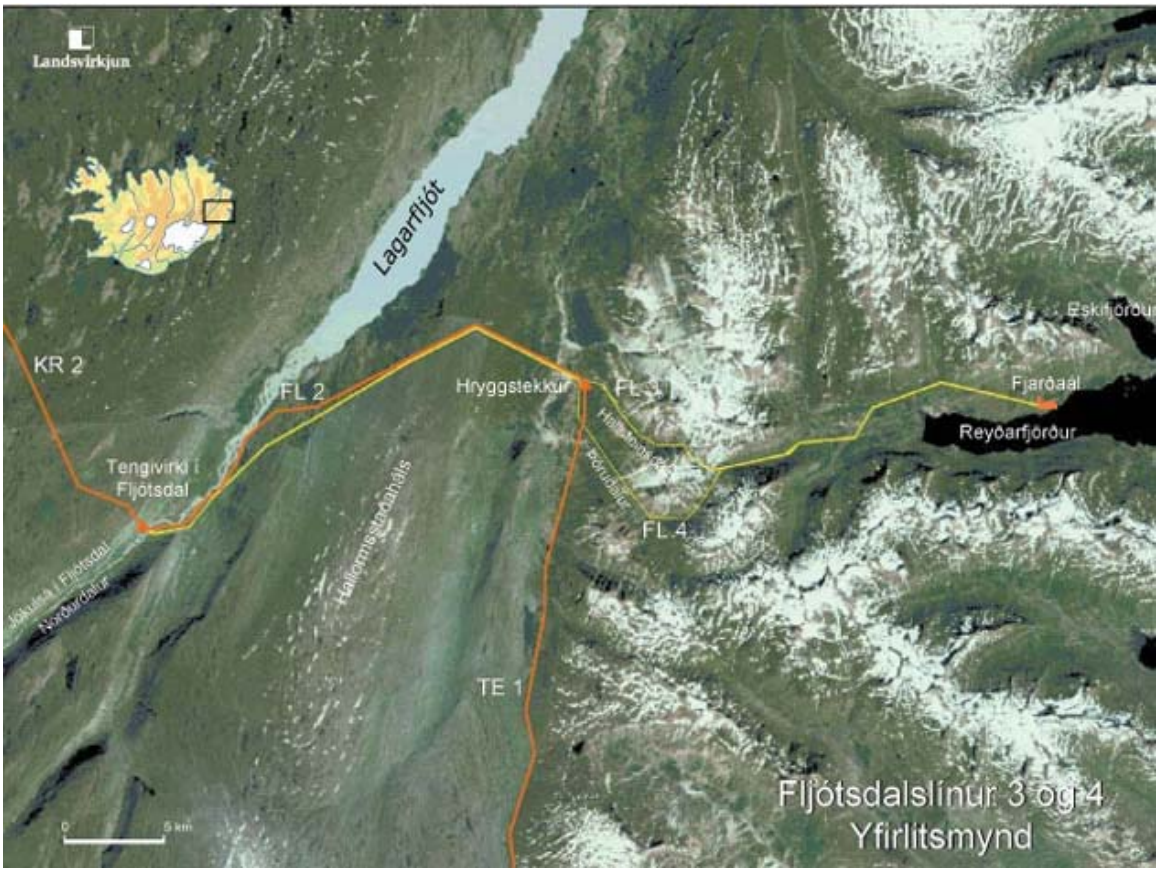


Figure A-3. Graphic Representation of Fljotsdalur Transmission Lines

APPENDIX B. SUMMARY OF ADVISORY GROUP ACTIVITY

The Advisory Group was established in summer 2004. Table B-1 contains the Advisory Group members and their affiliations. The group has met three times on 8-9 June 2004, 31 August-1 September 2004, and 18 January 2005. The first meeting focused on introducing the sustainability initiative, defining the role of the Advisory Group in the initiative, and compiling a list of issues associated with the Fjarðaál and Kárahnjúkar projects. The second meeting focused on review and discussion of the issues presented at the first meeting and review of the preliminary indicators associated with those issues. The third meeting focused on finalization of the indicators and metrics and discussion of the next steps in the initiative. In addition to these meetings, Advisory Group members have expended considerable effort to provide comments on the initiative, draft indicators and metrics, and earlier versions of this report.

