

Chapter 5 – Regional development *in strategic environmental assessment report*

(SEA 2007 report – US)

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Chapter 5 Regional development and migration

Note: This chapter is widely based on a report made by Niras for Greenland Development. The work was for practical reasons based on a preliminary version of Niras' report. In Niras' final report a number of figures etc. have been adjusted. It has not been possible to manage to work Niras' final report into this chapter. However, this will happen before the SEA report is finished in January 2008. Niras' report is available at www.aluminium.gl.

1.0 Summary

1.1 Introduction

This chapter of the strategic environmental assessment report addresses the regional economic and socioeconomic consequences of placing an aluminium smelter near Nuuk, Maniitsoq or Sisimiut. This section will therefore describe the impact on Greenland in terms of migration of labour to and from the town chosen for the aluminium smelter, and it will evaluate how the choice of location will affect regional development in Greenland in relation to patterns of settlement and regional development factors.

The chapter mainly describes the consequences for each of the three towns in which the aluminium smelter can be located – Nuuk, Maniitsoq and Sisimiut. Thus, no focus is placed on hydroelectric power stations. As the description focuses on the long-term regional economic and socioeconomic consequences, the focus of the assessment is on the operating phase of the aluminium smelting plant (and the hydroelectric power stations), i.e. from 2015. In the short term, the construction phase of hydroelectric power stations, the aluminium smelter and infrastructure will, of course, significantly enhance the regional economic and socioeconomic development trend that is expected to arise as a result of the location of the smelter.

National planning and regional development strategies are key to the future development – both economically and socio economically. The construction of a large-scale plant – for example, an aluminium smelter – therefore plays a role, too, and should be part of such a debate.

A number of investigations are in progress of economic conditions, investments etc. that will form part of the foundation for a decision for the Home Rule Government. These investigations will together with the strategic environmental assessment report form the entire foundation for a decision for the decision of

the Home Rule Government and the Parliament on, among other things, the siting of the smelter at the spring Parliament meeting in 2008.

1.2 Data basis

The chapter is based partly on a report commissioned by Greenland Development A/S and prepared by Niras Greenland A/S with the title "Økonomiske konsekvenser af etablering af aluminiumsindustri i Grønland" (Niras 2007). The subject of this chapter is only to some extent dealt with by the report. This chapter is therefore also based on interviews with Icelandic researchers from the University of Akureyri, who conducted the socioeconomic analyses in connection with the construction of Alcoa's aluminium smelter in Iceland. Because of the division of work between Greenland Development and the SEA working group in connection with the collection of background data, the SEA working group did not have sufficient time to incorporate additional background data. For that reason alone it is necessary to obtain additional information before a political decision is taken on the location of a smelter.

It is very difficult to predict people's behaviour in relation to migration because the number of factors that affect human behaviour is extremely large. However, researchers have, of course, an idea of what is significant, and in the present strategic process it is important to point out the significant parameters of which we do not have adequate knowledge:

- We do not know how much the coming migration will affect the social networks and what impact it will have on the economy.
- We know that social and family ties are very important in small communities like those in Greenland, but we do not know fully the extent to which it will affect the coming patterns of migration.
- We assume that community size is inversely proportional to the level of vulnerability to changes in social and family ties. But we do not know for sure whether this applies to Greenland.
- We do not know the towns that will experience migration. Thus we do not know whether it is the small or large towns that will see people move.
- We do not know what factors affect the ability to adapt in the Greenlandic society generally and among individuals specifically.
- We do not know the extent to which the inadequate infrastructure and the long distances between towns in Greenland will affect labour mobility/willingness, including inertia in relation to migration to new jobs.

It will not be possible before the decision at the spring Parliament meeting to get a full general view of all these conditions and as for some of the points it will not

be possible to get a clear picture at all, because not everything can be – and should not be able to be – predicted in an open and democratic society.

However, the questions mentioned are under all circumstances important to include in the considerations in progress. At present several reviews are in progress and they are expected to be ready prior to the decision at the spring Parliament meeting, just as through 2008 closer investigations on the mobility issue will be carried out so that they can take part in shedding new light on some of the mentioned areas and moreover in relation to industrial growth in other sectors.

As mentioned, there are many more factors that may affect the migration behaviour of the Greenlandic population and the list above is therefore far from exhaustive. Experience from Iceland shows that inertia is created in the migration because "people await the situation". Housing conditions including price and waiting lists etc. may also have a decisive effect on migration behaviour.

Migration is here used as an example of an area we do not know much about at present. However, there are other areas of which we do not have the knowledge required to take such a far-reaching decision on a well-informed basis.

The assessment of available regional growth models in a Greenlandic context is one of these other areas in which the data basis is inadequate. In this connection there are especially two scenarios that are interesting and should be clarified in both the medium and the long term:

1. What are the economic consequences for Greenland of focusing on several growth centres, for example, the four so called growth towns (Qaqortoq, Nuuk, Sisimiut and Ilulissat), which can compete with each other and hence sharpen regional competitiveness and create economic dynamics?
2. What are the economic consequences for Greenland of focusing on one strong regional growth centre in Nuuk in Greenland, which can enhance Greenland's importance in the North West Atlantic region where Greenland will be competing with, for example, Nunavut, Labrador, Iceland, the Faroe Islands and Scotland?

Strategies for regional development assume many forms in Europe. Finland, for example, has a clear goal of spreading economic growth over many growth

centres¹. At the EU level, the aim of the ESDP (European Spatial Development Perspective) is to develop a deliberate polycentric growth strategy in European cities to ensure that economic growth is developed in more cities than just London and Paris², for example.

In a Greenlandic context, however, there are large gaps in the detailed knowledge of, for example, the level of vulnerability of small communities to the 'brain drain', i.e. the migration of skilled persons and persons with a further or higher education.

This lack of knowledge outlined by this section illustrates firstly that there are many potential environmental targets that need to be set in an environmental assessment of an aluminium smelter in terms of migration and regional economic development. This strategic environmental assessment is mainly confined to areas addressed in the Niras report and is therefore far from adequate in an overall impact assessment of the location of an aluminium smelter in Greenland. In this chapter, therefore, only very simple, hypothetical environmental targets are set.

