

STOCKHOLM

Green Economy Leader Report

A report by the Economics of Green Cities Programme at
the London School of Economics and Political Science



THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■

LSE**Cities**

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II. Drivers of Stockholm's green economy

III. Stockholm's policy programmes

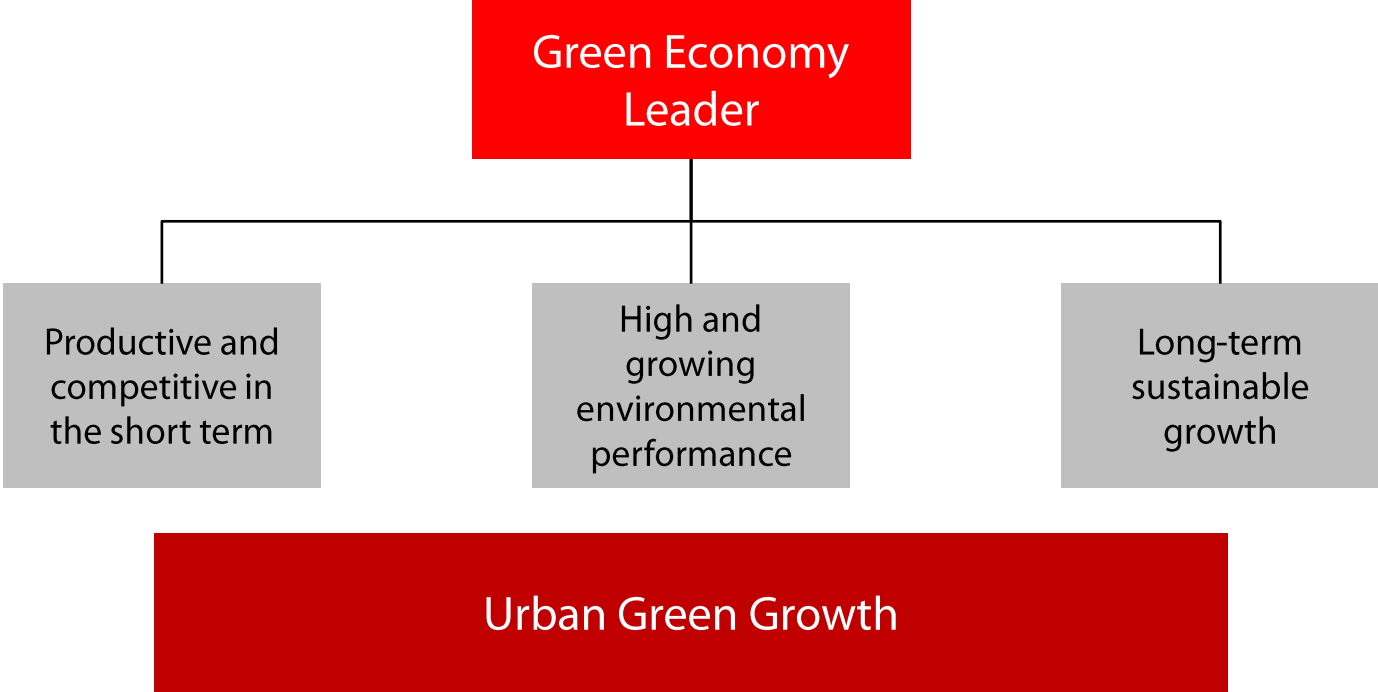
Low carbon energy and resources

Urban form, transport and accessibility

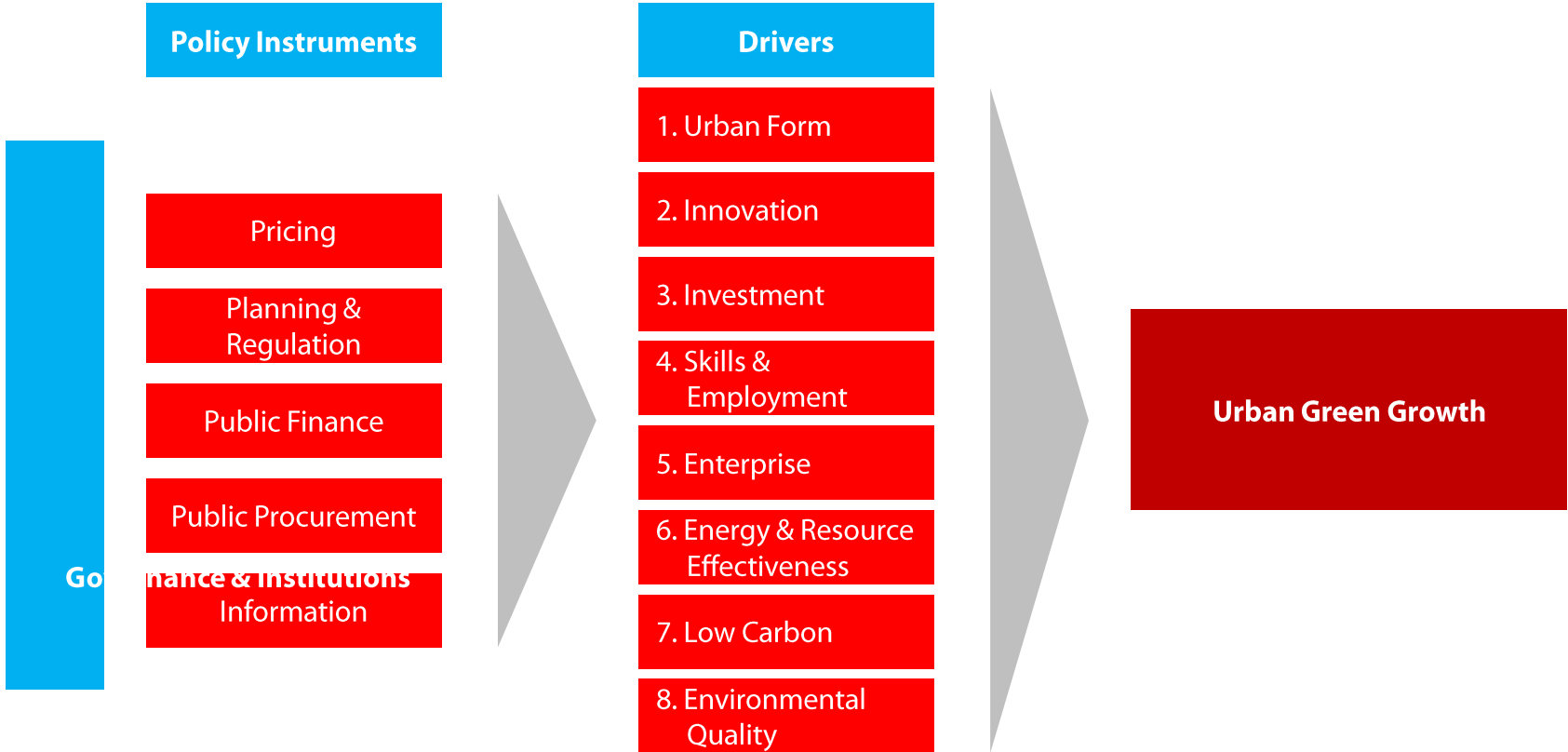
Innovation, business and eco-districts

I. FRAMEWORK FOR ASSESSING GREEN ECONOMY LEADERS

WHAT MAKES A CITY A GREEN ECONOMY LEADER?



