Visions of Sustainability in the Baltic Sea Region: Beyond Conventional Development

Baltic 21 Research Report

June 1998

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ISBN: 91 88714 55 1

Acknowledgements

The Stockholm Environment Institute thanks the Nippon Foundation for partial support for this effort through its grant to Global Scenario Group, an international body examining scenarios for a transition to sustainable development at global and regional levels. The authors are grateful to Prof. Lars Kristoferson, Secretary General of Baltic 21, and his staff, Ulrika Habarth and Kristina Dahlberg, for guidance and support in the preparation of this document. Finally, the work of Dr. Charles Heaps and Mr. Jimmy Henson at SEI-Boston was critical to the scientific analysis.

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1 Introduction

The Baltic 21 project was initiated by the Heads of Governments of the Baltic Sea States and the President of the European Commission at a summit meeting at Visby, 2-3 May 1996. The mission is to develop a programme of action concordant with the mandate of Agenda 21, the programme of action that was adopted at the Earth Summit in Rio de Janeiro in 1992. The summary report of the project, Agenda 21 for the Baltic Sea Region (BSR), provides principles and analysis for moving the region's social and economic development in a direction that is compatible with sustainable development. This background report provides an integrated view of where the region is now; where it seems to be heading, assuming conventional development conditions persist; and where alternatively it could aim — a sustainability vision.

1.1 Sustainable Development in the Baltic Region

Sustainable development means harmonising social, economic and environmental goals to ensure the well being of present and future generations as well as ecosystems. The challenge of sustainable development must be addressed at multiple spatial levels — global, regional, national and local. Although the focus of Baltic 21 is regional, a global perspective is necessary since the linkages are bi-directional. Regional activities have an influence on biospheric processes while globalisation has increasing environmental, economic, cultural and demographic influence on regions.

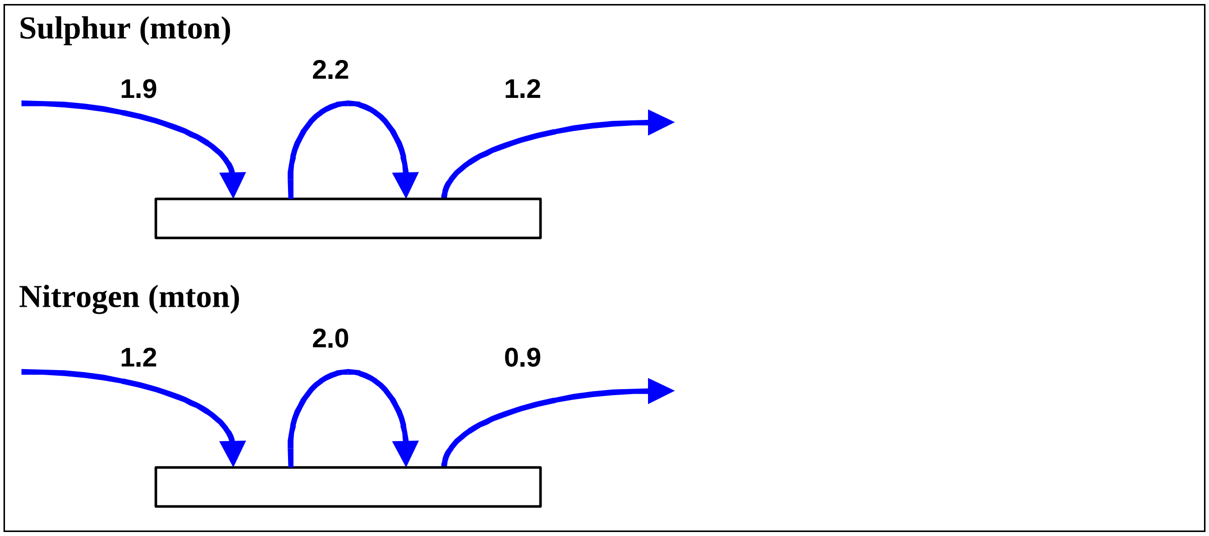
The goal for Baltic 21 is stated in the Visby Declaration as "the constant improvement of the living and working conditions of their peoples within the framework of sustainable development, sustainable management of natural resources, and protection of the environment." Sustainable development includes three mutually interdependent dimensions — economic, social and environmental. As defined in the Baltic 21project, this means:

- a safe and healthy life for current and future generations;
- a co-operative and prosperous economy and society for all;
- local and regional co-operation based on democracy, openness and participation;
- ecosystem diversity and productivity restored or maintained;
- pollution to the atmosphere, land, and water does not exceed the carrying capacity of nature;
- increased efficiency in the use and management of renewable resources so they remain within their regeneration capacity; and
- non-renewable resources are used efficiently and recycled, while renewable substitutes are developed and promoted.

The Baltic Sea region recognises its interdependence with other regions and is committed to contributing to the fulfilment of sustainable development at the European and global level. An important methodological consideration of any examination of the requirements for a transition to sustainable development is the designation of the "system boundaries." Certainly, sustainable development objectives must address environmental, social and economic conditions within the region. However, the region's full environmental footprint includes impacts beyond its boundaries through trade, pressure on primary resources outside the region, and influence on global biogeochemical cycles.

The importance of system boundaries is illustrated by the case of acidic depositions in the Baltic Sea region where much of the sulphur (46 percent) and nitrogen (37 percent) originates outside the region (see Figure 1). Another example is the climate change issue, where international agreements for the abatement of global greenhouse gas emissions will constrain and guide the development of energy and land-use practices within the region.

Figure 1. Sulphur and Nitrogen Budgets of Baltic Sea Region



Source: EMEP, Norway meteorological Institute, Report 1/95.

In general, environmental impacts caused by human activity can be allocated to the geographic region in which they occur, or to the people undertaking the activity. The distinction is illustrated by a matrix depending on where the activities occur (within or outside the BSR) or if it is to the benefit of people living inside or outside the BSR (Figure 2).

Figure 2. What is included in a sustainable Baltic Sea Region?

	Activities in BSR	Activities outside BSR
People in BSR	**A** • home heating • vehicular travel • production for domestic markets	**B** • production of BSR imports • overseas travel • foreign assistance and investment
People outside BSR	**C** • production for export • tourism	**D** • coal fired power plants in the US • production for trade (excluding BSR)

The activities in Box A clearly must be included in an analysis of sustainable development in the BSR. Activities in Box D would not appear to be germane to the BSR since they occur outside the region and for the benefit of people living outside the region. However, if the effects of these activities are global (e.g., greenhouse gas emissions from fossil fuel use) they determine the scale of activities allowed in the BSR and are therefore important considerations.

In accounting for the activities in Boxes B and C, an individual, consumer-based model would focus on Box A and B, that is, on the people living in a region. A geographic, production-based model would emphasise Boxes A and C, the activities that take place in a given region. As the sustainable region concept is extended to other regions, it will be important to clarify and harmonise approaches in order to assign responsibilities and goals consistently — and to avoid either double counting or neglecting important factors.

Ultimately, an egalitarian approach to reconciling regional sustainability goals and global responsibilities would be to estimate an environmental space according to global carrying capacity and subsequently allocate that space internationally on an equal per-capita basis. For now, the focus in this report is on what the region can do for itself, while keeping in mind the wider perspective, through the inclusion of such issues as climate change and acidification.

1.2 Key Issues

The Baltic Sea Region is in many ways fortunate, with an abundance of natural resources and a highly educated population. At the same time, the region faces significant challenges in meeting its sustainable development goals. Broadly, the two key problem areas are an unacceptable degree of socio-economic disparity and excessive pressure on environmental resources.

The vast difference in living standard across the region conflicts with the justice criteria of sustainable development. To address this, the standard of living must be increased, particularly in the SEBR[1] with the goal of gradually diminishing and eventually closing the gap between countries. Furthermore, differences within countries should also decrease. In the SEBR the market framework needs to be strengthened to support long-term investments and entrepreneurship. At the same time, there is a pressing need to improve the socio-economic situation for the poorest strata. Access to high quality basic services, such as education, health care, housing, energy, and transportation, should be universal.

A number of environmental concerns must be addressed in the context of a transition to sustainable development. Key issues are:

- regional contributions to emissions of greenhouse gases and ozone depleting substances, and other global issues;

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[1] SEBR refers to the Southeast Baltic Region (Estonia, Latvia, Lithuania, Poland and the Russian Federation). NWBR refers to the Northwest Baltic Region (Denmark, Finland, Germany, Iceland, Norway and Sweden).

- acidification of land and water, which is a serious problem in sensitive areas; and
- eutrophication in the Baltic Sea and in inland waters, which changes the ecological balance and causes algae blooms and other problems.

A further problem is the depletion of non-renewable resources such as energy and materials (like phosphorus). Moreover, renewable resources are sometimes exploited in an unsustainable fashion; forest loss in high-altitude mountains is but one example. Other important environmental issues are the maintenance of biodiversity, the protection of endangered species, and pollution in various environmental media — water quality, radiation hazards, and air quality in urban areas. These environmental problems are caused largely by the activities of today. However, problems persist from the past, as well, such as containers of mustard gas dumped in the Baltic Sea during World War II.

In the first wave of concern for the environment in the 1960s, the focus was on reducing point-source pollution through end-of-pipe technologies. Considerable scope remains for this type of intervention, particularly in the SEBR. However, the major challenge today is diffuse sources of pollution from transportation, households and other sectors. Beyond pollution prevention, the focus turns to a deeper level: the patterns of consumption and production that drive environmental pressures.