1.3 Conclusion

At the present moment the strategic environmental assessment cannot provide any very detailed assessments of the regional economic and socioeconomic consequences of constructing an aluminium smelter in one of the three towns. However, the conclusions on economic effects and migration pressure as illustrated by the matrix can be drawn.

Environmental targets	Location in:	Nuuk	Maniitsoq	Sisimiut
		<u>Assessment</u>	<u>Assessment</u>	<u>Assessment</u>
1. Economic activity in Greenland should, as far as possible, be spread geographically in an aim to achieve regional equality and balance		Large negative	Large positive	Positive
2. Economic activity in Greenland should, as far as possible, be concentrated in a strong growth centre in Nuuk		Large positive	Small negative	Small negative

Table 5- 1: Assessment by town

¹ The Ministry of the Interior in Finland describes the regional development strategies here: <http://www.intermin.fi/intermin/home.nsf/pages/521E4C0E6BB6D91CC2256FB9006F420C?OpenDocument>

² The report: ESDP - European Spatial Development Perspective - Towards Balanced and Sustainable Development of the Territory of the European Union, can be found here: http://ec.Europe.eu/regional_policy/sources/docoffic/official/reports/pdf/sum_en.pdf

As mentioned this table is based on Niras' report. Unfortunately it is not possible at the present time in the light of existing figures and material to elaborate this table. To the extent that material can be found to elaborate the table attempts will be made to work it into the SEA 2008 report. Failing that it will as a minimum be clarified which further investigations can be pointed at for a more satisfactory and more pointing forward pinpointing of the problems.

Based on the available knowledge and the two environmental targets it is obvious that if you prefer environmental target 1, the aluminium smelter should not be located in Nuuk because the need for labour is largest in the rest of Greenland, and so is the migration need. Massive mitigation measures can be partially implemented, e.g. intermunicipal economic equalisation systems. However, this cannot neutralise the massive migration pressure that will be put on the rest of Greenland. If, on the other hand, you prefer environmental target 2, the location in Nuuk is clearly preferable. However, it is also evident that Nuuk will continue its very favourable economic development whether or not the smelter is located in Nuuk. Hence, economic activity will continue to be very heavily concentrated in Nuuk even if the aluminium smelter is located in one of the two other towns.

The simple matrix and only two and very simple environmental targets set out above illustrate that there are many very significant matters that we know nothing about and which should be clarified politically before a decision on the location of an aluminium smelter is taken. A matter of particular importance is the creation of a debate on national planning and regional development to establish how Greenlandic towns and settlements are to develop in relation to each other in future. A decision on the location of an aluminium smelter is in reality a choice of a regional, irreversible and path-dependent³ development strategy although there is no real national development strategy for the Greenlandic regions.

It is of decisive importance to clarify politically the regional development that is desired to take place in the next century because the location of an aluminium smelter will have a great impact on the regional development and define the potentials and limitations of the future regional policy.

³ Path dependence in connection with regional development is to be regarded as a regional development path which cannot be changed without great effort.

In addition to the above considerations of regional conditions, there are other significant economic conditions that are important to the project:

”On the available basis it is not possible to assess on economic criteria alone what location of the smelter is best for Greenland. Furthermore, the various possible locations of the smelter are likely to represent important differences in the need for public investment in infrastructure. This factor must also be included in the overall considerations. In the considerations of the location of the smelter it is also very important to evaluate the amount of investment required to connect the smelter to the neighbouring town since this connection is necessary for daily commuting purposes. This applies even more so as there may be significant differences between the related expenditure amounts. In this connection, consideration should also be given to any additional perspectives associated with the individual locations in relation to urban development, transport pattern etc.” (Niras 2007).

Under the auspices of Greenland Development several of these perspectives have already been subjected to closer elucidation. These new elucidations are expected to be ready in the beginning of 2008 and will thus be able to enter into the draft for decision at the spring Parliament meeting in 2008.

1.4 Recommendations

In the light of the ascertained lack of relevant professional knowledge it is recommended that prior to the political decision of siting of an aluminum smelter, more information on regional development is obtained.

The recommendation is among other things motivated on the fact that the coming political decision on siting of the smelter defines a course for the future development of society, which is irreversible in relation to regional development policy and spatial planning in Greenland.

As stated a number of amplifying investigations are already at present in progress. These will to the utmost extent possible be finished in order that they can enter into the foundation for a decision of siting of an aluminum smelter.

It is recommended that societal analyses are concentrated on so that a number of the areas where present knowledge is insufficient can be illuminated and this knowledge can enter into the further considerations on starting the aluminum smelter project. For example an analysis of the backgrounds for concrete

migration patterns would be of great help. Bids on potential areas for investigation are given in the section on data basis.

Under the auspices of SEA a seminar has been planned to take place in the last half part of January 2008 with a view to obtaining further relevant professional knowledge on the area. This seminar will consist of presentations from researchers and planners from among others Canada, Iceland and Sweden. The seminar will focus on topics such as growthcenters, specialised or diversified regional economies, ability to readjust in society and population etc.

When the results from the ongoing and planned investigations and seminars are available it will be necessary to consider whether it may be necessary with further professional illumination of particular issues. If so it will be recommended to carry them out during 2008.

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National planning and regional development strategies are key to the future development – both economically and socioeconomically. The construction of a large-scale plant – for example, an aluminium smelter – therefore plays a role, too, and should be part of such a debate.

A number of investigations are in progress of economic conditions, investments etc. that will form part of the foundation for a decision for the Home Rule Government. These investigations will together with the strategic environmental assessment report form the entire foundation for a decision for the decision of the Home Rule Government and the Parliament on, among other things, the siting of the smelter at the spring Parliament meeting in 2008.