8 DRIVERS OF URBAN GREEN GROWTH



II. DRIVERS OF STOCKHOLM'S GREEN ECONOMY

STOCKHOLM'S SUSTAINABLE GROWTH

Swedish GDP per capita - top 15 countries in the world

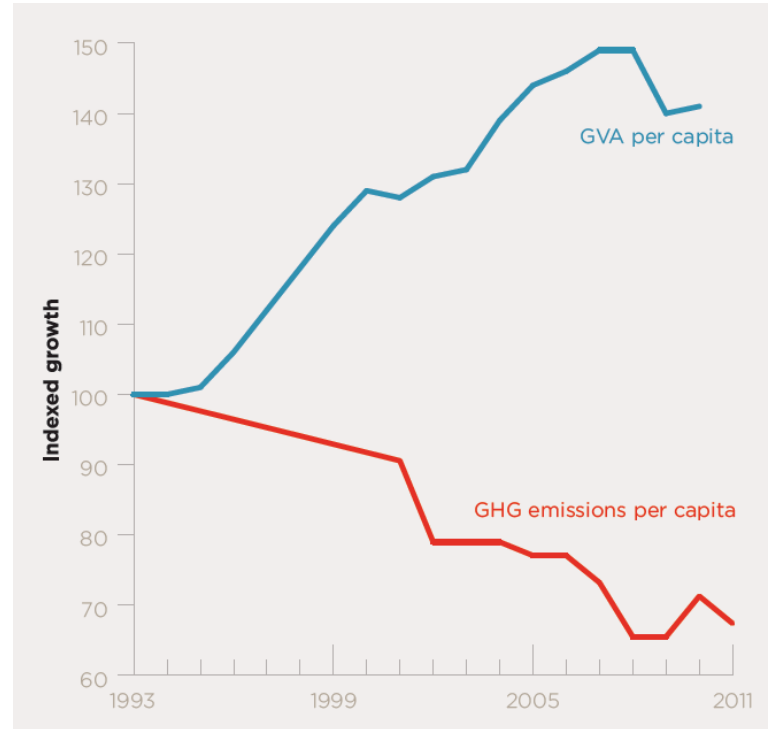
Swedish economy characterised by innovative, hi-tech industry and a large, effective public sector.

The wider Stockholm region accounts for 42% of Sweden's GDP.

Between 1993 and 2009, growth in Stockholm County averaged 4.1% p.a.

Stockholm's strong growth has been delivered while increasing environmental performance and transitioning to a low carbon economy.

Decoupling in Stockholm, 1993 - 2011

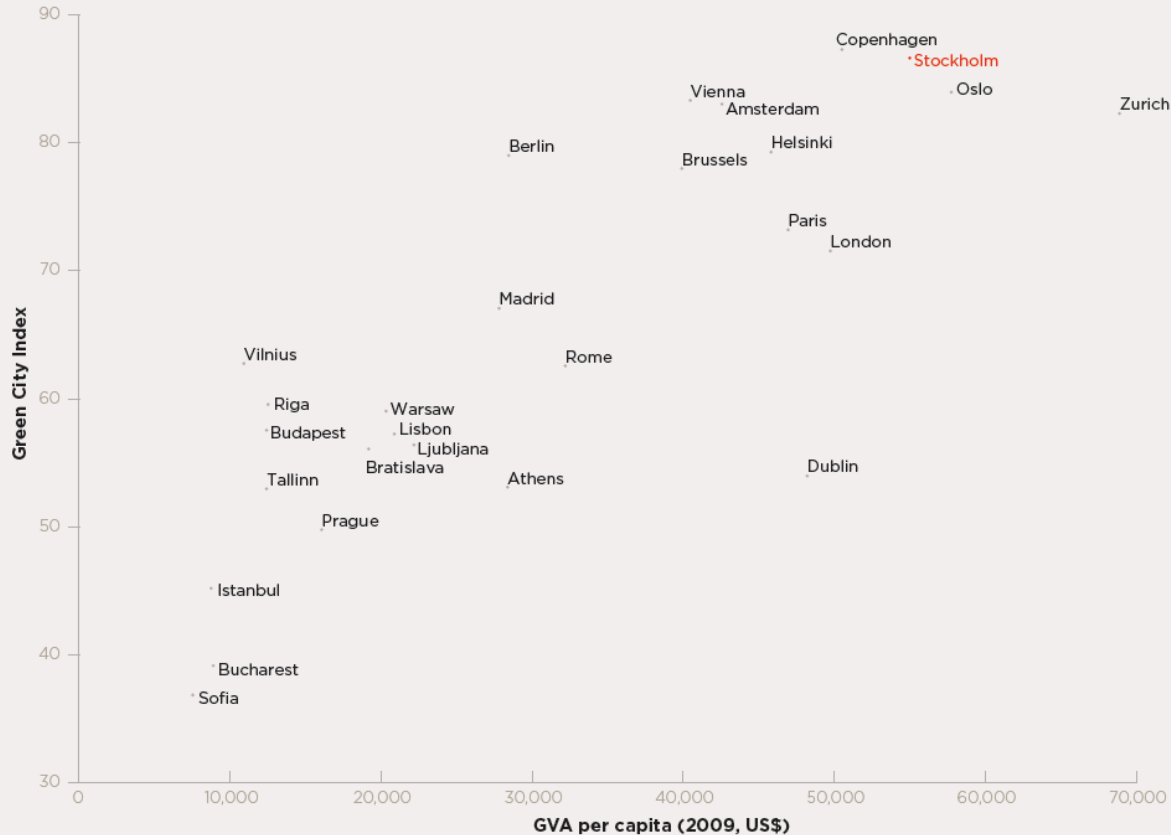


GVA is for Stockholm metropolitan area. GHG emissions are for City of Stockholm.

