



# Renewable Energy Potential of Small Island States

*Bengt-Olof Grahn  
Region Gotland, Sweden*

*Building Small Island Resilience to Global Climate Change  
September 20-23, 2016  
Charlottetown, Prince Edward Island, Canada*



# Gotland's geographical location



# Quick reference

**Area:** 3, 140 km<sup>2</sup>

**Coastline:** 800 km including Fårö

**Largest lake:** Bästeträsk, 6,3 km<sup>2</sup>

**Highest point:** Lojsta hed, 82 m above sea level

**Length:** Fårö-Hoburgen 176 km

**Width:** 50 km

# Quick reference

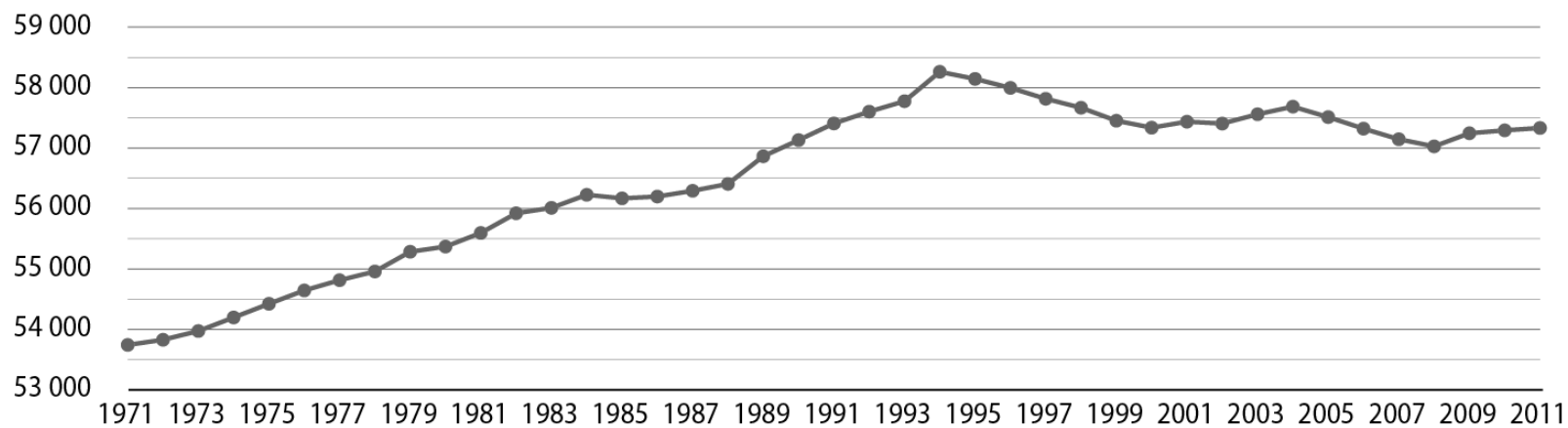
Population: approx 57,300

Visby: approx. 23 400 (40%)



# Quick reference

## Population development 1945-2012



# Vision Gotland 2025

Gotland will be the Baltic region 's most creative and magical place, characterized by nearness, sustainable growth and love of life.



WWW.LEANDERFOTOGRAF.SE : MARCUS JOHNSON

# Vision goals to be achieved by 2025

- At least 65,000 inhabitants.
- Local prosperity will be among the best in the country.
- The natural meeting place in the Baltic region.
- The local population will be in good health and be the most contented in the country.
- **Gotland will be a world leading island region on environmental and climate issues. I` will get back to this**





# Communications to and from...

Excellent communications are vital to the development of the region as a whole



Ferry



Air



# Visby – a living world heritage site

” ... an extremely distinguished example of a Northern European walled Hanseatic town which has in a unique way preserved its townscape and its highly valuable architecture, the form and function of which clearly express the importance of this human settlement.