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3. What are the economic consequences for Greenland of focusing on several growth centres, for example, the four so-called growth towns (Qaqortoq, Nuuk, Sisimiut and Ilulissat), which can compete with each other and hence sharpen regional competitiveness and create economic dynamics?
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will be competing with, for example, Nunavut, Labrador, Iceland, the Faroe Islands and Scotland?

Strategies for regional development assume many forms in Europe. Finland, for example, has a clear goal of spreading economic growth over many growth centres⁴. At the EU level, the aim of the ESDP (European Spatial Development Perspective) is to develop a deliberate polycentric growth strategy in European cities to ensure that economic growth is developed in more cities than just London and Paris⁵, for example.

In a Greenlandic context, however, there are large gaps in the detailed knowledge of, for example, the level of vulnerability of small communities to the 'brain drain', i.e. the migration of skilled persons and persons with a further or higher education.

This lack of knowledge outlined by this section illustrates firstly that there are many potential environmental targets that need to be set in an environmental assessment of an aluminium smelter in terms of migration and regional economic development. This strategic environmental assessment is mainly confined to areas addressed in the Niras report and is therefore far from adequate in an overall impact assessment of the location of an aluminium smelter in Greenland. In this chapter, therefore, only very simple, hypothetical environmental targets are set.

4.0 Environmental targets and materiality

Despite the fact that the location of the aluminium smelter has far-reaching regional economic and socioeconomic consequences, it is difficult in the strategic environmental assessment to set clear environmental targets in relation to these specific consequences. This is mainly due to the fact that Greenland does not have a politically clearly formulated regional development strategy in a national perspective. In other words, there is no national planning for the geographical localisation of economic activity. The reason for this is that no clear political position has been taken on how, at the overall level, the Greenland Parliament wants the economy and population of the Greenlandic

⁴ The Ministry of the Interior in Finland describes the regional development strategies here: <http://www.intermin.fi/intermin/home.nsf/pages/521E4C0E6BB6D91CC2256FB9006F420C?OpenDocument>

⁵ The report: ESDP - European Spatial Development Perspective - Towards Balanced and Sustainable Development of the Territory of the European Union, can be found here: http://ec.Europe.eu/regional_policy/sources/docoffic/official/reports/pdf/sum_en.pdf

municipalities to develop in interaction with each other and how the regional economic strengths should be balanced. To be able to set clear and concrete environmental targets in the strategic environmental assessment political clarification is needed first. As, however, as already stated, this political position on the issue has not been taken, it is difficult to set clear environmental targets in this area. Furthermore, an enormous number of other essential environmental targets can be set. However, the data basis of this assessment is very small and the environmental targets are therefore limited. By way of example, the section on data basis points out that we have no knowledge about the importance of social and family ties to the cohesion and/or mobility of towns, for example. Knowledge in this area will make it possible to set additional environmental targets in an assessment of the regional economic and socioeconomic consequences of constructing an industry of this size in Greenland.

However, in an effort nevertheless to shed light on the regional economic consequences the analysis in this chapter is based on a number of socioeconomic factors, which can help describe the consequences of a location close to one of the three towns. In the absence of a clear political basis, two hypothetical environmental targets are used, which in any event will be included as key issues in a political consideration of the issue of national planning and regional development strategies in Greenland. Overall, it may be formulated as a question of geographical localisation of economic activity in a national planning perspective.

The two hypotheses presented here are directly opposed to each other. This shows in no uncertain manner that it is difficult to set clear environmental targets in the area if no political position has been taken on the subject and that this all-decisive political theme should be considered before the decision is taken on the location of a large-scale industry with such dramatic consequences for the regional patterns of development and the balance among the regional economies.

Therefore it is recommended that this theme be given high political priority and that more information is obtained to illuminate this topic and give an illuminated foundation for a decision on environmental goals in the area of regional politics before you politically stick to **an** environmental goal.

The two hypothetical environmental targets set here for use in the strategic environmental assessment of regional economic and socioeconomic consequences for the location of an aluminium smelter are:

1. Economic activity in Greenland should, as far as possible, be spread geographically in an aim to achieve regional equality and balance. This will be in pursuance of a regional development strategy that may be called "polycentric"
2. Economic activity in Greenland should, as far as possible, be concentrated in a strong growth centre in Nuuk. This will be in pursuance of a regional development strategy that may be called 'monocentric'.

The level of materiality is believed to be **very high** for both environmental targets.

5.0 Settlement and migration as indicators

In the Niras analysis of the consequences for the three towns an assessment of the migration generated by a given location of the aluminium smelter is used. The necessary migration is calculated theoretically based on the extent of derived employment that is expected to be generated in the town in which the smelter is located. The number of employees for direct employment is the same no matter where the smelter is located, but the amount of derived employment is theoretically set differently for the three towns.

In its report Niras draws attention to the fact that the theoretical basis required to make such calculations does not exist for Greenland. The various expectations for derived employment are therefore based on an estimate (Niras 2007,[Box 2]).

Niras assumes that Nuuk will have the largest amount of derived employment and the largest geographical concentration of derived employment. Niras also assumes that Maniitsoq and Sisimiut will have a smaller and nearly identical amount of derived employment and a geographically larger spread of derived employment. Based on these assumptions, a picture is constructed of the expected changes in the pattern of settlement for each of the three towns.

In its report, Niras actually sets five factors, which may affect the size of the derived employment impact. In its analyses, however, Niras only uses one of these factors, namely town size. A factor that Niras mentions but which is not included in the analysis is the location of the smelter in relation to a town and thus the distance from home to work. In Iceland, 45 minutes is the maximum travel time to work before the employment multiplier (and thus derived employment) falls. This factor is not analysed in the Niras report but it is to a minor extent included in the overall conclusion.

In the following, therefore, it is only the analyses relating to town size that will be discussed whereas the issue of location close to a town will only be included in the conclusion.

No matter where the aluminium smelter is located, it is the same type of labour that is needed even though the migration need for labour is different for the three towns.

The different needs for labour in the three towns are described separately in the sections on each town. A chart of the need for persons to migrate from other places in Greenland can be seen in Table 2.