STOCKHOLM'S GREEN ECONOMY

Figure 3.6
Relationship
between
environmental
performance
and wealth in
European cities

The green index is based on Siemens European Green City Index 2009. Wealth is measured as Gross Value Added (GVA) per capita in 2009.



Sources: Brookings Institution, LSE Cities et al. 2010; Siemens 2009

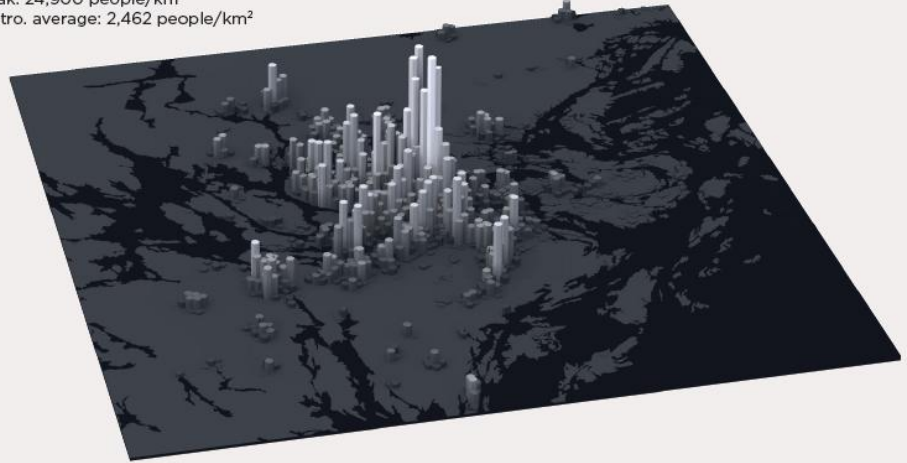
DRIVER 1: URBAN FORM

Development concentrated along the city's main public transport corridors.

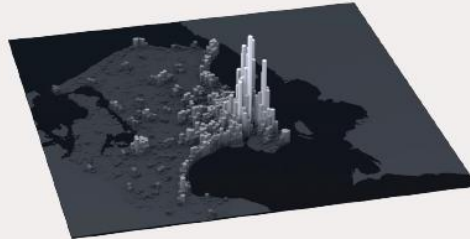
Green wedges contain urban sprawl and contribute to residents' well-being.

Result of early strategic planning beginning in the 1950s.

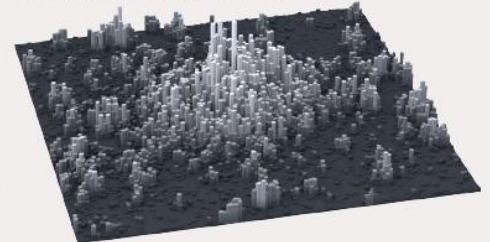
STOCKHOLM
Residential population density
Peak: 24,900 people/km²
Metro. average: 2,462 people/km²



COPENHAGEN
Residential pop. density
Peak: 24,050 people/km²
Metro. average: 2,814 people/km²