*UNESCO'S World Heritage Committee*



# Gotland Food Capital of the Year 2013

*"Gotland has thriving agriculture with strong links to innovative food processing. The area boasts high-class restaurants and culinary experiences close to nature, coupled with a drive to increase the proportion of local ingredients in public provided food and to reduce food waste".*



# Business

- One of Sweden´s most enterprising counties, with 7 500 companies.
- The start-up rate for new businesses is among the highest in Sweden.
- Agriculture and food are the largest industries on the island, along with tourism.
- The highest share of female entrepreneurs in Sweden
- Region Gotland is the largest single employer.



WWW.LEANDERFOTOGRAF.SE : MARCUS JOHNSON

# Business, largest employers

Region Gotland	6 000
AB Svenska Spel	425
Destination Gotland	375
Social Insurance Administration	400
PayEx Finance AB	325
Samhall AB	275
Cementa AB	225
Campus Gotland, Uppsala University	225
Attendo Sverige AB	175

Auditors

## Regional Council 2010 – 2014

C 15 – M 15 – FP 4 – S 24 – V 6 - MP7

### Regional Executive Board

#### Committees

Regional Executive Board

Public Works Committee  
Town Planning Committee  
Public Health and Environment

Culture and Leisure Committee  
Childcare and Education Committee  
Upper Secondary and Adult Education Committee

Social Service Committee  
Health and Medical Care Committee

Election Committee  
Public Trustee  
Patient Committee

#### Departments

Executive Office  
Department of Service

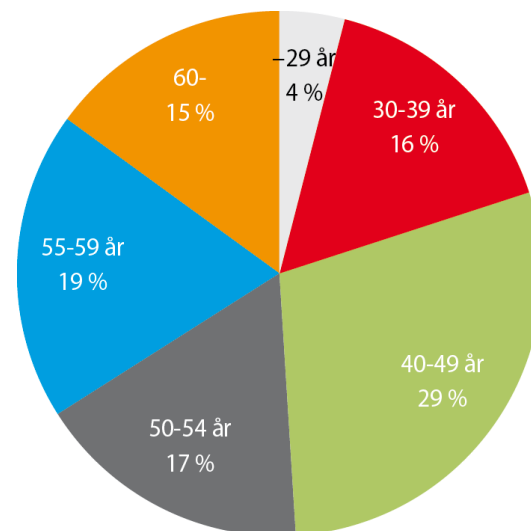
Department of Community Planning and Development  
Department of Technical Services

Department of Culture and Leisure  
Department of Childcare and Education  
Department of Upper Secondary and Adult Education

Department of Social Services  
Department of Health and Medical Care

# Overview of staff

Number of employees 5 953 people  
– of whom 452 as temporary staff  
Average age 49 years  
Average retirement age 65 years