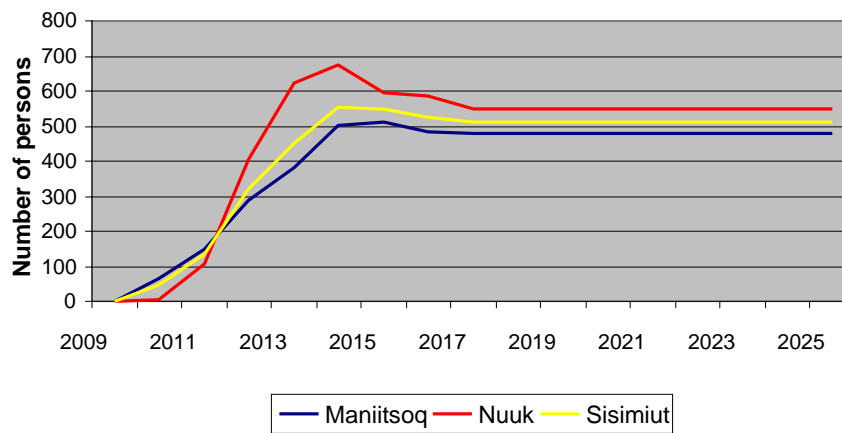


Table 2: Necessary influx of native labour from the rest of Greenland depending on whether the smelter town is Maniitsoq, Nuuk or Sisimiut (Niras 2007).

The description in the Niras report of the need for labour is divided into two main types. The direct need and the derived need:

”Aluminium production will not only generate enhanced employment and value creation etc. in society as a direct consequence of the activity itself. Production will have a knock-on or derived effect in the rest of society. These derived effects are divided into indirect and induced effects, respectively. Indirect effects comprise the activities of other companies which are direct suppliers to the smelter. The direct and the indirect activity generate income that is spent on consumption etc. The employment generated by this consumption is called the induced effect. An example of the direct, indirect and induced employment effects is given below.” (Niras 2007).

Direct effect	Employment linked to the aluminium production process (including employment at the associated hydroelectric power stations and ports).
Indirect effect	Employment with suppliers of goods and services to the aluminium production, i.e., for example, use of electricians, catering firms, consultants etc.
Induced effect	Employment generated when direct and indirect employees spend their income. For example, employment generated when direct and indirect employees at the aluminium plant buy groceries, thereby generating increased employment in supermarkets.

Table 3 (Niras2007)

These direct and derived effects are therefore of importance to the size of labour and hence the consequences for migration. This means that the regional economic and socioeconomic consequences are also affected by these effects. In the following a description is given of the type of labour needed in the smelter town and thus the type of labour that needs to migrate to the town in which the aluminium smelter is located. The type of migration that may be expected to arise from the location of the aluminium smelter in one of the three towns is described by the need for labour. In the following figures and tables, total employment and hence the need for labour is the sum of the direct and indirect effects described above. Unless otherwise stated, tables and figures are from the Niras report (Niras 2007).

5.1 Need for labour for the operations of the aluminium smelter

	2011	2012	2013	2014	2015-	2015- (%) ⁶
Greenlandic labour	5	5	25	200	425	100
<i>Further and higher education</i>	2	2	10	75	75	18
<i>Skilled</i>	3	3	15	125	125	30
<i>Unskilled</i>	0	0	0	0	225	52
Guest workers	0	0	0	0	0	0
Total	5	5	25	200	425	100

Table 4: Need for labour in terms of FTEs for the operations of the smelter broken down into education and training levels. Source: Alcoa information except the breakdown into education and training in the years 2011-14.

	2011	2012	2013	2014	2015 -	2015- (%) ⁷
<i>Further and higher education</i>	1	1	4	28	60	20
<i>Skilled</i>	1	1	5	42	90	30
<i>Unskilled</i>	2	2	9	71	150	50
Total	4	4	18	141	300	100

Table 5: Derived need for labour in terms of FTEs in relation to the operations of the smelter.

⁶ Column added by the author of this report

⁷ Column added by the author of this report

	2011	2012	2013	2014	2015 -
<i>Total internal [native⁸] employment</i>	9	9	43	341	725
<i>Total employment – guest workers</i>	0	0	0	0	0
Total	9	9	43	341	725

Table 6: Total employment per year for the operations of the aluminium plant.

5.2 Need for labour for the operations of the hydroelectric power stations

	2011	2012	2013	2014	2015-	2015 - (%) ⁹
Greenlandic labour	2	2	10	25	50	100
<i>Further and higher education</i>	2	2	5	10	10	20
<i>Skilled</i>	0	0	5	15	40	80
<i>Unskilled</i>	0	0	0	0	0	0
Guest workers	0	0	0	0	0	0
Total	2	2	10	25	50	100

Table 7: Need for labour in terms of FTEs for the operations of the hydroelectric power stations. Source: Alcoa information except the breakdown into education and training in the years 2011-14.

⁸ Inserted by the author of this report

⁹ Column added by the author of this report

	2011	2012	2013	2014	2015 -	2015 - (%) ¹⁰
<i>Further and higher education</i>	0	0	0	1	2	20
<i>Skilled</i>	0	0	1	2	3	30
<i>Unskilled</i>	0	0	1	3	5	50
Total	0	0	2	5	10	100

Table 8: *Derived need for labour in terms of FTEs in relation to the operations of hydroelectric power stations.*

	2011	2012	2013	2014	2015 -
<i>Total internal [native¹¹] employment</i>	2	2	12	30	60
<i>Total employment – guest workers</i>	0	0	0	0	0
Total	2	2	12	30	60

Table 9: *Total employment per year for the operations of hydroelectric power stations.*

5.3 Summary of need for labour

The above tables show that 725 persons are needed for the operations of the smelter, with direct employment accounting for approx. 52 % unskilled labour, 30 % skilled labour and approx. 18 % with a further and higher education.

Derived employment accounts for approx. 50 % unskilled labour, 30 % skilled labour and approx. 20 % with a further and higher education.