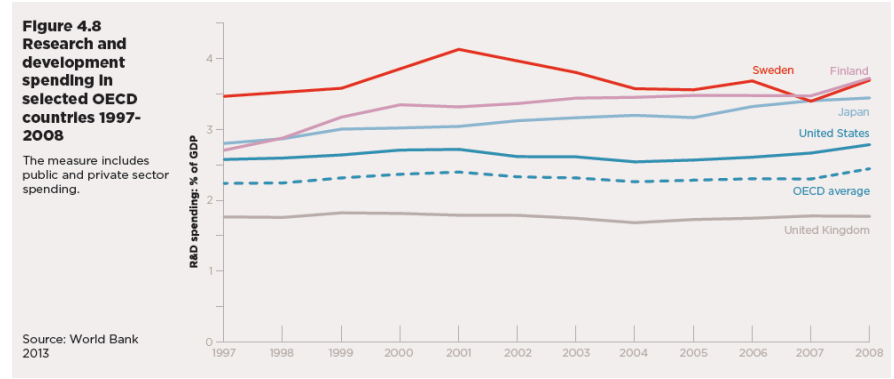
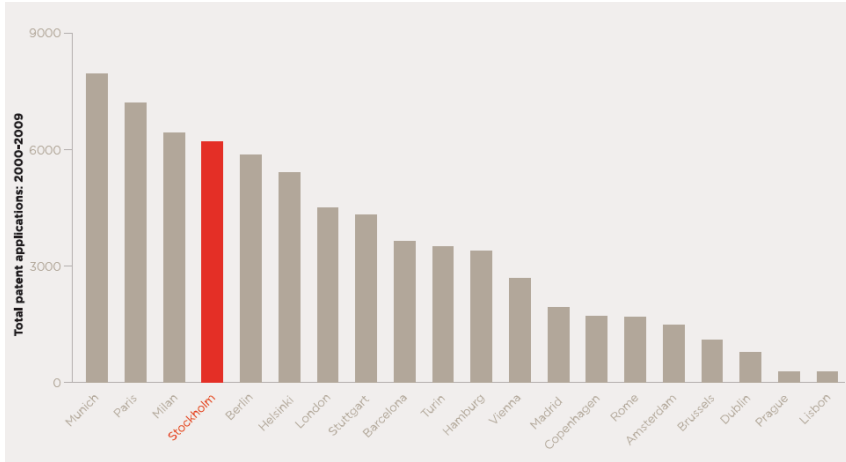


LONDON
Residential population density
Peak: 27,100 people/km²
Metro. average: 4,275 people/km²



DRIVER 2: INNOVATION

Applications to European Patent Office 2000 - 2009 *Spending on Research & Development 1997-2008*



Stockholm has an innovation-led economy with first class universities, research institutions, and public private technology centres.

At the national level, Sweden ranks first on the EU's Innovation Union Scoreboard.

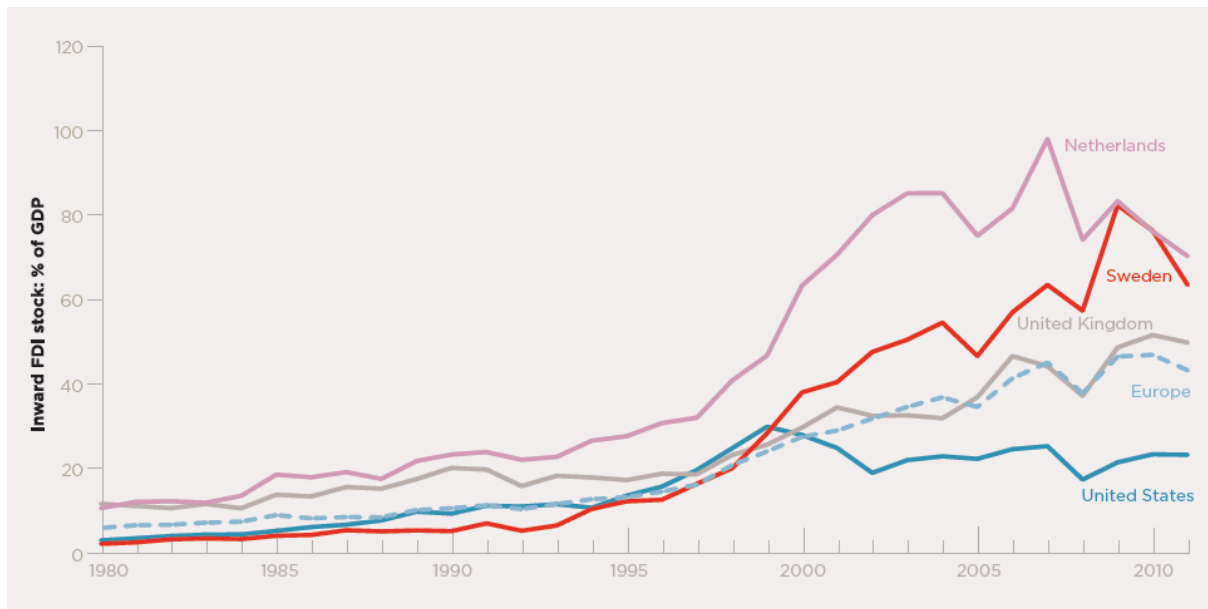
At 3.7% of GDP, private and public spending on R&D is one of the highest in the world.