1.3 On the Use of Scenarios

Development is sustainable if it bequeaths sound socio-economic and ecological systems to future generations. Therefore, a time horizon of many decades is needed in an enquiry on sustainability. But the likely condition of society and the environment far in the future cannot be predicted with any known degree of reliability. Simple projection of current trends ignores the evolution of many social, political, and environmental features, as well as an array of possible surprises. Formal forecasting methods may be appropriate for the projection of various variables in the short term, but are ineffective for projecting the response of complex systems in the long term.

Though the long-range future cannot be predicted, it is possible to generate insight by developing coherent stories, or scenarios, about plausible possibilities. Scenario analysis is a key tool for illuminating the alternative pathways that complex and uncertain systems can take. Scenarios that are relevant to the problem of sustainable development are constructed from various elements — an understanding of current conditions, an identification of driving forces for change, a vision of the future, and a coherent story of a process of change leading to that future.[2]

Both imagination and science are required components for generating effective scenarios. Visions of the future in the absence of quantitative analysis tend to be idiosyncratic. Quantitative assumptions across a range of dimensions — economic growth and structure, population, technology, resources and the environment — help ensure that a

[2] Raskin, P., M. Chadwick, T. Jackson and G. Leach (1996), *The Sustainability Transition: Beyond Conventional Development*, Stockholm Environment Institute.

scenario is self-consistent and make the implications more vivid. On the other hand, quantitative modelling exercises without vision will miss critical qualitative aspects of the human condition and future possibilities.

Scenario-based planning has a long tradition in defence analysis, business strategic planning, and global socio-economic and environmental assessment. Alternative scenarios assist decision-makers in coping with uncertainty and in understanding the scope of possibilities in the long run. *Explorative scenario methodologies* are used to scan a range of visions and trajectories to provide a background for analysis and policy assessment.[3] Scenario analysis helps in devising flexible and adaptive strategies that are robust across a wide range of possible futures.[4] *Backcasting* is a technique for introducing normative future images and determining what pathways could lead to the desired future state.[5] This approach is relied on here in developing the *Sustainability Vision* for the Baltic Region.

1.4 This Report

The Baltic 21 project concentrates on seven sectors —agriculture, energy, fisheries, forestry, industry, tourism, and transport. Multinational groups for each sector conducted background studies. Sectoral reports analyse the issue of sustainability for the respective sector, and suggest directions for achieving sustainable development by 2030. In order to consider broad factors shaping the region's future, the Baltic 21 process also included an examination of integrated scenarios for the region. This included a look at cross-sectoral conditions, evolving trends, and sustainability visions for the region, as summarised in this report.

We present two pictures of the future of the region. A *Conventional Development Scenario* (*CDS*) assumes a business-as-usual mode of development in which concerted policy interventions to promote sustainable development are absent. We find that environmental pressures are likely to increase in such a non-intervention future and inequity to persist. We then offer a contrasting *Sustainability Vision* in which the region adopts a set of normative environmental and social goals, and adopts the policy initiatives for achieving them.

Ideally, multiple scenarios would be useful to analyse a full range of possibilities, uncertainties and policy options. This was not possible given the time available and scope of the study. Nevertheless, two scenarios illuminate the contrasting possibilities for the future. In the *CDS*, the region does not adopt pro-active steps to achieve sustainable development. In the *Sustainability Vision*, a strong institutional response to the sustainability challenge emerges in the form of an effective set of policies, appropriate

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[3] Schwartz, P. (1992), *The Art of the Long View*, London, Century Business; von Reibnitz, U. (1988), *Scenario Techniques*, McGraw-Hill, Hamburg, New York.
[4] Dreborg, K. (1997), *Gaming and Backcasting: Two Approaches in the Face of Uncertainty*, Royal Institute of Technology, Stockholm.

[5] Robinson, J. 'Energy backcasting: a proposed method of policy analysis', *Energy Policy*, December 1982; Robinson, J. ' Futures under glass: a recipe for people who hate to predict', *Futures*, October 1990; Dreborg, K. 'Essence of Backcasting', *Futures*, vol. 28, No. 9, pp 813-828, 1996.

technologies and new values. In addition a limited set of “what-if?” questions are posed in Section 4, in which important parameters are varied and the consequences for the *Sustainability Vision* assessed.

2 A Conventional Development Scenario

The Baltic 21 initiative is rooted in the conviction that appropriate policies and actions can bring regional development into harmony with the principle of environmental sustainability. A corollary to this proposition is that current trends, existing policies and orthodox notions of development may not be adequate for achieving sustainable development. To illuminate the risks and uncertainties of a business-as-usual approach to regional development, we introduce below a *Conventional Development Scenario* (*CDS*). The scenario both illustrates the problem of unsustainable development and provides a baseline for assessing the requirements for a transition to sustainability.

2.1. Overview

The *CDS* assumes continuity in the evolution of economic, social and environmental systems in the Baltic region. It envisions a future that unfolds gradually under the influence of currently dominant driving forces. A key element of the scenario is the absence of significant and co-ordinated policy initiatives for achieving sustainability goals. The economy grows steadily in scale, becomes more oriented toward service sectors, and the market fully takes hold as the engine for growth. Economic globalization and trade liberalisation continue to influence the regional economy and society. Transnational corporations play an increasingly important role.

In the *CDS*, the imperatives of the global market provide the context for co-operation and co-ordination. The level of regional integration and sense of common identity is minimal as each country seeks advantage on a global field of economic competition. Technological change in the scenario proceeds gradually, driven largely by market incentives, while government-sponsored research and development (R&D) efforts recede in importance. Information technology (IT) fosters the process of economic globalization. IT also provides the medium for an increasingly homogenised international culture with a distinctly consumerist emphasis. Some resist these trends — communitarians, local economic interests, geopolitical isolationists and environmentalists — but are unable to forge sufficient political will for an alternative vision.

Based on this broad narrative, we can present a quantitative illustration of the *CDS*. The points of departure for the scenario are detailed country-level economic, resource and environmental accounts for 1995 (selected data is collected in the Annex). Developed for each country to the year 2030, the scenario is summarised here for the entire Baltic Region and for the NWBR and SEBR subregions. The summary findings presented below are the result of detailed sectoral analysis, drawing from the sectoral background papers, existing data sets and regional scenario analysis.[6]

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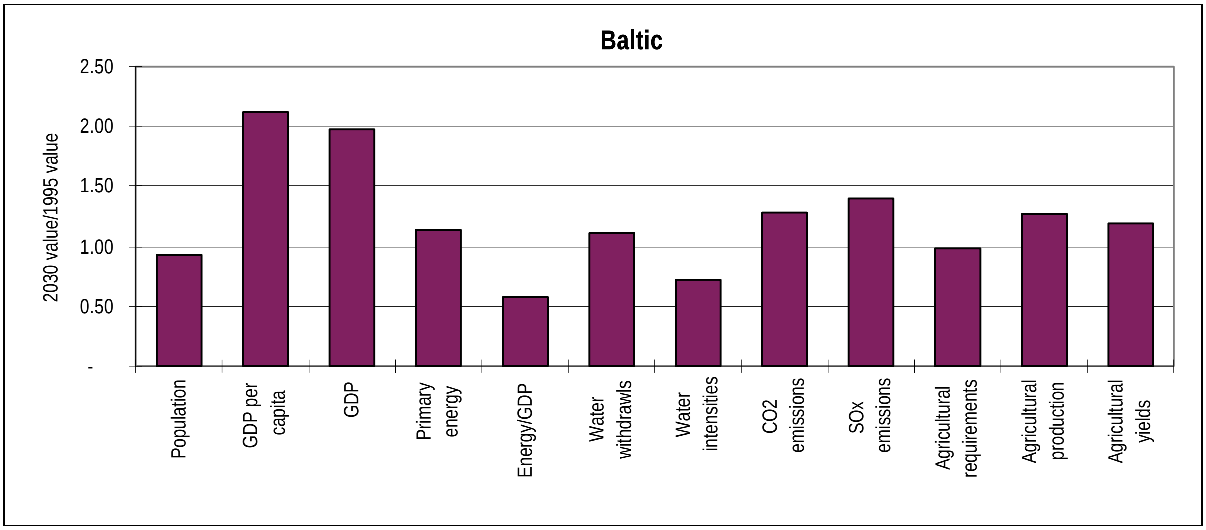
[6] The data structures and procedures are described in E. Kemp-Benedict and P. Raskin (1997), *Integrated Scenarios for Baltic 21: An Update*, Stockholm Environment Institute — Boston Center. The scenario is based on previous assessments of conventional development for the Western European, Eastern European and Former Soviet Union regions in Raskin (note 2) and Raskin, P., G. Gallopin, P. Gutman, A. Hammond and R. Swart (1998), *Bending the Curve: Toward Global Sustainability*, Stockholm Environment Institute (forthcoming).

Summary indicators for the scenario are gathered for the region as a whole in Figure 3. The demographic and economic growth assumptions are drawn from mid-range values typically employed in international assessments.[7] We see that there is no population growth in the scenario, with the decrease in population traced to a projected 14 percent drop of population in Russia. The regional economy doubles in scale by 2030, an average annual growth of about 2 percent.