The tables show that 60 persons are needed for the operations of the hydroelectric power stations, with derived and indirect employment accounting for approx. 50 % unskilled labour, approx. 30 % skilled labour and approx. 20 % with a further and higher education.

¹⁰ Column added by the author of this report

¹¹ Inserted by the author of this report

6.0 Assessment of regional consequences if the smelter is located in one of the three towns

Based on the need for labour in the three towns and the geographical differences in derived effects and types of labour needed, the two environmental targets are assessed with a view to shedding light on the regional economic and socioeconomic consequences for each town.

Breakdown of derived employment		Location in:		
		Maniitsoq	Nuuk	Sisimiut
Establishment of smelter and new town extension as well smelter operations	Maniitsoq	60 %	5 %	5 %
	Nuuk	20 %	85 %	20 %
	Sisimiut	15 %	5 %	70 %
	Rest of Greenland	5 %	5 %	5 %
Total		100 %	100 %	100 %

Table 10: The geographical percentage breakdown of derived employment as a result of the establishment of a smelter and a new town extension as well as smelter operations (Niras 2007).

6.1 Nuuk

Derived employment

As will be seen from Table 10, derived employment in towns other than Nuuk will be modest. 85 % of derived employment is in Nuuk while Maniitsoq, Sisimiut and the rest of Greenland each get 5% derived employment and hence very small economic growth if an aluminium smelter is located in Nuuk. In Table 11 this fact is illustrated over time.

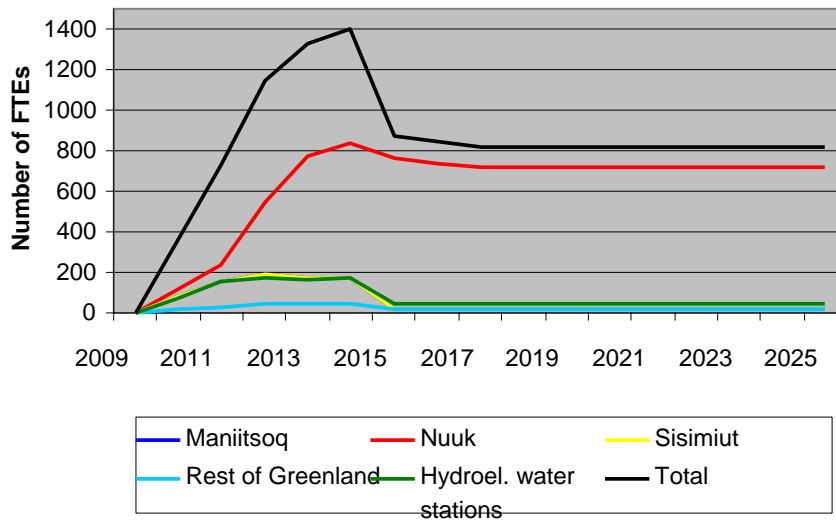


Table 11: The total internal need for labour broken down into four regions and hydroelectric power stations if the smelter is located in Nuuk.

Derived employment and environmental target 1

A location in Nuuk will have a very large negative impact on environmental target 1 in terms of derived employment because the economic activity in Greenland is geographically spread only to an insignificant degree.

Derived employment and environmental target 2

As a result of environmental target 1, the location of the aluminium smelter in Nuuk will have a very large positive impact on environmental target 2 in terms of derived employment because no less than 85 % of the economic activity linked to derived employment will be concentrated in Nuuk.

Migration

The location of a smelter in Nuuk will generate a substantial need for labour in Nuuk. Migration from other parts of Greenland will therefore be needed. Table 12 and Table 13 below show this need if the smelter is located in Nuuk.

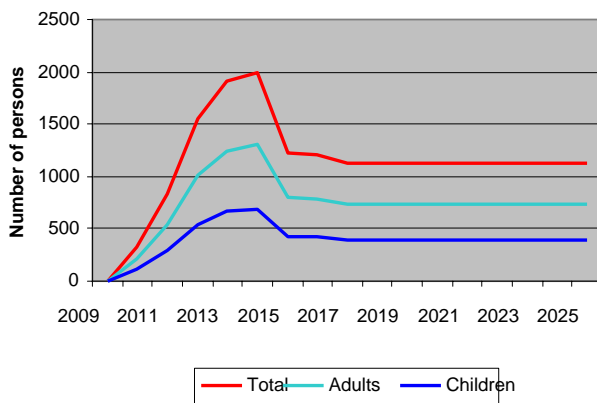


Table 12: Migration pressure on the rest of Greenland if the smelter is located in Nuuk

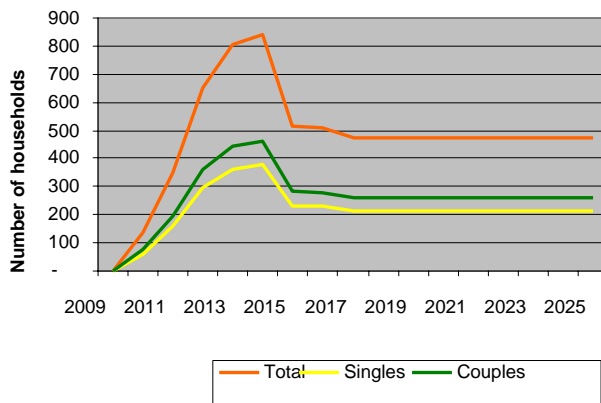


Table 13: Migration pressure on the rest of Greenland if the smelter is located in Nuuk

As the derived need for labour is greatest in Nuuk, a location of the smelter in Nuuk will generate a large need for labour who must come from other parts of Greenland. Approx. 2,000 persons in the construction phase and approx. 1,100 persons in the operating phase must therefore move to Nuuk from another Greenlandic town.