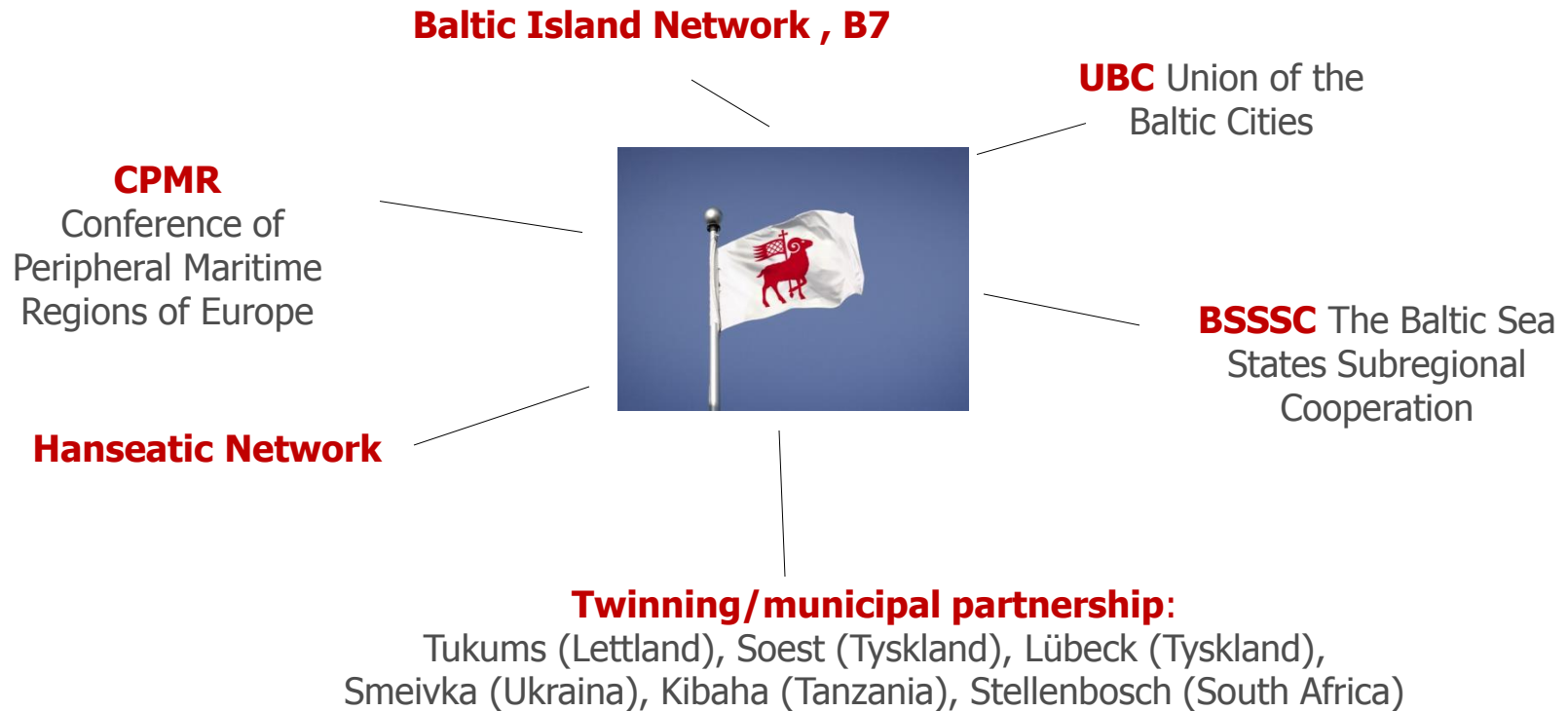
# Region Gotland's remit



- Childcare, schools and adult education, leisure.
- Care of the elderly and the disabled, individual and family care
- Emergency services
- Cleaning, water, streets/roads, parks, harbours
- Environmental protection, animal protection and health & safety



# International cooperation



# Eco-Municipality of Gotland

Gotland is to become a sustainable society within the course of one generation.



## *"Gotland will be a world-leading island region on environmental and climate issues." "What is the path way towards this tough goal?"*

- Gotland has knowledge and several projects in the forefront and active efforts to develop Renewable energy.
- On Gotland, as in many other places, the increased share of sustainable energy is a springboard towards an ecologically sustainable society.
- By 2020, the goal is to meet 100 percent local renewable energy to households and most businesses on the island. Of all fuels to the cement industry about 70 percent will be renewable or recycled by 2020.
- In 2020, provided the new mainland electric cable is on place, the production of renewable electricity on Gotland will be twice as large as the annual electricity needs of Gotland.
- By switching from fossil fuels to renewable energy the greenhouse gas emissions from the energy used for heat, electricity and transportation on Gotland have decreased by 45 percent, from 1990 to 2020. Cement and lime industry fuels excluded. They are part of a European Common quota.
- The cement industry on Gotland has its own vision of becoming climate neutral by 2030.
- Better management of energy has given a reduced need for purchased electricity and fuels at an average of 1.5 percent per year for residential, commercial and service, travel and trade during 2010-2020.

*"Gotland will be a world-leading island region on environmental and climate issues.*

Strategies to reach this tough goal according the plans.