Figure 3. *Conventional Development Scenario* Indicators for the Baltic Region



All else being equal, the economic growth might be expected to double both the requirements for natural resources and the pressure on the environment. This is not the case in the scenario primarily because of a continuation of trends toward greater efficiency of resource use. Most end-use activities become more efficient in the scenario — automobile efficiency, appliances, industrial processes, irrigation systems and so on. In addition, the composition of the economy shifts toward the service sector, which is relatively less resource intensive. The combined effect is to lower the aggregate resource intensities of the economy, as illustrated by decreasing energy/GDP and water/GDP in Figure 3. Nevertheless, the expansion of the scale of activity outpaces these improvements so that total energy and water requirements increase despite the impressive improvements in efficiency.

The requirements for agricultural products in the *CDS* remain steady over the scenario (see Figure 3). This is traced to the underlying assumptions of little change in per capita caloric intake or diet structure, i.e., the share of meat consumption in diets, combined with a slightly smaller population. On the production side, yields increase by about 20

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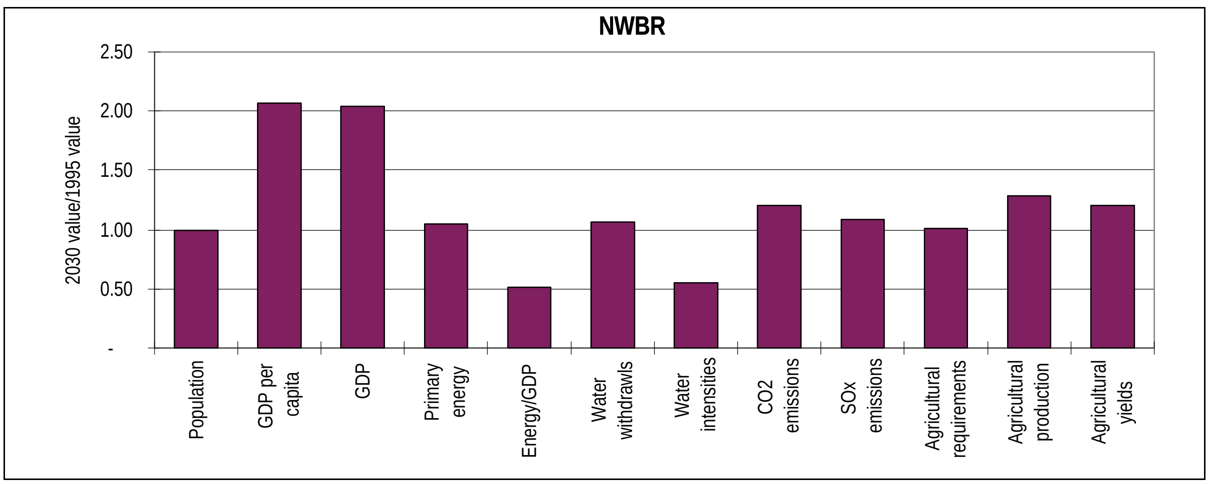
[7] Population projections are from the United Nations (1997), *Annual Populations 1950-2050 (electronic distribution)*, New York. Economic growth assumptions are based on mid-range IPCC values, which in turn are based on World Bank sources (*1992 IPCC Supplement*, World Meteorological Organization, Geneva.

percent between 1995. At the same time, chemical inputs to agriculture systems increase, contributing to water quality deterioration, a problem that persists over the next decades.

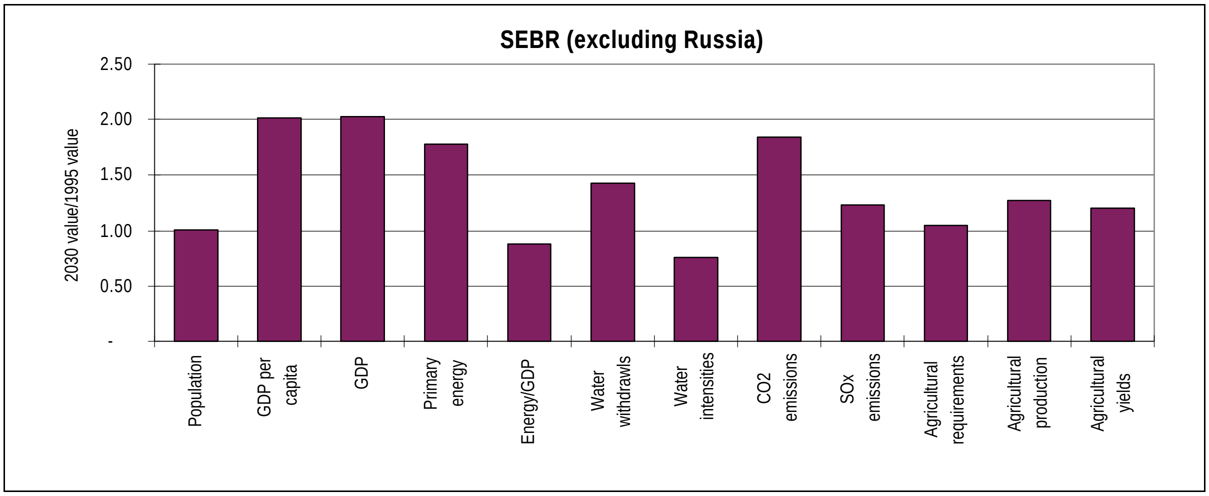
The increased levels of CO_2 and SO_2 shown in the figure illustrate air emission implications of the scenario. Other environmental pressures are also likely to increase. For example, in modern economies, a huge variety of potentially hazardous substances are used in manufacturing processes and embodied in final products. Some, including heavy metals and chlorinated organic compounds, are known to be toxic and persistent, and to accumulate in living organisms and be concentrated through the food chain. Under the conditions of policy complacency assumed in the *CDS*, the toxicological risks to human health and ecosystems grow as the variety and level of synthetic chemical production increase.

The scenario indicators are reported for the NWBR and SEBR subregions in Figure 4.[8] Note that the growth in resource requirements and environmental pressures tends to be greater in the SEBR than the NWBR. This is traced to the greater rate of improvement of resource intensity in the richer NWBR. In addition to differences in end-use efficiency, the substantially higher growth in CO_2 and SO_2 emissions in the SEBR result from greater reliance on coal.

Figure 4. Subregional Indicators

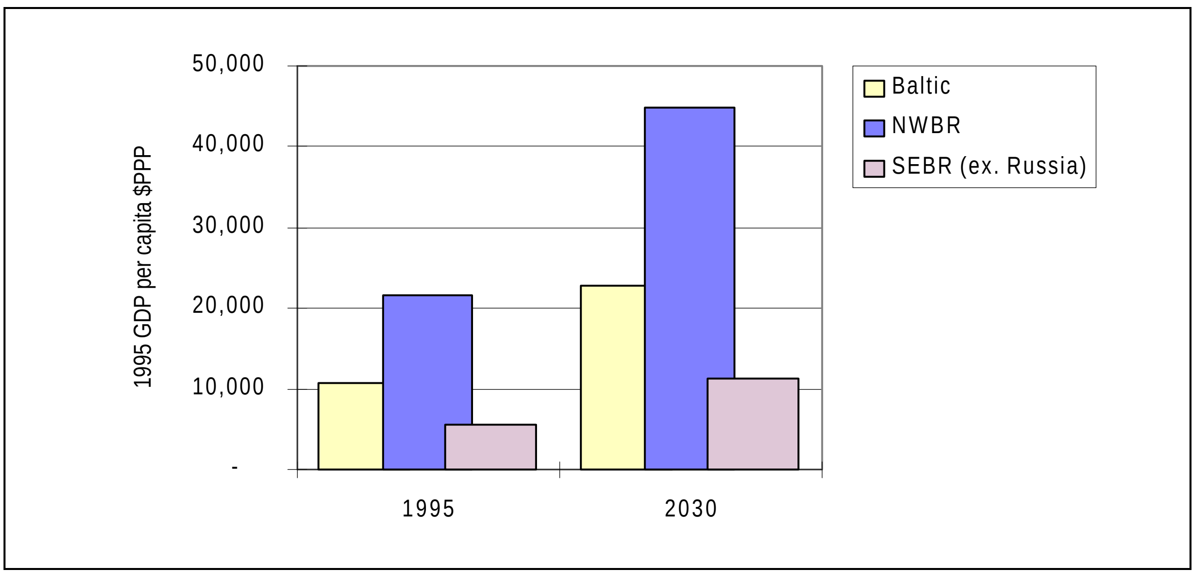


[8] Note that we exclude Russia in reporting on the SEBR here and elsewhere. Due to its great size, the results for Russia would dominate, while only a portion of that country is within the Baltic region proper.