DRIVER 3: INVESTMENT

Inward investment has grown strongly in Stockholm over the last 10 years, particularly in the high-end services sector.

Sweden has one of the highest levels of inward foreign direct investment in the world - higher than that for the United States, Japan or Brazil.

Growth in the stock of inward Foreign Direct Investment (FDI) 1980-2011



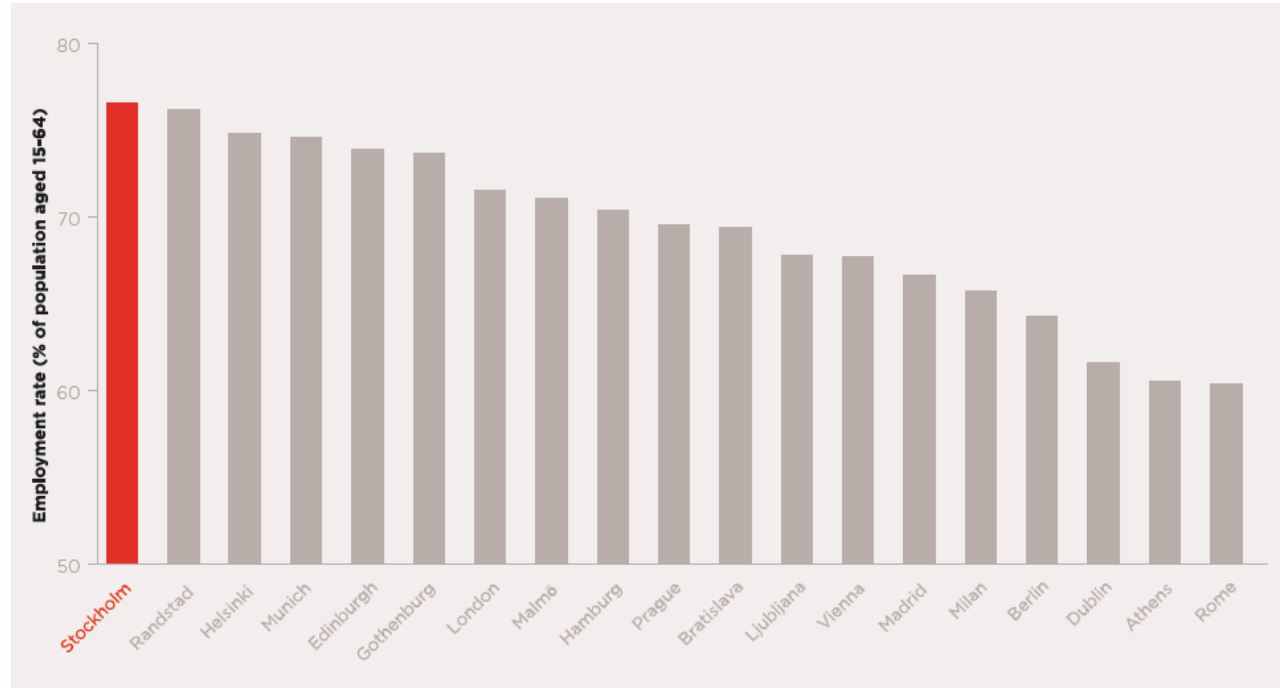
UNCTADStat 2012

DRIVER 4: SKILLS AND EMPLOYMENT

Average employment rates in European urban regions, 2001-2010

Stockholm has one of the highest employment rates in Europe, averaging 77% over the last 10 years.

The city also has a highly skilled workforce, providing talent for productive knowledge-economy sectors.