Table B-1. Name and Affiliation of Advisory Group Members and Consultants

Name	Institute, Association or Company
Group Members	
Andrés Svanbjörnsson	Ministry of Industry and Commerce
Anita Roper	Alcoa
Anna Heida Pálsdóttir	Alcoa Fjardaál
Arngrímur Vidar Ásgeirsson	East-Iceland Youth and Sports Association
Assheton Stewart Carter	Conservation International/Center for Environmental Leadership in Business
Audur Anna Ingólfsdóttir	The Icelandic Travel Industry Association
Björgólfur Thorsteinsson	Landvernd
Craig Bridge	Bechtel
Davíd Baldursson	Church in Eskifjördur and Reyðarfjördur
Einar Rafn Haraldsson	East-Iceland Health Center.
Eiríkur Björn Björgvinsson	Austur-Hérad Municipality
Grétar Thór Eythórsson	University of Akureyri
Gudmundur A. Gudmundsson	Icelandic Institute of Natural History
Gunnthórunn Ingólfsdóttir	Fljótsdalshreppur Municipality
Halla Eiríksdóttir	NAUST (East-Iceland Nature Conservation Association)
Hildur B. Hrólfsdóttir	Landsvirkjun (National Power Company)
Hrönn Pétursdóttir	Alcoa Fjardaál
Hugi Ólafsson	Ministry for the Environment
Inger L. Jónsdóttir	Sheriff's Office in Fjardabyggð
Jón Ingi Kristjánsson	AFL (Union Association)
Kristín Ágústsdóttir	East-Iceland Nature Institute
Lára G. Oddsdóttir	Church in Power Project District
Lárus Bollason	Mininstry of Social Affairs
Ódinn Gunnar Ódinsson	Austur-Hérad Municipality (Egilsstaðir)
Patrick Grover	Alcoa
Pálína Gudmundsdóttir	Verkmenntaskóli / East-Iceland Trade School (VA)
Jon Thor Sturluson	University of Iceland, Reykjavik
Pétur Ingólfsson	Landsvirkjun (National Power Company)
Ragnheidur Ólafsdóttir	Landsvirkjun (National Power Company)
Róbert Ragnarsson	Mininstry of Social Affairs

Signý Ormarsdóttir	East-Iceland Cultural Association
Sigurdur Ólafsson	East-Iceland Education Network
Sigurdur St. Arnalds	Landsvirkjun (National Power Company)
Sigurdur Rúnar Ragnarsson	Church in Neskaupsstadur
Smári Geirsson	Fjardabyggð Municipallity
Soffía Lárusdóttir	Austur-Hérad Municipality
Stefán Stefánsson	East Iceland Development Center
Tómas Már Sigurdsson	Alcoa Fjardaál
Thorvaldur Jóhannsson	SSA
Vigfús Ingvar Ingvarsson	Church in Austur-Hérad
Consultants	
Árni Geirsson	ALTA
Hildur Kristjánsdóttir	ALTA
Sigurborg Kr. Hannesdóttir	ALTA
David Blaha	ERM
Alistair Fulton	ERM
Julia Tims	ERM
Jonathan Samuel	ERM
Audur H. Ingólfsdóttir	Environice

Expert Consultations

In addition to the consultants working directly on the initiative (as listed above), Alcoa and Landsvirkjun consulted additional experts at various institutions throughout the first two phases of this initiative. These institutions are listed below. Their role has been to provide advice and information specific to the indicators, metrics, and baseline data. Accordingly, these institutions are not responsible for the presentation of the information provided in this report. This listing is provided to document the consultation process and does not imply that these institutions support the Kárahnjúkar and Fjardaál projects or believe the projects are sustainable.

Icelandic Institute of Natural History
University of Iceland
University of Akureyri
World Wildlife Fund
Iceland Statistics
National Energy Authority
Public Roads Authority
Surgeon General
Marine Research Institute
Soil Conservation Service
East Iceland Environmental Research
VST Engineering
East Iceland Health Care Institute

Issues Raised at the 1st and 2nd Advisory Group Meetings and Process for Moving from Issues to Indicators

Advisory Group members presented and discussed issues associated with the projects at the first and second Advisory Group meetings. All issues were evaluated to determine their relevance to the projects and their applicability to sustainable development (e.g., are they pertinent to a sustainability issue or objective and will they change or show trend over time). Issues that were not relevant to the projects or that addressed one-time project effects rather than long-term sustainability issues were omitted from further consideration. Four issues that were identified by the Advisory Group were omitted. Table B-2 presents these issues and their rationale for omission.