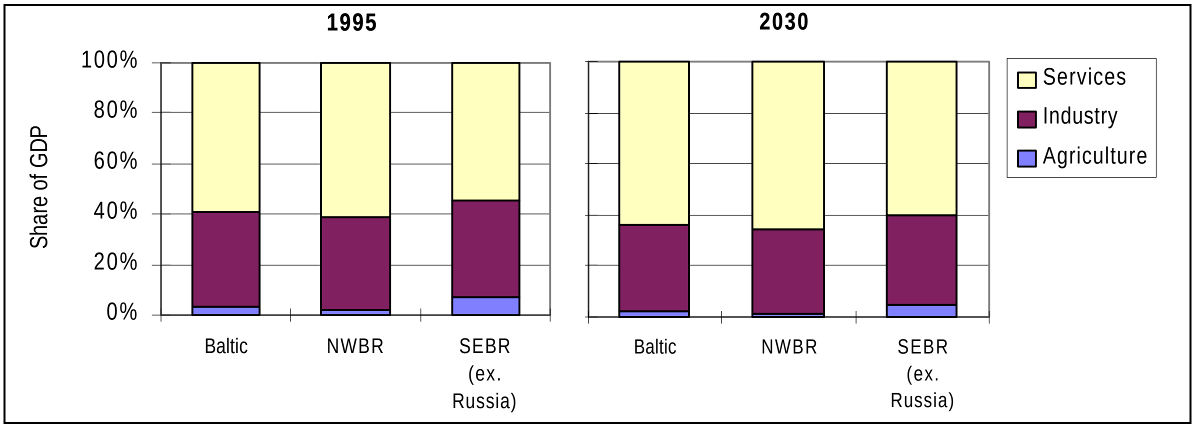
Demographic and economic growth patterns are similar between the two regions. This implies that the pattern of income disparity between the subregions endures. To see this, income patterns in the scenario are reported in absolute terms in Figure 5. Since the growth rates are about 2 percent in both regions, the absolute disparity in per capita income also doubles, from about $16,000 per capita in 1995 to $32,000 per capita in 2030.

Figure 5. Income Trends



The structure of economic activity gradually alters over the scenario as shown in Figure 6. The contribution to total value added of the service sector increases by 5 percent while industry and agriculture sector shares decrease.

Figure 6. Economic Structure

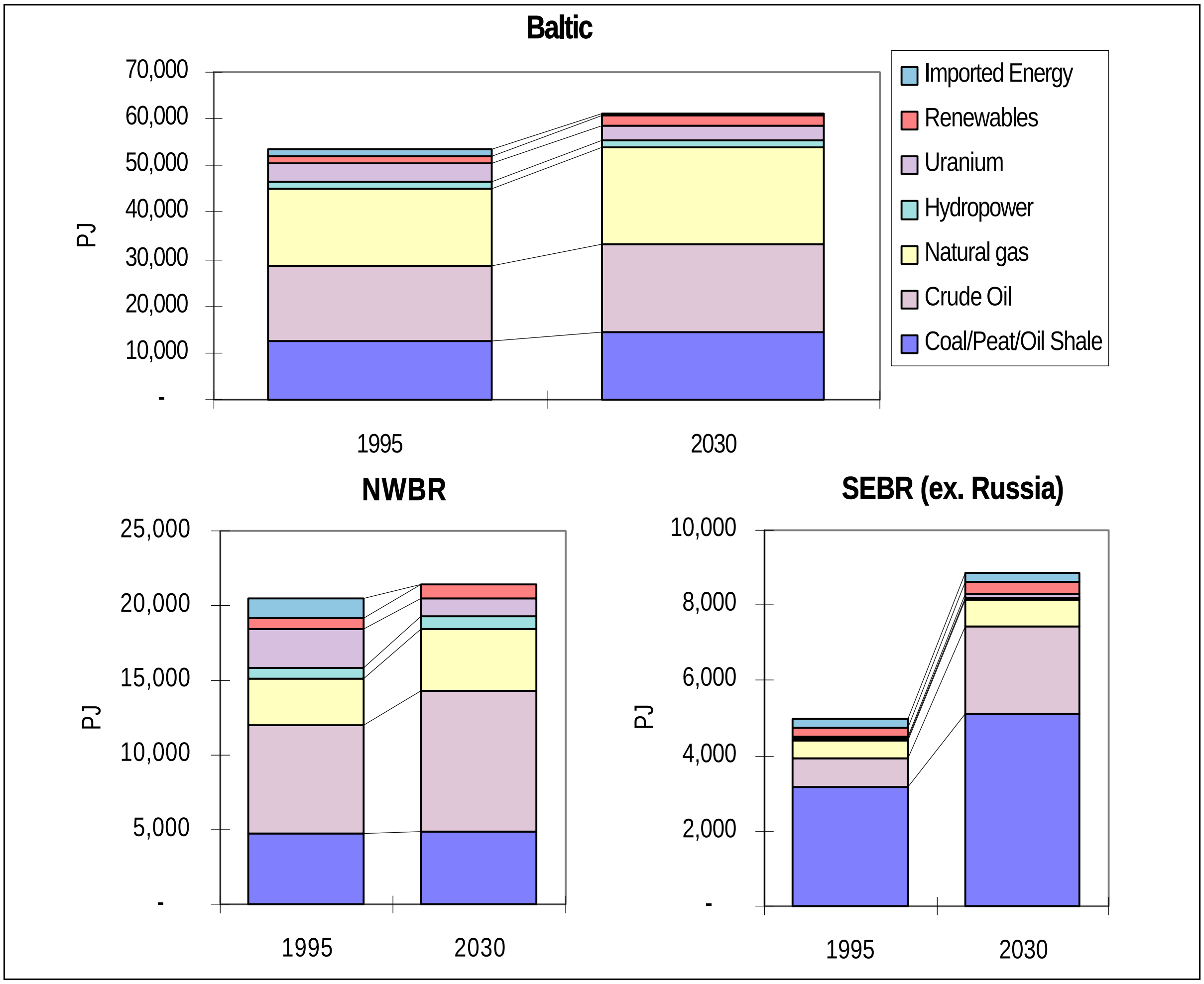


2.2. Sectoral Patterns

In this section, we summarise the changing requirements for energy, agriculture and water in the scenario. In Figure 7 we take a closer look at energy patterns in the scenario. The mix of energy sources gradually evolves from historic patterns. In general, the many activities (or "end uses") driving energy demand increase in the context of rising incomes. Transportation levels (passenger-km/year) rise due to more luxury travel and to higher commutation loads associated with the extension of suburban settlement patterns. Industrial output grows somewhat and service sector activities grow rapidly. Household appliance ownership increases. Meanwhile, energy intensity (demand per unit of activity) becomes more efficient. For example, average automobile efficiency approaches about 0.06 litres/km by 2030 compared to roughly .09 in the NWBR currently.

The mix of energy sources comprising the primary energy supply gradually changes during the course of the scenario (Figure 7). In the NWBR, natural gas and renewables increase somewhat, while nuclear energy decreases both as a share and in absolute terms. The SEBR, excluding Russia, becomes increasingly reliant on coal for electricity and heat generation.

Figure 7. Primary Energy Supply



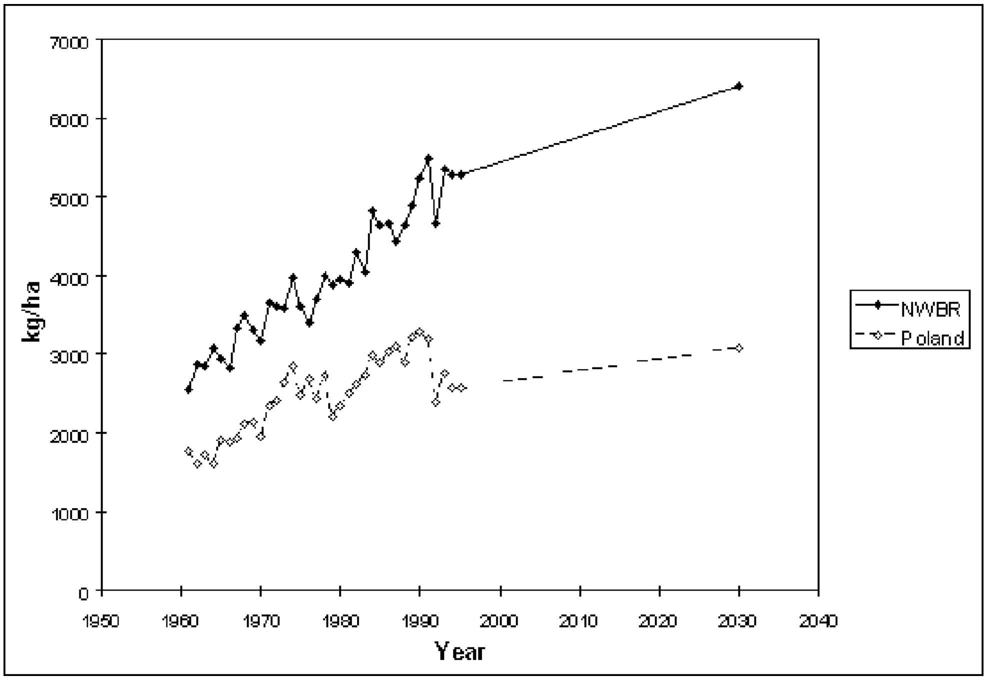
Agriculture requirements in the *CDS* change little. The level of caloric intake and dietary structure are similar to today's patterns. On the production side, crop yields are assumed to increase by about 20 percent by 2030 on both rainfed and irrigated farmlands.[9] Yields have increased significantly in recent decades, a result of increasing use of irrigation, improved plant varieties and better farming practices. This is illustrated in Figure 8 for the case of cereal crops for the NWBR and Poland (time series data for the countries of the former Soviet Union are not available). Total land under cultivation does not change significantly in the scenario, while the agricultural land under irrigation increases by about 10 percent in all countries. It is assumed that the scope for expansion of irrigation land is constrained by limits on water and the availability of cost-effective opportunities.