Region Gotland will:

- Implement the conversion of transport and travel behavior in accordance with the energy plan.
- Further development of energy efficient buildings and equipment and set energy requirements in procurement and purchasing.
- Integrate the work on climate adaptation in all urban planning.
- Act climate smart.
- Contribute to increased knowledge on environmental and climate issues among citizens, visitors and businesses. For example, through information campaigns, dialogue forums with industry representatives, etc.

*"Gotland will be a world-leading island region on environmental and climate issues."*

## Constraints and challenges with a goal this tough !

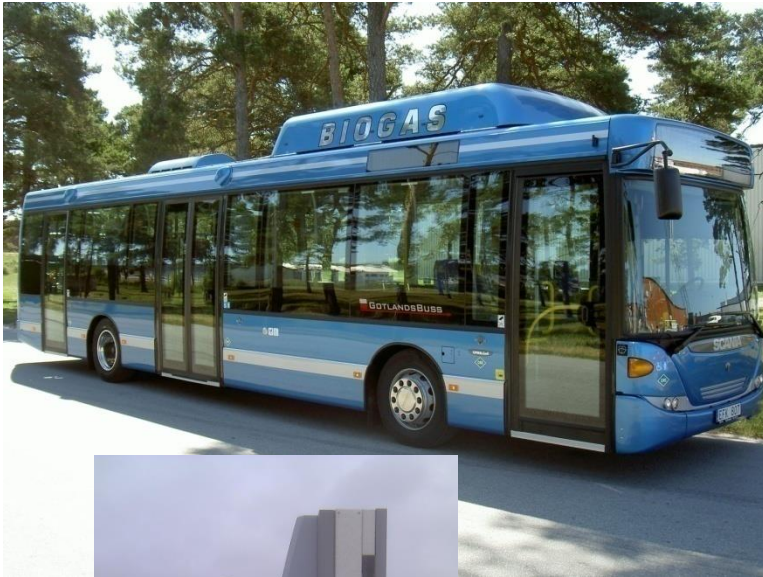
- To develop the University to be extremely competent so it attracts educators as well as students to Gotland.
- To build scientific networks with other countries and become a growth chamber for sustainable development.
- To attract important companies from all over the world and create a "Silicon Valley atmosphere" so to speak.
- To attract more people to come and live on Gotland.
- To make the sustainable investments crucial for this development.



## What is the situation today when it comes to sources for Renewable energy on Gotland?

- The potential of available **farming** waste is high, it can cover the demand from 50 % of the transports on Gotland.
- The areas for production of **crops for energy** are available, corn, beats and green biomass.
- Bro Gas AB produces **20 GWh biogas yearly**, can increase to 40 GWh.
- Gotland has good locations for **wind and solar power**. Installed wind power is approximately 200 MW today. Solar efficiency like in Germany 1 KW=1000 KWh
- Reasonable concentrated CO<sub>2</sub> emissions can be found at the Cement works on Gotland – **POWER to GAS ?** REN energy wind, solar etc.
- Since 2016 we are producing a slurry from our organic **household waste**  
~ **3600 tons for making biogas fuel for cars.**

# Biogas buses, trucks and cars on Gotland



We now have, among municipalities, the second best infrastructure for charging stations for EV's





# Renewable car fuels now available on Gotland

- RME (Rape Seed Oil)
- E 85 (Ethanol)
- Biogas (locally produced)
- HVO (Hydrated Vegetable Oils)
- Electricity
- (Hydrogen can be the next step, made possible with P2G)
- .....

# ■ The future projects

- LNG and LBG for the ferry boats
- Power to Gas
- Hydrogen
- Smart commuting system with aim to reduce the number of cars with only one person travelling ( this is not easy in the country side and it demands good ideas).