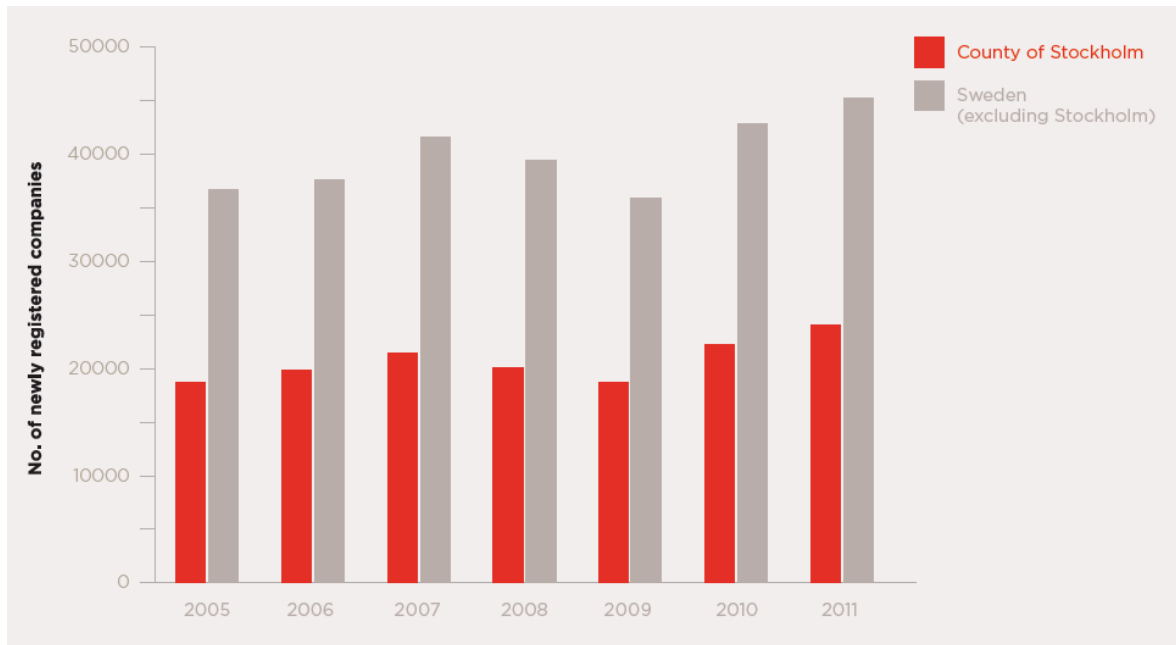


DRIVER 5: ENTERPRISE

Stockholm's business environment provides start-ups and SMEs with opportunities to enter and compete fairly in markets and access substantial venture capital.

Over 24,000 companies were newly registered in 2011 - 29% higher than in 2005, despite the global economic downturn.