Since production increases more rapidly than agricultural requirements, the region enjoys increasingly strong food security. If we define a self-sufficiency ratio (SSR) as total production over requirements, the Baltic region as a whole had an SSR of about 1.1 for cereals and .85 for all crops, with a wide range of values across countries (Table A-5). In

[9] Baltic 21 Agricultural Secretariat (1998), *The Baltic Sea Agenda 21 Sector Report — Agriculture: Final Report*.

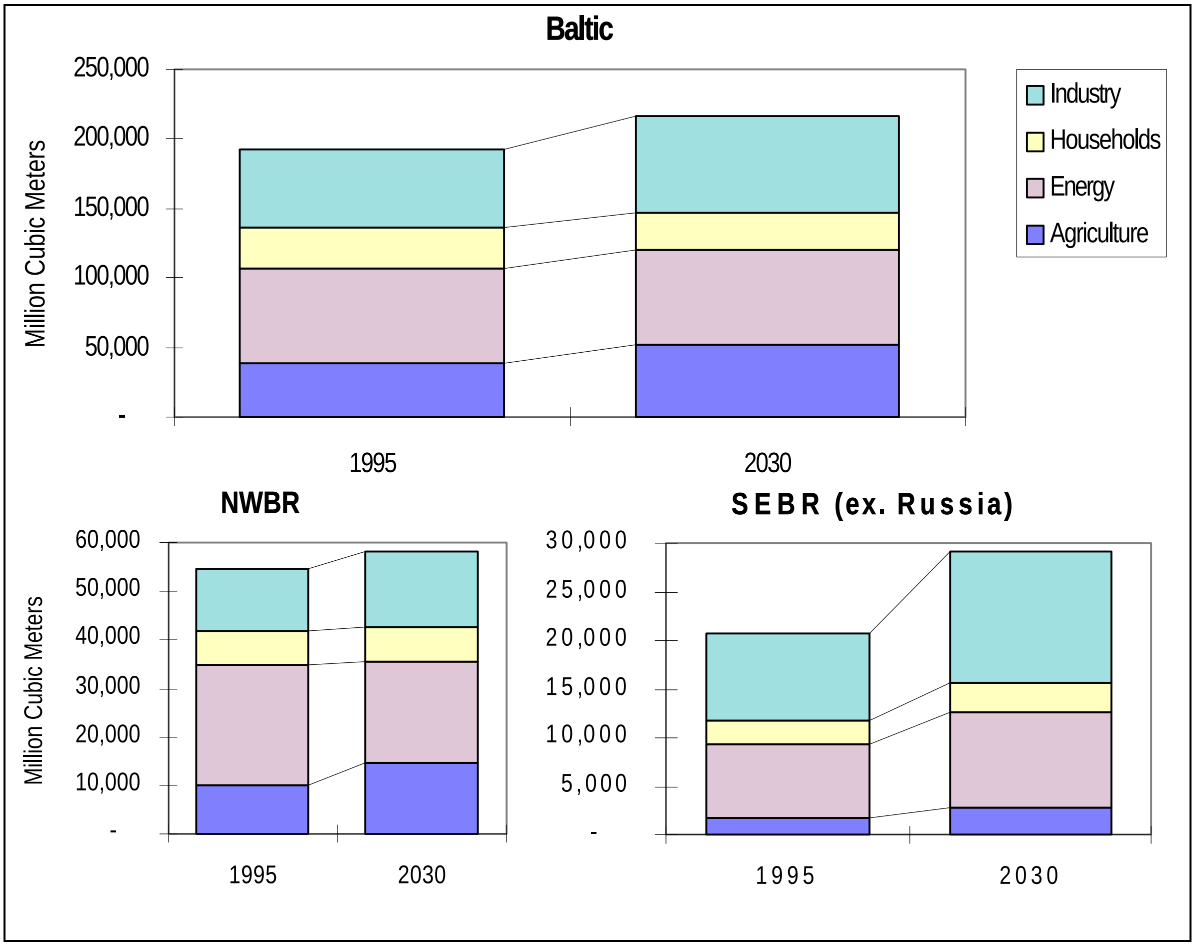
the scenarios, all countries improve their net trade balances. The challenge is to achieve these levels of agriculture intensification in a sustainable manner. The growing competition for water between agriculture, urban uses, and industrial demands will need to be managed in a number of watersheds. Fertiliser and pesticide pollution will need to be reduced to address water ecosystem problems and to control nitrate levels in drinking water. In general, the transition from the *CDS* to a sustainability vision will require the adjustment of agricultural practices that can maintain, and hopefully improve, land, water, fisheries, and forests.

Figure 8. Cereal Yields: Past Patterns and Scenario Assumptions



The changing requirements for freshwater in the *CDS* are shown in Figure 9. Water requirements increase gradually in the NWBR and by almost 50 percent over the scenario period in the SEBR (excluding Russia). Also shown in the figure is the changing sectoral composition of water withdrawals, which shows requirements increasing in all sectors, notably in agriculture in all regions and industry in the SEBR.

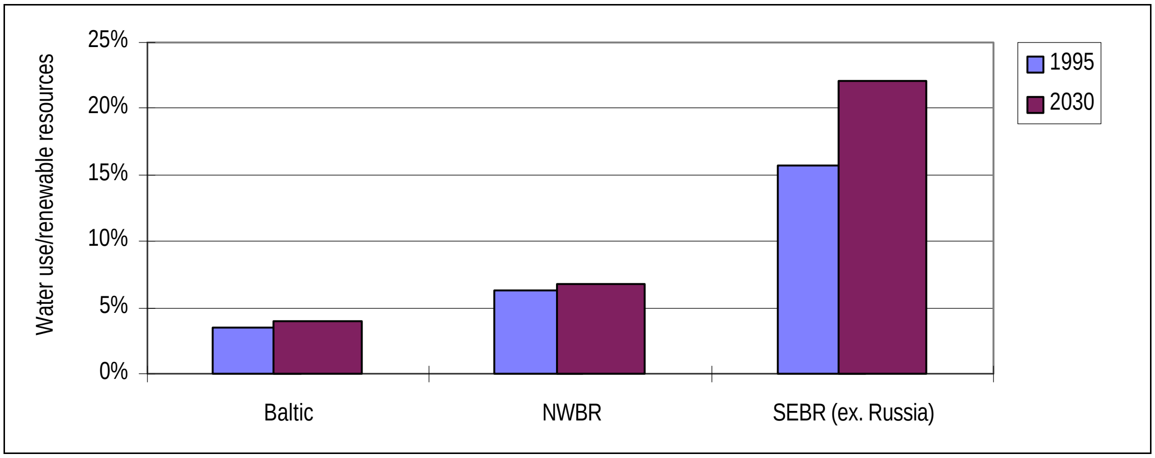
Figure 9. Water Withdrawals



The country and national level of spatial disaggregation used in this analysis is too coarse to shed much light on the degree of pressure on water resources. To carefully gauge the issues of water sufficiency, competition and aquatic ecosystem stress, a basin-level degree of resolution would be required. However, the general patterns can be gleaned from Figure 10, which tracks the changes in the scenario in the use-to-resource ratio — annual water withdrawals divided by annual average renewable water resource flows. National values of the use-to-resource ratio in excess of about 20 percent may signal the onset of water stress conditions.[10] Thus, in countries with already high use-to-resource ratios (Table A-6), the scenario suggests an unsatisfactory water future. A critical uncertainty in the scenario, which could complicate the transition to sustainable water practices, is the implication of global climate change on regional hydrological patterns. In the absence of policies to address water allocation, water quality and ecosystem maintenance, the danger of discord rises between groups dependent on shared resources.

[10] Raskin, P., P. Gleick, P. Kirshen, G. Pontius and K. Strzepek (1997), *Water Futures: Assessment of Long-range Patterns and Problems*, Stockholm Environment Institute and the United Nations.

Figure 10. Water Use-to-Resource Ratio



2.3. Conventional Development vs. Sustainable Development

The *CDS* as a model of future development for the Baltic region offers a mixed report. In this picture, national economies grow substantially over the next few decades, but disparities between and within countries widen. The standard of living is up when measured by such quantitative indicators as GDP per capita, but concern grows that the quality of life has deteriorated as traditional cultural values erode and social friction escalates. Pressure on the regional environment is ameliorated by a number of factors — investments in end-of-pipeline controls, products that are progressively less material- and energy-intensive technologies, and international environmental agreements. However, rapid growth in the *scale* of production and consumption has nullified these gains, and regional ecosystems remain threatened.

A sustainable path of development for the region would progressively mitigate environmental, resource and social stresses in the course of time. It would build a socio-ecological system that is resilient. Institutional and technological structures would have increasing capacity to adapt to unforeseen shocks and uncertainties. The policy-complacent form of development as envisioned in the illustrative *Conventional Development Scenario* does not meet these criteria. Rather, the environmental pressures and economic disparities of the current era would be aggravated. A transition to sustainability requires transcending these conditions by pro-actively seeking a new sustainability vision.

3 A Sustainability Vision

Informed by the sectoral reports, we may begin to envision a sustainable Baltic region in the year 2030. Building a shared vision for the future is a *process* that must continue with the involvement of experts, decision-makers and the general public. The glimpse offered here is not meant to be definitive — any vision is provisional and subject to revision over time. Rather, it is offered as an initial image of a *desirable* future, an image that should be expanded and amended. It is, however, useful in galvanising actions, values, and policies that can change the course of regional development toward the desired goal.