Gotland and the new Cruise ship harbour which will be finalized 2018



One of the largest marine cranes in Europe

Two new gas LNG driven ferries  
are coming in 2017 and 2018  
for the connections between  
Gotland and mainland Sweden



Sketch of new ferries  
gratefully submitted by Rederi  
AB Gotland

[www.gotlandsbolaget.se](http://www.gotlandsbolaget.se)



## The Sabatier Process:

Invented by **Paul Sabatier 1927** for which he was awarded the Nobel Prize.

**Wind power** can be used to convert electricity to **hydrogen via** electrolysis and CO<sub>2</sub> emissions **can be captured** and then turned in to **methane** using a metanisation process.

How much of the cement industry's emission is actually CO<sub>2</sub> ?

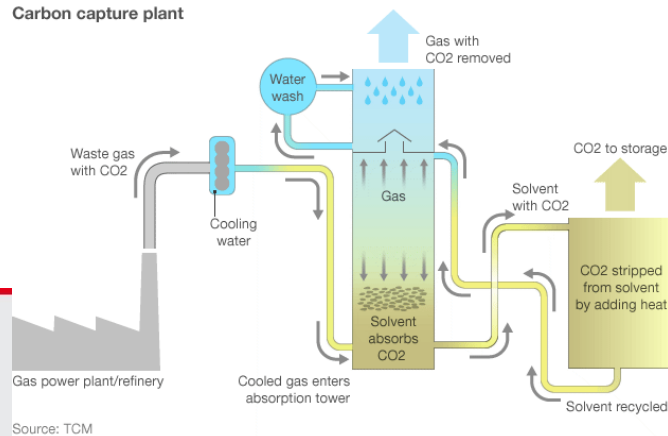
Wasted resources can be used to produce something good.

It is done today in test sites in but not on a large scale.

Project partners on Gotland are now applying for funding to do a market analysis and a business case.

**The future:** Energy storage has always been a problem but in the future a gas grid could be used to store excess wind and solar power by converting electricity to hydrogen. The hydrogen produced can be used for powering vehicles or used in a methanisation plant for conversion of CO<sub>2</sub> to methane. By using the CO<sub>2</sub> emission from the Cement works a big polluting source can be converted into Methane and used to propel vehicles

Carbon capture plant



**Huge challenges lay in the future** for us to solve. Effective logistic solutions without pollution of green house gases needs to be implemented. A society with a big amount of locally produced biogas is therefore favourable.

**Gotland focuses on Biogas as one source for today's and tomorrow's heat production and fuel.** But we will not neglect the progress of other energy sources such as Hydrogen and Electricity. A variety of energy forms will probably be used in the future.

**Fast, smart logistic transports are needed even more in the future !**





# What is needed to boost the process?

- **Political actions to enhance the incentives for a further step towards more use of biogas**= methane as one energy source. Decisions are often made and not durable over time, Ethanol came up fast but was not the best in long term.
- **Smart multi-level governance to overcome bottle necks when it comes to domestic and international regulations.** A good example is the sulphur directive from 2015 for the Baltic Sea. Prohibition of crude oils and heavy diesels has created a market for new technologies like LNG ships.
- **Marketing and promotion** – to the public and companies this must be long term and reliable.
- **End users-** vehicles, ships and in the future even airplanes

# Lessons learned

- Development and changes take time.
- Economy and growth are often slow on Islands.
- It is hard to fully count on the Municipality organisation to reach broad and fast development of sustainable development since the economy often is low.
- Cooperation with local business and companies is very important.
- It is hard to attract people and companies to live and thrive on the islands 12 months a year.
- Political goals and visions are good but must be set on shorter terms, perhaps within mandate periods.
- Building trust and engagement among the island's population is important.
- Creating local demand for the new products.

# REMEMBER !

- The best energy is the energy (KWh) not used at all!  
Savings and more rational use of energy should always come first!

# ■ Thank you for listening & Welcome to Gotland and Sweden

Bengt-Olof Grahn

International Project Coordinator

Dept, Technical Services

Region Gotland

[bengtolof.grahn@gotland.se](mailto:bengtolof.grahn@gotland.se)

[www.gotland.se](http://www.gotland.se)