Migration and environmental target 1

The heavy migration pressure generated on the rest of Greenland (despite a large supply of existing labour) will result in a very heavy negative impact on environmental target 1 if the smelter is located in Nuuk. The negative impact is further increased by the fact that the level of vulnerability to the migration pressure of the other towns in Greenland depends on the size of the potential labour force in the towns from which migration originates. Thus, the negative

impact will be greater in small communities because the proportion of the labour force migrating to Nuuk will be larger.

As regards the need for labour grouped by level of education, the tables also show that skilled and unskilled labour and a slightly smaller proportion of persons with further and higher education will be in great demand. This effect is sometimes referred to as the 'brain drain' or the 'Disease', and here, too, the level of vulnerability is largest in small communities where it takes very little migration of qualified labour force to generate a large regional economic impact. This fact increases further the negative impact on environmental target 1.

Migration and environmental target 2

As a result of the great need for labour in Nuuk because of direct and derived employment and the great migration pressure on the rest of Greenland, there are only positive impacts on environmental target 2.

Mitigation measures

A central purpose of a strategic environmental assessment is that the environmental assessment provides the possibility of taking mitigation measures at the strategic level. In the present case, mitigation measures might include locating the aluminium smelter in a different town.

The purpose of mitigation can be briefly summarised as follows:

- To avoid, minimise and/or compensate negative environmental impacts.
- To ensure that none of the mitigation measures will have a negative impact.

Mitigation measures and environmental target 1

The mitigation measures for environmental target 1 are mainly aimed at another location of the smelter than Nuuk. The clear trend towards strengthening Nuuk as a growth centre can primarily be mitigated by a location in one of the other towns. At the same time, dramatic impacts from the 'brain drain' effects can be mitigated by a gradual expansion of the aluminium factory to full production so that the local communities affected by migration can adapt themselves to the situation.

Lastly, the impacts can be indirectly mitigated by economic redistribution through intermunicipal income equalisation systems.

Mitigation measures and environmental target 2

There is no need for mitigation measures in relation to environmental target 2.

6.2 Maniitsoq

Derived employment

Besides the direct employment on the smelter Table 10 shows that derived employment from the establishment of a new town extension and smelter operations is geographically more evenly distributed than if the smelter is located in Nuuk. In Maniitsoq, derived employment will be equal to 60 %, in Nuuk to 20 % and in Sisimiut to 15 % while it will be 5 % in the rest of Greenland.

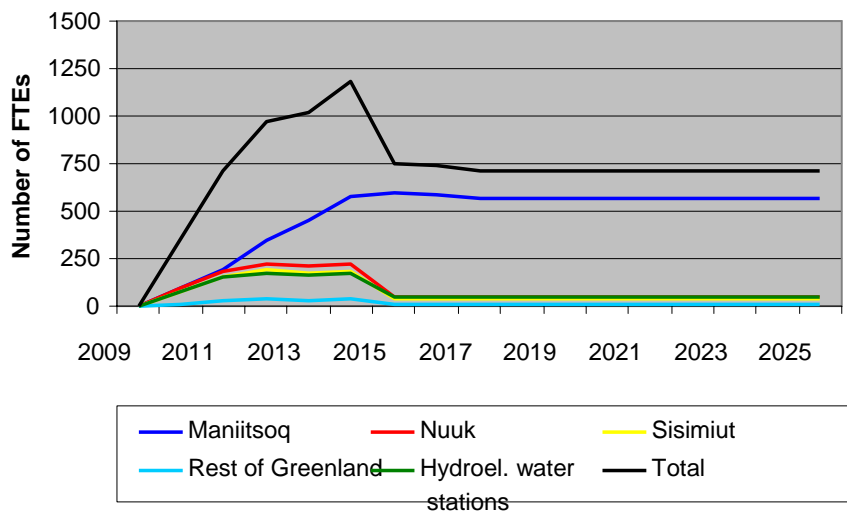


Table 14: The total internal need for labour broken down into four regions and hydroelectric power stations if the smelter is located in Maniitsoq

Derived employment and environmental target 1

Besides direct employment, a location in Maniitsoq has a very positive impact on environmental target 1 in terms of derived employment because the economic activity is to a greater extent spread geographically in Greenland.

Derived employment and environmental target 2

As a result of environmental target 1, a location of the aluminium smelter in Maniitsoq will have a small negative impact on environmental target 2 in terms of derived employment because only 20 % of the economic activity linked to derived employment will be concentrated in Nuuk.

Migration

Table 2 shows that with a location in Maniitsoq the need for labour is much lower than in Nuuk because the amount of derived employment is smaller. Hence the migration pressure on the rest of Greenland is smaller. Table 15 and Table 16 show the need for labour with a location in Maniitsoq and hence the need for migration from the rest of Greenland.

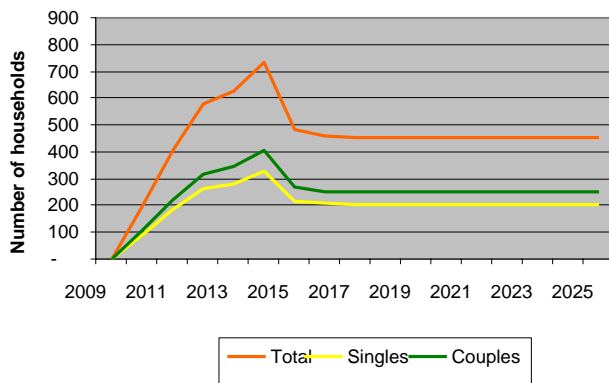


Table 15: Migration pressure on the rest of Greenland if the smelter is located in Maniitsoq.

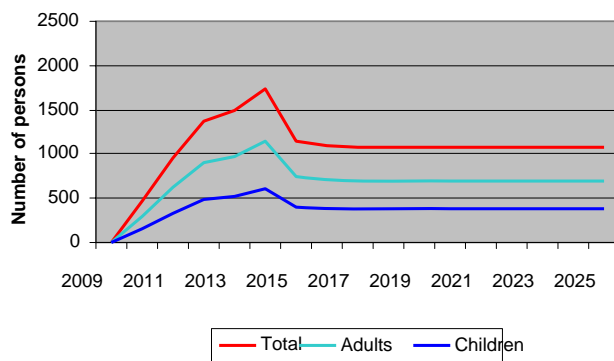


Table 16: Migration pressure on the rest of Greenland if the smelter is located in Maniitsoq.