3.1. Elements of the Vision

The vision is based on five key aspects representing economic, social and environmental dimensions of sustainability in the region. These are:

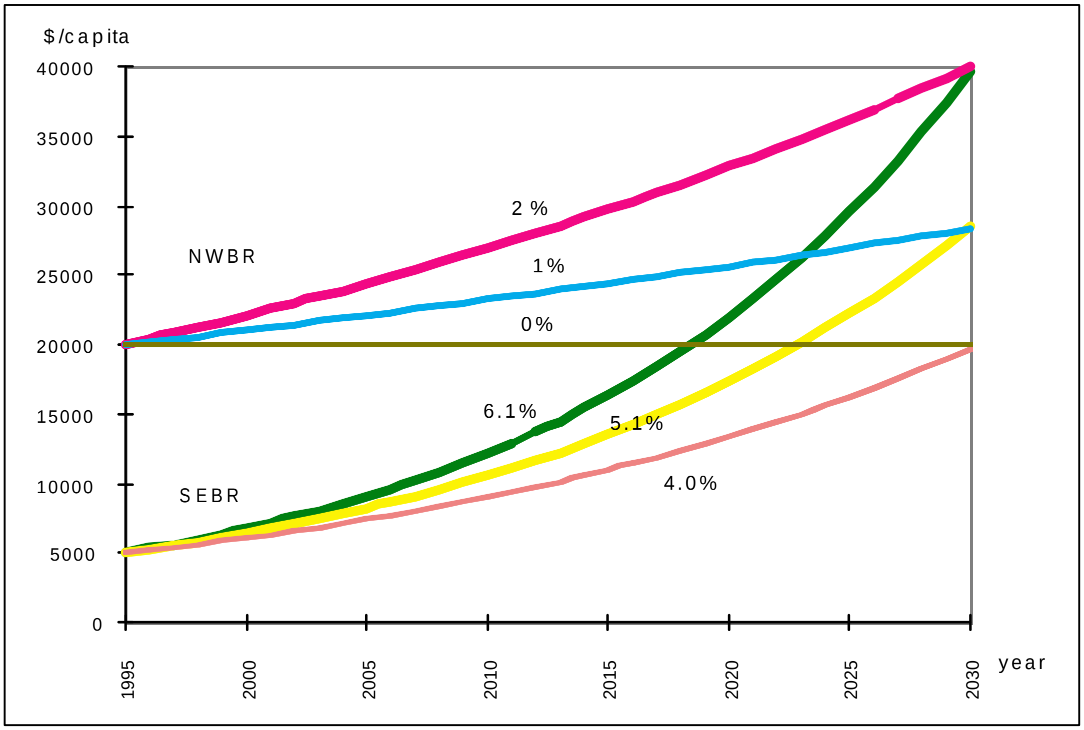
- economic equity;
- full employment;
- reduced greenhouse gas emissions;
- acidification of soils and waters within safe tolerance levels; and
- return of the Baltic Sea to ecological balance.

We consider these dimensions below.

In the context of rapid economic development in the SEBR, regional differences in living standard gradually disappear by 2030 in this vision. The economic differences within countries are also decreased. Economic growth in the SEBR is driven by a booming industrial sector that benefits from the comparatively high level of education and skill of the work force. Currently, the GDP per capita in the NWBR is four times that in the SEBR, based on purchasing power parities. To illustrate how the difference might be eliminated, if the economy grows at 6 percent per year in SEBR and 2 percent in NWBR, GDP per capita in the two subregions would be equal by 2030. On the other hand, if the growth were 4 percent in SEBR and 2 percent in NWBR the ratio would be 1 to 2 in 2030 (see Figure 11).

The economic growth assumptions in the illustrative examples —6 percent per year in SEBR and 2 percent in NWBR — represent a significant expansion of economic activity in the region. The GRP (Gross Regional Production) in 2030 would be 4.5 times the GRP in 1995. All else equal, such a large expansion in the scale of activity would exacerbate environmental pressures dramatically. Therefore, a transition to environmentally sustainable development under these assumptions would entail the massive development and deployment of clean and efficient technology, along with adjustments to patterns of consumption and production.

Figure 11. Illustrative GDP per capita growth assumptions in NWBR and SEBR



Economic growth would need to be decoupled from the throughput of resources to remain within ecological goals. This is illustrated in Figure 12, in which environmental impact is decomposed into the product of three factors: population, economic activity and technology. The technology variable is expressed as an aggregate *resource intensity* when natural resource impact is analysed, or emission intensity when the focus is on pollution.

Figure 12. Environmental Impact as the Product of Population, Economic Activity and Technology

I = Environmental Impact [resource use or emissions]	**P** Population [number of people]	**A** Economic Activity [GNP/capita]	**T** Technology [resource use or emissions/GNP]
Example: 1/2	1	4	1/8
Decrease needed E.g., decrease CO2 emissions or nutrient depositions by 50%	No major changes	GNP growth factor	Reduction of resource or emission intensity

(I = P *A *T).

As the arrows suggest, a reduction of environmental impact in association with an increase in economic activity requires major decreases in the intensity of resource use (or emissions) per unit of GDP. Resource requirements and environmental pressure would need to be decoupled from the level of economic activity. The required improvements in efficiencies pose substantial challenges to technological, organisational and management systems.

In the vision, policies aimed at heightened social security succeed throughout the region, leading in particular to low unemployment (<5%). This success is related to a restructured and well-functioning market economy in the whole region, coupled to appropriate policies and regulations for achieving social and environmental goals. Moreover, the region is able to effectively co-operate on the harmonisation of new policies, such as ecological tax-reform, and they are introduced in a co-ordinated and timely fashion.

Regional greenhouse gas (GHG) emissions are reduced by 30 percent by 2030, spurred by international agreements on the control of global GHG emissions. But the aim in the region is to reduce emissions still further. The measures that reduce GHG emissions also contribute to other goals — reduction of local air pollution, generation of employment, and improvement in human health. Energy consumption is stabilised by 2010 and NO_x emissions are reduced by 25 percent, with substantial improvements in other pollutant levels, as well. In particular, acidification caused by emissions from within the region decreases in a program devised to achieve co-benefits with GHG emission reductions. European agreements reduce the transboundary emissions from outside the BSR.

The measures include considerable improvement in energy efficiency in energy, transport and industrial sectors, and fuel switching to renewable energy. In the industrial sector, structural changes complement improved technological efficiency in order to reconcile high GDP growth with ambitious environmental goals. A higher share for industrial subsectors with low resource intensity, such as IT, pharmaceuticals and medical equipment, makes an important contribution. Plant and equipment are up-graded and modernised, resulting in major improvements in energy efficiency, especially in the SEBR. Better insulation of buildings sharply improves the efficiency of heating. Increased combined heat and power production reduces energy requirements in the energy transformation sector. Greater public and private awareness of environmental goals leads to better energy housekeeping while a growing demand for "green" products spurs the eco-efficiency movement in industrial and service sectors.

The region becomes an international pacesetter in the research, development and deployment of sustainable farming practices. Increased consumer interest in local ecological-based agriculture products stimulates further developments and reduces transport associated with agriculture trade. The forestry and agricultural sectors provide biomass energy. Cropping systems are introduced that increase the organic matter content of soils. At the same time, the productivity of forest and other sectors is secured through the decreased acidification of soils.

Despite strong economic growth in the scenario, a number of measures counteract the tendency toward increasing transport levels.[11] Better integration of land use and traffic planning, and the spread of telecommuting, reduce travel needs. This, along with the market penetration of highly energy efficient vehicles and modal shifts leads to decreasing energy use and CO_2 emissions in the transport sector. Integration of land-use and traffic planning cause a decline in structurally determined travel, particularly short distance trips by car. In the SEBR, various economic incentives accelerate the replacement and modernisation of the fleet.

In the sustainability vision, the Baltic Sea is again an environmentally healthy and fully productive resource. The progressive environmental recovery of the Sea steadily results from initiatives in the energy, transport, industry and agricultural sectors. Numerous measures — more efficient energy use, cleaner production processes, better management of crop and animal production, reduced arable land, wetlands restoration, enhanced sewage treatment — combine to reduce pollution loads. As the capacity of the Baltic Sea to sustain marine ecosystems improves, fisheries and tourism thrive.

In the scenario, a host of other issues are addressed, as well. These include the protection of biodiversity, the reduction in use of non-renewable resources, and the near elimination of fugitive heavy metals, persistent organic pollutants and radioactive hazards into the environment. Proactive approaches are emphasised that provide incentives for changing practices and technologies. The capacity of society to adapt to new challenges in a timely and effective manner has evolved substantially. Strategies include improved monitoring systems and policy co-ordination within and between regions. Indeed, a

[11] The strategy is suggested by *Baltic 21 - Transport Sector Report*, Wuppertal Institute, February 1998, pp 32 -33.

prerequisite for the vision is the progressive improvement in regional co-operation. Legal rules are harmonised to pave the way for common environmental and economic policies.

As the sustainability scenario evolves, goal conflicts arise. The most important of these is the tension between the goals of high economic growth and environmental preservation. In the scenario, the region is able to implement "win-win" solutions — measures to increase resource efficiency and reduce emissions that also improve economic efficiency and generate employment. For example, the introduction of well-designed re-use and recycling programs stimulates secondary markets within the region. The booming field of energy and water demand management services and renewable energy resources stimulates local economies. In general, regional policies accelerate a broad process of dematerialisation in which goods become increasingly more knowledge intensive and resource sparing.