Table B-2. Issues Omitted from Consideration as Indicators

Issue	Rationale for Omission
Project effects on geologic formations	One-time project effect – will not change over time.
Aesthetic effects of transmission lines	One-time project effect – will not change over time.
Light pollution	Advisory Group determined that this is not a significant issue. Lack of trend - will not change over time.
Amount of protected areas	Lack of project effect.

Those issues that were considered relevant to the projects and that could be applied to sustainability objectives were used to develop indicators. These issues are presented in Table B 3.

Table B-3. Issues Identified at First and Second Advisory Group Meetings:

Issues
Changes in wildlife habitat
Change in ecosystem – loss of vegetation
Effect of tourism on vegetation and wildlife
Changes in freshwater ecosystems
Changes in ecological condition of Heradsfloi Bay – marine ecosystem condition
Movement of Heradsfloi shoreline and change in delta
Dust from Halslon and Jokulsá a Dal
Erosion of river bank at Jokulsá a Flotsdal
Sediment deposition in Halslon reservoir
Effect of change in frequency and magnitude of floods and flows on sediment deposition in Jokulsá a Dal
Reclamation of mines and spoil areas
Air emissions
Greenhouse gas emissions
Traffic-related CO2 emissions during construction and operation
Human health – uptake of fluoride (F) by human food sources
Contaminants in aquatic fauna at smelter outfall
Groundwater and surface water quality at smelter
Oil or chemical spills
Quantity and treatment of solid waste from construction and operation
Future loss of wilderness
Changes in demographics in local community
Equality in workforce
Satisfaction with workplace
Number of accidents and health of employees and subcontractors of Alcoa/Landsvirkjun
Noise effects of smelter
Social well being and safety (crime rate, drug use, physical and mental well being)
Active participation in community (social capital) and availability of cultual opportunities in local area
Commute distance to and from work
Enhance levels of education and training
Investment in/provision of community infrastructure needs to keep pace with development and increase in population
Community infrastructure - Increase community services related to mental health, police, schools, spiritual, recreation
Spending on municipal services
Preserve / enhance economic diversity in local and marginal communities
Financial welfare of tourism companies
Financial welfare of local area (cost of living, household debt)
Financial welfare of families
Change in tourism/business travel
Supply Chain Effects: contribution of Alcoa/Landsvirkjun to local economy through procurement of goods and services from local and National companies
Financial welfare of municipalities
Community relations between Alcoa/Landsvirkjun and local community
Improved transportation in the fjords and region
Transportation – create easy access to work and education
Loss of waterfalls
Traffic along Karanhnjukar Road

Some snapshots from the Advisory Group's meetings

APPENDIX C. GLOSSARY OF TERMS

Advisory Group – A group of people representing various stakeholders that have agreed to participate in the sustainability initiative.

Baseline information – Information used as the basis for evaluating the companies' future performance. Baseline information often provides a snapshot in time or a position of an indicator that is recorded prior to project influence. Although the position may change over time, the baseline remains unchanged and available as a reference.

Indicator – A variable considered individually or collectively with other indicators to reflect whether the projects are performing in accordance with defined sustainability objectives.

Management Team – Employees of Alcoa and Landsvirkjun and their consultants that are working on the initiative.

Metrics –Measurements used to document changes in indicators.

Projects – The three projects under review in the sustainability initiative, i.e. the Kárahnjúkar dam, the Fjardaál smelter, and the transmission lines.

Sustainability Initiative – The work of Alcoa and Landsvirkjun to identify issues and develop indicators to help monitor the performance of the projects at meeting sustainability objectives.

Sustainability objectives – Objectives that Alcoa and Landsvirkjun have adopted for this purposes of this initiative. These objectives are based on internationally accepted principles about sustainable development and lay the foundation for the sustainability initiative.

Sustainability process – A process to develop indicators, establish performance targets, measure performance, and communicate outcomes within the context of the sustainability initiative.

Targets – Specific goals that will be set for each indicator in Phase 3 of this initiative. Targets can be quantitative goals or trends and typically include timelines for meeting the targets.