Migration and environmental target 1

As a result of the lower migration pressure on other parts of Greenland and the direct employment, the location of the smelter in Maniitsoq will have a positive impact on environmental target 1.

Migration and environmental target 2

The favourable economic development seen in Nuuk so far is expected to continue no matter whether the smelter is located in Maniitsoq. This therefore has a very small negative impact on environmental target 2 (Niras 2007), which is intensified by the fact among others that Nuuk is less vulnerable to a 'brain drain' and 'Dutch Disease' because of its size and larger qualified labour force.

Mitigation measures

A central purpose of a strategic environmental assessment is that the environmental assessment provides the possibility of taking mitigation measures at the strategic level. In the present case, mitigation measures might include locating the aluminium smelter in a different town.

The purpose of mitigation can be briefly summarised as follows:

- To avoid, minimise and/or compensate negative environmental impacts.
- To ensure that none of the mitigation measures will have a negative impact.

Mitigation measures and environmental target 1

There is no need for mitigation measures in relation to environmental target 1 if the smelter is located in Maniitsoq because it has a very positive impact.

Mitigation measures and environmental target 2

The small negative impact on environmental target 2 can be mitigated by a location in Nuuk.

6.3 Sisimiut**Derived employment**

Besides the direct employment on the smelter Table 10 shows that derived employment from the establishment of a new town extension and smelter

operations is geographically more evenly distributed than if the smelter is located in Nuuk but not to the same extent as with a location in Maniitsoq. In Sisimiut, derived employment will be equal to 70 %, in Nuuk to 20 % and in Maniitsoq only to 5 % while it will be 5 % in the rest of Greenland.

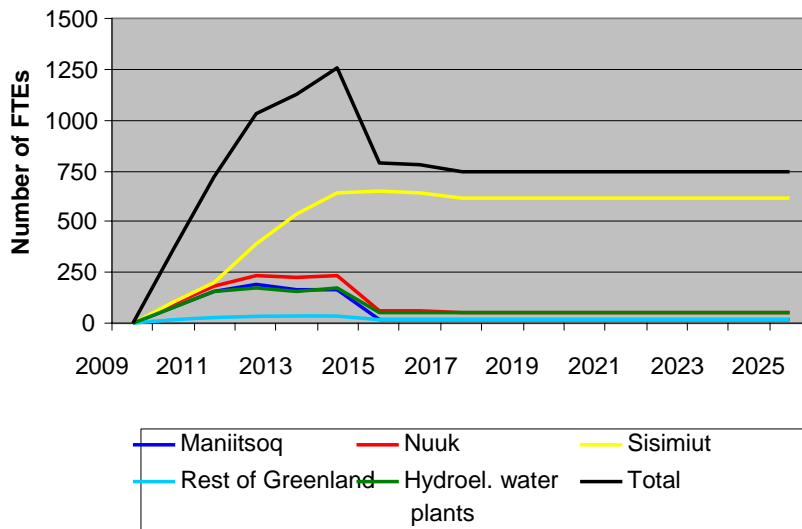


Table 17: The total internal need for labour broken down into four regions and hydroelectric power stations if the smelter is located in Sisimiut.

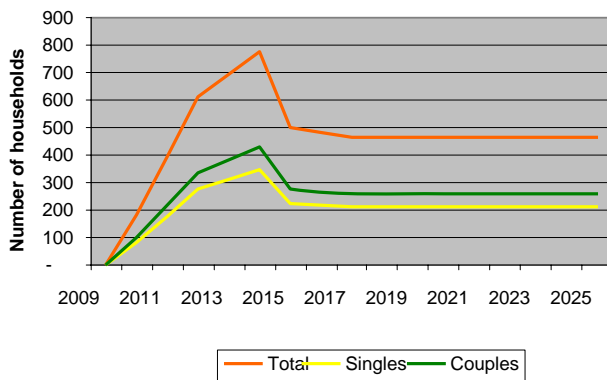


Table 18: Migration pressure on the rest of Greenland if the smelter is located in Sisimiut.

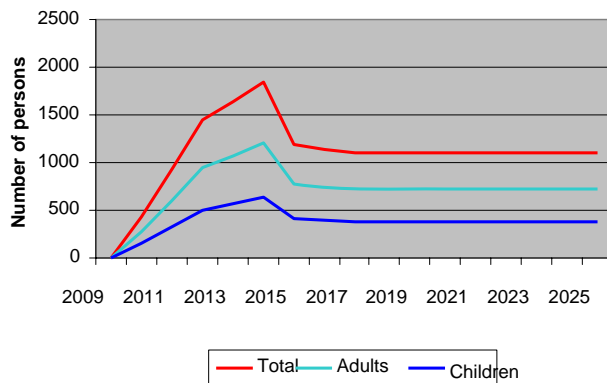


Table 19: Migration pressure on the rest of Greenland if the smelter is located in Sisimiut.

Derived employment and environmental target 1

Besides direct employment, a location in Sisimiut has a positive impact on environmental target 1 in terms of derived employment because the economic activity is to a greater extent spread geographically in Greenland than in Nuuk though less than in Maniitsoq.

Derived employment and environmental target 2

As a result of environmental target 1, a location of the aluminium smelter in Sisimiut will have a small negative impact on environmental target 2 in terms of derived employment because only 20 % of the economic activity linked to derived employment will be concentrated in Nuuk.

Migration

Table 2 shows that with a location in Sisimiut the need for labour is lower than in Nuuk because the amount of derived employment is smaller. Hence the migration pressure on the rest of Greenland is smaller. Table 15 and Table 16 show the need for labour with a location in Sisimiut and hence the need for migration from the rest of Greenland.

Migration and environmental target 1

As a result of the lower migration pressure on other parts of Greenland than Nuuk and the direct employment, a location of the smelter in Sisimiut will have a positive impact on environmental target 1.