Meanwhile, the region becomes an international leader in the design, development and fabrication of environmentally friendly technologies. The early preparation for the possibilities emerging from information technologies finds ready markets elsewhere. The experiences with the development and implementation of cleaner technologies and renewable resource systems position the region well for the changing economy of the next decades.

Some changes emerge organically as consumer preferences change and new technologies, such as innovations in information technology, enter the market. But policy initiatives play a major role in increasing resource efficiency, controlling pollution and ensuring low-impact land use policies. Also, the integrated approach to the various goals in the sustainability vision — environmental, health and economic growth — is only possible through comprehensive strategies coupled to sectoral initiatives. Possible sectoral programs are summarised in the box below.

Last, but far from least, the people in the region increasingly adopt a set of values — a new sustainability paradigm — that influence lifestyles and emphasises the importance of finding meaning in cultural and spiritual engagement as opposed to the mere accumulation of things.[12] Among the ascendant values are an identity with nature, a desire for social equity and a sense of solidarity and participation in communities at all levels — local, national, regional, and global.

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[12] Gallopin, G., Al Hammond, Paul Raskin and Rob Swart (1997), *Branch Points: Global Scenarios and Human Choice*, Stockholm Environment Institute.

Key Sectoral Initiatives in the Sustainability Scenario

AGRICULTURE

- integrated crop and animal production facilitates nitrogen and phosphorus recycling
- wetland restoration reduces nutrient loss and protects bio-diversity
- new cropping systems decrease input of mineral fertilisers, preserve soil nutrients and sequester more CO_2
- bio-energy production increases, especially on abandoned arable land
- municipal waste recycling provides nutrients and organic matter
- soil fertility improves due to better controlled input of nitrogen and phosphorus, use of non-compacting machinery, etc.
- nitrogen and phosphorus run-off to surface waters is reduced by 50%

ENERGY

- sharp decreases in energy intensity in industry, transport and heating
- efficiency increases in energy production and transmission, e.g., more combined heat and power production
- major fuel switching, e.g. fossil solid use decreases by 60%, natural gas increases by 100% and renewable energy increases by 70%
- cleaner processes, e.g., use of high sulphur oil abandoned
- net energy consumption increases by 20 %, while primary energy use decreases by 20 % due to reduced losses in transformation and transmission of energy
- CO_2 emissions decrease by 30% relative to 1995

FISHERY

- Baltic Sea pollution from other sectors is minimised (e.g., agriculture pesticides)
- fish catch are adjusted to maintain ecological balance of stocks (especially cod and salmon)
- biodiversity in aquatic ecosystems is preserved

FORESTRY

- all forests are subject to sustainable management practices
- forest carbon sequestering increases
- bio-energy increase
- bio-diversity is preserved
- non-wood forest values (e.g. recreation and berries) are secured along with continued wood production

INDUSTRY

- material and energy intensity is reduced
- renewable resources substitute for conventional inputs
- re-use and re-cycling at maximum feasible levels
- hazardous substance emissions decrease radically
- Use heavy metals (e.g., lead, cadmium and mercury) are tightly restricted

TOURISM

- tourist industry benefits from general environmental improvement
- environmental management systems are introduced within the tourism sector (including certifying and labelling)
- the sector significantly reduces energy and water use, waste and pollution at resorts, hotels and other facilities

TRANSPORT

- NWBR reduces energy consumption 15% by 2010 by introducing a fuel standard for new passenger cars of 4 litres per 100 km
- SEBR stabilises energy consumption by 2010
- SEBR toxic emissions are rapidly reduced by incentives to accelerate the turnover of the vehicle fleet (e.g., NOx emissions are reduced by 25%)
- additional urban sprawl is avoided through integrated land-use and traffic planning
- personal transport (person-km) and freight transport (ton-km) are reduced by 50% by 2030.

Source: BA21 sector reports

3.2. Driving Forces and Key Actors

The sustainability scenario discussed above assumes:

- reasonably ambitious international agreements on reduction of CO_2 emissions (otherwise strict sustainability policies in the BSR may damage the competitiveness of firms in this area);
- a co-operative climate between nations in the BSR (as well as at the pan-European level), and accord among political leaders regarding the importance of sustainability;
- sufficient public support for a policy of sustainability; and
- changing consumer demand toward durability of goods, more services and less material-intensive products.

Many factors will shape the future of the Baltic region. Some are external and only partially in the control of the region through participation in global processes — economic globalisation, global environmental change, cultural influences, information technology, and migration pressure. At the same time, the regionally-specific evolution of market factors, policy and human values can critically influence the pathway to the future.

Market Drivers

Some steps on the path towards sustainability may be taken without any specific policy measures. In a market economy, production and consumption are largely determined by the interplay between consumers and producers. Firms respond to demand, but also seek to influence demand by introducing and promoting new products.

Consumer-driven change (*demand pull*) toward sustainability could result from the emergence of values supporting environmentally-certified products, green consumerism and demand for local products. The stimulation of this market could come from firms whose products cater specifically to these demands, from information and education campaigns mounted by both government and NGOs and from deeper value changes, as discussed below. Technology-driven change (*technology push*) arises as enterprises position themselves in the market place through innovative products and cost reducing technologies. Examples are trends toward miniaturisation of computers and other IT applications, product dematerialisation and modular production units.

In many cases demand pull and technology push interact. An example of the co-evolution of demand and technology is the development of mobile telephones. Technological innovation initially put a new product on the market. Once there, further product development has been influenced by consumer preferences.

The Policy Dimension

Government provides a framework of rules and incentives that shapes markets, fosters stability, and promotes social goals. Policy is the vehicle for reconciling the disparate activities of the market with the *common good*. It is well understood that environmental externalities that are not reflected in market prices must be handled through policy intervention that internalises costs or through direct regulation. The same considerations apply to social and equity goals that are not automatically addressed through market mechanisms.

In addition, the sustainable development imperative suggests that government must act as a trustee for future generations, charged with steering development in a direction that is compatible with the long-term preservation of environmental quality. Co-operation among BSR nations must also be stressed in the context of the regional sustainable development process. This, of course, will be a process over time, where the views of different parties gradually converge. In addition to developing a harmonised institutional and policy framework, governments can make direct investments in infrastructure, influence trade and financial flows in the region, and promote education, research and culture.

Human Values

Prevailing attitudes and values shape markets, the political process, and civil society. At one extreme, if the influences of the global economy and market cultural norms dominate, individualism and consumerism may prevail as drivers of market growth and materialistic lifestyles. At the other extreme, an alternative model may come into prominence that places great value on the environment, social fairness, concern for future generations, and qualitative aspects of the life experience. While the former set of values seems ascendant under conventional development conditions, the alternative vision will require the emergence of a new sustainability paradigm. Information and education campaigns can influence attitudes, enhance awareness, and alter consumer demand in directions more compatible with sustainability. The participation of civil society in this process will be critical.

4 Discussion

The task of Baltic 21 is to propose an agenda for a sustainable BSR directed toward political leaders. In this context, it is important to emphasise the roles of political co-operation, regulatory policies, and economic incentives in the transition to sustainability. At the same time, it is important to underscore that success requires the support of many actors, in particular, consumers, voters, business firms and innovators. Similarly, the sector reports tend to stress a technology-push approach, with several recommendations on appropriate R&D. The notion of the co-evolution of consumer demand and technological opportunities suggests that attention be paid to consumer demand, and the values and preferences that lie behind that demand.

As a complement to the Action Plans in the sector reports, the integrated scenario perspective suggests a broader political challenge, namely the mobilisation of the general public for the cause of sustainability. This does not imply that everybody must become an idealist who acts according to the common good, regardless of personal benefits. Rather, what is needed is a widespread willingness to accept the adoption of rules and incentives that promote behaviour that is sustainable in the aggregate.

The sustainability problem is a kind of *social dilemma*, as studied in social sciences and game theory.[13] A classic example of a social dilemma is the "tragedy of the commons" in which a group of people shares a common resource, e.g., a fishing ground. Since over-use will ruin the resource for everyone, it is in the common interest to restrict exploitation to a sustainable level. Yet, individuals are tempted to take as large a share as possible, because if they do not, others may do so and ruin the resource, making individuals double losers. The rationality of the individual is in conflict with the rationality of the group.

Situations like the tragedy of the commons occur at all levels of human interaction, among individuals, companies and political entities. For example, the dilemma arises when national governments weigh national commitments on CO_2 emissions in order to promote a global goal, or when urban commuters must choose between a convenient but polluting trip by car or a less convenient but cleaner trip by some means of public transport. The Sustainability Vision rests on the assumption that a majority favours — or at least tolerates — a set of measures that change individual and corporate behaviours to align with the aggregate goals set by sustainability principles. Achieving the common objectives is seen as desirable from an individual point of view.

The degree to which a broad commitment to sustainability values is weak will determine the strength of the resistance to policies that restrict individual choice in order to attain a common goal. How would this affect the prospects of the scenario?

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[13] See e.g., Robert Axelrod (1984), *The Evolution of Cooperation*, Basic Books, New York; Garret Hardin (1968), The Tragedy of the Commons, *Science*, Vol.162 (1968), pp 1243-8, Elinor Ostrom (1990), *Governing the Commons: The Evolution of Institutions for Collective Actions*, Cambridge University Press.

- Taxes and regulations to promote efficiency and reduce pollution would be difficult to implement. An important example is the degree of reliance on private cars.
- Technological improvements may not have the desired effect. Many consumers seem to prefer that improved energy efficiency lead to stronger and faster cars, rather than lower petrol consumption.
- Incentives for changes in production technology (e.g. cleaner, more energy-efficient processes) may be constrained so as to not significantly affect the product delivered to the consumer.
- Demand pull from consumers for greener products might be minimal.

On the other hand, a popular resurgence of civic and green values may arise over the coming decades. This may come as a reaction to the degradation of the environment and to increasing social segregation. Political activism for sustainability may take the form of both renewal of traditional political formations and grass-root movements motivated by environmental and community values, and of a search for more meaningful lifestyles.

How would such changes in values and popular involvement in societal issues affect the prospects for the sustainability scenario?

- Politics would become more "bottom-up" with a stronger focus on local and regional issues. The urban environment and the accessibility of recreational areas of high quality in the countryside might attract more attention than, say, the greenhouse effect.
- Many people would be prepared to change behaviour in accordance with civic and sustainability values. Life-style changes that reduce environmental impact would be easier to implement, such as use of public transportation rather than private cars.
- Consumer demand would become "greener" and more directed towards locally produced goods. A demand-pull effect would draw industry toward producing more durable and dematerialised goods and to abandon hazardous inputs.

The emergence of popular values supportive of sustainable development is a precondition for the sustainability scenario along with appropriate policies, technological change and multinational agreements. Greater environmental awareness and sensitivity to the implications of value choices could be fostered through:

- more emphasis on norm formation and civic values in school curricula;
- better education on the human impact on the environment;
- strengthened environmental programs in technical education;
- information campaigns; and
- moral leadership from political leaders.

Given the limited scope of this study, the scenarios presented here are necessarily provisional and indicative. Still, they help clarify the questions of where the region might be headed and where it could go — and provide a basis for gleaning key strategic requirements for sustainability in the region. As the Baltic 21 initiatives proceed, the elaboration of integrated policy scenarios for a sustainability transition will be a key tool for analysis and motivation.

The BSR is at a crossroads. If the region muddles along a conventional path of development it risks the deterioration of its natural endowment and the persistence of social and economic inequities. On the other hand, if it is able to keep the momentum of Baltic 21 going and seize opportunities, there is the possibility of launching a transition toward a sustainable development scenario. The technologies and instruments are available. The question is whether the values, institutions and political will can be galvanised to seize the historic opportunity.

Then, the region will look back from the vantage point of the year 2030 with pride that it was a global vanguard in the long transition from a future rife with environmental and social perils to one rich in possibilities — from conventional development to sustainable development.

ANNEX: DATA TABLES FOR 1995

A-1. Population and GDP

Country	Population, 10^6	GDP (PPP$), 10^9	GDP/Cap (PPP$)
Denmark	5.2	123	23,525
Finland	5.1	108	21,135
Germany	81.6	1,763	21,612
Norway	4.3	102	23,580
Sweden	8.8	178	20,273
Estonia	1.5	6	4,295
Latvia	2.5	9	3,386
Lith	3.7	16	4,171
Poland	38.6	228	5,915
Russia	148.5	693	4,667
NWBR	105.0	2,274	21,653
SEBR (ex. Russia)	46.3	259	5,584
Baltic	299.8	3,226	10,759

A-2. Structure of GDP

		Share of GDP	
Country	Agriculture	Industry	Services
Denmark	3%	28%	70%
Finland	4%	35%	61%
Germany	1%	36%	63%
Norway	2%	32%	66%
Sweden	2%	30%	69%
Estonia	7%	26%	67%
Latvia	8%	29%	63%
Lithuania	9%	33%	58%
Poland	5%	37%	58%
Russia	6%	37%	57%
NWBR	1%	35%	64%
SEBR (ex. Russia)	6%	36%	58%
Baltic	3%	35%	62%

A-3. Primary Energy Requirements

Country	Primary Energy, PJ	Intensity PJ / 10^9PPP$	Shares by Fuel Type: Coal/ Peat/Shale	Oil	Natural Gas	Uranium	Hydro	Biomass / Renewable	Imported Electricity
Denmark	931	7.6	36%	48%	10%	0%	0%	6%	0%
Germany	14,639	8.3	28%	42%	18%	11%	0%	1%	0%
Finland	1,435	13.3	19%	40%	8%	15%	3%	13%	2%
Norway	1,260	12.3	3%	47%	11%	0%	35%	4%	0%
Sweden	2,201	12.3	5%	35%	1%	36%	10%	12%	0%
Estonia	248	38.8	64%	24%	8%	0%	0%	5%	0%
Latvia	187	21.7	8%	55%	16%	0%	6%	11%	4%
Lith	357	22.9	3%	47%	21%	24%	1%	3%	1%
Poland	4,194	18.4	71%	16%	8%	0%	0%	4%	0%
Russia	27,967	40.4	17%	28%	47%	4%	2%	2%	0%
NWBR	20,466	9.0	23%	42%	15%	13%	4%	3%	0%
SEBR (ex. Russia)	4,987	19.3	63%	20%	9%	2%	0%	5%	0%
Baltic	53,420	16.6	24%	33%	31%	7%	3%	3%	0%

A-4. Final Fuel Demand

Country	Final Demand, PJ	Shares by Sector: Industry	Transport	Households/ Services	Agriculture
Denmark	634	25%	30%	39%	6%
Finland	991	50%	20%	26%	3%
Germany	10,093	37%	28%	34%	1%
Norway	759	41%	25%	30%	4%
Sweden	1,465	41%	23%	35%	1%
Estonia	120	40%	20%	37%	3%
Latvia	158	26%	26%	44%	5%
Lith	213	29%	25%	42%	4%
Poland	2,773	39%	23%	33%	4%
Russia	20,160	54%	7%	31%	8%
NWBR	13,941	38%	27%	33%	2%
SEBR (ex. Russia)	3,263	38%	23%	34%	4%
Baltic	37,365	47%	16%	32%	5%

A-5. Crops

Region	Production (million tonnes)	Requirements (million tonnes)	SSRs*	Yield (tonnes/ha)	Crop Land (kha)	Percent Irrigated
Denmark	11.2	10.3	109%	7.4	2,377	19%
Finland	5.1	5.6	91%	5.1	2,593	2%
Germany	73.0	85.8	85%	9.4	12,015	4%
Norway	1.9	5.1	38%	5.1	901	11%
Sweden	7.8	10.6	74%	5.9	2,782	4%
Estonia	1.0	2.4	42%	3.1	1,145	4%
Latvia	1.9	3.7	52%	3.9	1,740	4%
Lith	3.3	5.6	59%	1.9	3,047	4%
Poland	51.9	56.4	92%	5.5	14,639	1%
Russia	111.7	129.8	86%	2.1	132,302	4%
NWBR	99.4	117.4	85%	8.3	20,668	6%
SEBR (ex. Russia)	58.3	68.1	86%	4.9	20,571	2%
Baltic	269.5	315.3	85%	3.4	173,541	4%

* SSR = Self-Sufficiency Ratio = Production / Requirements

A-6. Water

Region	Total Withdrawal 10^6 m^3	Use/Resource Ratio	Withdrawals by Sector Industry	Agriculture	Domestic
Denmark	1,199	9%	27%	43%	30%
Finland	2,204	2%	85%	3%	12%
Germany	46,422	27%	69%	20%	11%
Norway	2,025	1%	72%	8%	20%
Sweden	2,930	2%	55%	9%	36%
Estonia	3,301	19%	92%	3%	5%
Latvia	701	2%	44%	14%	42%
Lith	4,400	18%	90%	3%	7%
Poland	12,280	22%	76%	11%	13%
Russia	117,001	3%	60%	23%	17%
NWBR	54,780	6%	68%	18%	13%
SEBR (ex. Russia)	20,682	16%	80%	8%	12%
Baltic	192,463	3%	65%	20%	15%

A-7. Emissions

Region	CO2* Million Tonnes Carbon	CO2 tC per Capita	SOx Million Tonnes
Denmark	17	3.3	0.4
Finland	16	3.1	0.3
Germany	231	2.8	5.5
Norway	7	1.5	0.1
Sweden	15	1.7	0.1
Estonia	5	3.5	0.3
Latvia	3	1.1	0.1
Lith	4	1.1	0.3
Poland	86	2.2	5.4
Russia	415	2.8	29.8
NWBR	286	2.7	6.4
SEBR (ex. Russia)	98	2.1	6.1
Baltic	799	2.7	42.3

* Energy and industrial sources (excludes land-use change emissions)

A-8. Land-Use Patterns

Region	Total Land Million ha	Shares by Land Type Built	Cropland	Forest	Other	Pasture
Denmark	4,246	8%	56%	11%	19%	8%
Finland	30,459	1%	9%	76%	14%	0%
Germany	34,927	15%	34%	31%	5%	15%
Norway	30,684	1%	3%	27%	69%	0%
Sweden	41,164	1%	7%	68%	23%	1%
Estonia	4,228	1%	27%	48%	17%	7%
Latvia	6,206	2%	28%	46%	11%	13%
Lith	6,482	2%	47%	31%	13%	7%
Poland	30,439	5%	48%	29%	5%	13%
Russia	1,688,850	0.4%	8%	45%	41%	5%
NWBR	141,480	5%	15%	50%	24%	5%
SEBR (ex. Russia)	47,355	4%	43%	33%	7%	12%
Baltic	1,877,685	1%	9%	45%	38%	5%