Migration and environmental target 2

The favourable economic development seen in Nuuk so far is expected to continue no matter whether the smelter is located in Sisimiut. This therefore has a very small negative impact on environmental target 2 (Niras 2007), which is intensified by the fact among others that Nuuk is less vulnerable to a 'brain drain' and 'Dutch Disease' because of its size and larger qualified labour force.

Mitigation measures

A central purpose of a strategic environmental assessment is that the environmental assessment provides the possibility of taking mitigation measures at the strategic level. In the present case, mitigation measures might include locating the aluminium smelter in a different town.

The purpose of mitigation can be briefly summarised as follows:

- To avoid, minimise and/or compensate negative environmental impacts.
- To ensure that none of the mitigation measures will have a negative impact.

Mitigation measures and environmental target 1

There is no need for major mitigation measures in relation to environmental target 1 if the smelter is located in Sisimiut because it has a positive impact.

Mitigation measures and environmental target 2

The small negative impact on environmental target 2 can be mitigated by a location in Nuuk.

7.0 Conclusion

At the present moment the strategic environmental assessment cannot provide any very detailed assessments of the regional economic and socioeconomic consequences of constructing an aluminium smelter in one of the three towns. However, the conclusions on economic effects and migration pressure as illustrated by the matrix can be drawn.

Environmental targets	Location in:	Nuuk	Maniitsoq	Sisimiut
		<u>Assessment</u>	<u>Assessment</u>	<u>Assessment</u>
1. Economic activity in Greenland should, as far as possible, be spread geographically in an aim to achieve regional equality and balance		Large negative	Large positive	Positive
2. Economic activity in Greenland should, as far as possible, be concentrated in a strong growth centre in Nuuk		Large positive	Small negative	Small negative

Table 20: Assessment by town

As mentioned this table is based on Niras' report. Unfortunately it is not possible at the present time in the light of existing figures and material to elaborate this table. To the extent that material can be found to elaborate the table attempts will be made to work it into the SEA 2008 report. Failing that it will as a minimum be clarified which further investigations can be pointed at for a more satisfactory and more pointing forward pinpointing of the problems.

Based on the available knowledge and the two environmental targets it is obvious that if you prefer environmental target 1, the aluminium smelter should not be located in Nuuk because the need for labour is largest in the rest of Greenland, and so is the migration need. Massive mitigation measures can be partially implemented, e.g. intermunicipal economic equalisation systems. However, this cannot neutralise the massive migration pressure that will be put on the rest of Greenland. If, on the other hand, you prefer environmental target 2, the location in Nuuk is clearly preferable. However, it is also evident that Nuuk will continue its very favourable economic development whether or not the smelter is located in Nuuk. Hence, economic activity will continue to be very heavily concentrated in Nuuk even if the aluminium smelter is located in one of the two other towns.

The simple matrix and only two and very simple environmental targets set out above illustrate that there are many very significant matters that we know nothing about and which should be clarified politically before a decision on the location of an aluminium smelter is taken. A matter of particular importance is the creation of a debate on national planning and regional development to establish how Greenlandic towns and settlements are to develop in relation to each other in future. A decision on the location of an aluminium smelter is in reality a choice of a regional, irreversible and path-dependent¹² development strategy although there is no real national development strategy for the Greenlandic regions.

It is of decisive importance to clarify politically the regional development that is desired to take place in the next century because the location of an aluminium smelter will have a great impact on the regional development and define the potentials and limitations of the future regional policy.

In addition to the above considerations of regional conditions, there are other significant economic conditions that are important to the project:

”On the available basis it is not possible to assess on economic criteria alone what location of the smelter is best for Greenland. Furthermore, the various possible locations of the smelter are likely to represent important differences in the need for public investment in infrastructure. This factor must also be included in the overall considerations. In the considerations of the location of the smelter it is also very important to evaluate the amount of investment required to connect the smelter to the neighbouring town since this connection is necessary for daily commuting purposes. This applies even more so as there may be significant differences between the related expenditure amounts. In this connection, consideration should also be given to any additional perspectives associated with the individual locations in relation to urban development, transport pattern etc.” (Niras 2007).

Under the auspices of Greenland Development several of these perspectives have already been subjected to closer elucidation. These new elucidations are expected to be ready in the beginning of 2008 and will thus be able to enter into the draft for decision at the spring Parliament meeting in 2008.

¹² Path dependence in connection with regional development is to be regarded as a regional development path which cannot be changed without great effort.

8.0 Anbefalinger

In the light of the ascertained lack of relevant professional knowledge it is recommended that prior to the political decision of siting of an aluminum smelter, more information on regional development is obtained.

The recommendation is among other things motivated on the fact that the coming political decision on siting of the smelter defines a course for the future development of society, which is irreversible in relation to regional development policy and spatial planning in Greenland.

As stated a number of amplifying investigations are already at present in progress. These will to the utmost extent possible be finished in order that they can enter into the foundation for a decision of siting of an aluminum smelter.

It is recommended that societal analyses are concentrated on so that a number of the areas where present knowledge is insufficient can be illuminated and this knowledge can enter into the further considerations on starting the aluminum smelter project. For example an analysis of the backgrounds for concrete migration patterns would be of great help. Bids on potential areas for investigation are given in the section on data basis.

Under the auspices of SEA a seminar has been planned to take place in the last half part of January 2008 with a view to obtaining further relevant professional knowledge on the area. This seminar will consist of presentations from researchers and planners from among others Canada, Iceland and Sweden. The seminar will focus on topics such as growthcenters, specialised or diversified regional economies, ability to readjust in society and population etc.

When the results from the ongoing and planned investigations and seminars are available it will be necessary to consider whether it may be necessary with further professional illumination of particular issues. If so it will be recommended to carry them out during 2008.

9.0 References

Niras (2007). Økonomiske konsekvenser af etablering af aluminiumsindustri i Grønland. Analyser af kapaciteten. DRAFT. [24] October 2007.

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