Newly registered companies in Stockholm and Sweden, 2005-2011



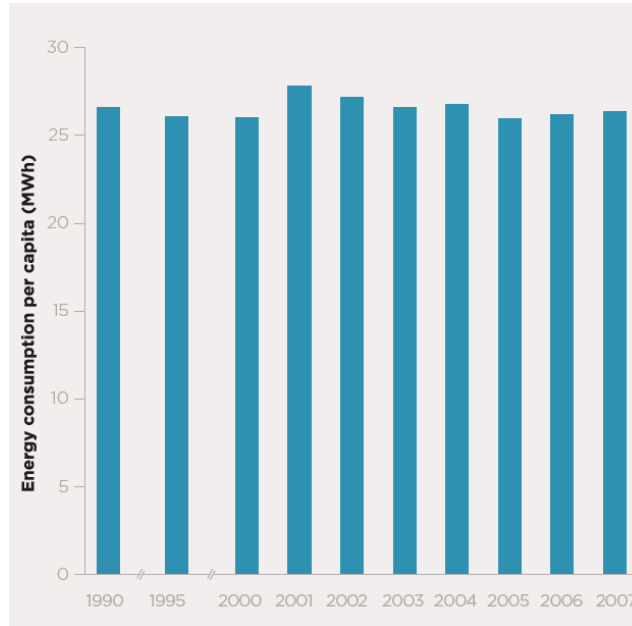
City of Stockholm 2012

DRIVER 6: ENERGY AND RESOURCE EFFECTIVENESS

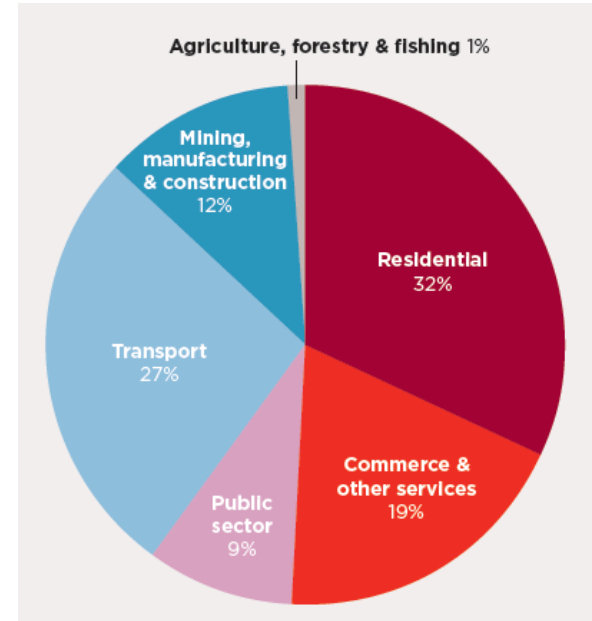
Stockholm County's energy consumption per capita is lower than the national average due to lower industrial activity.

But since 1990, overall energy use in the county has remained unchanged.

*Energy consumption per capita,
Stockholm 1990 - 2007*



*Energy consumption by sector,
Stockholm 2004*



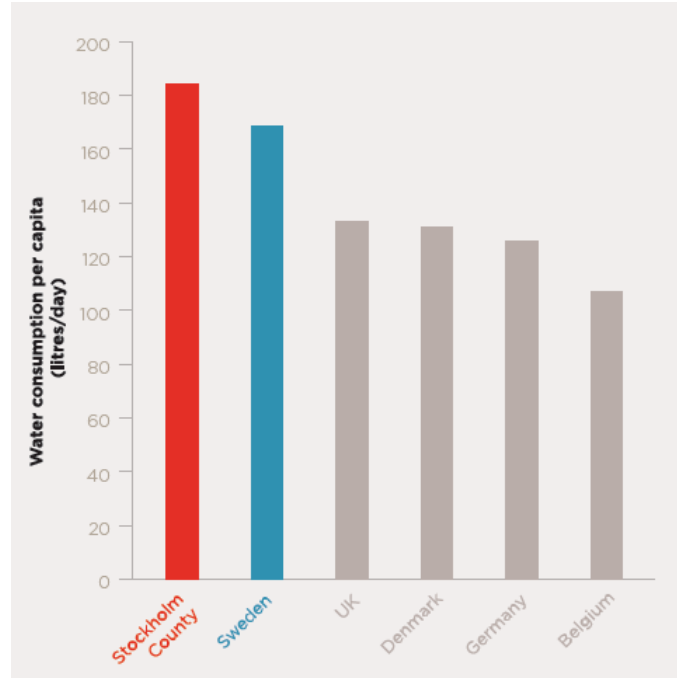
City of Stockholm 2012

DRIVER 6: ENERGY AND RESOURCE EFFECTIVENESS continued...

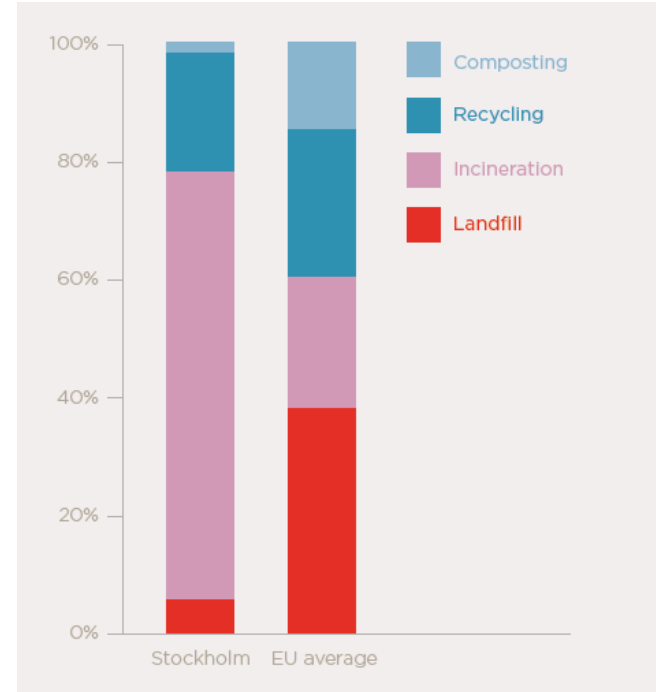
Water use in Stockholm remains substantially higher than the European average, but water security is strong

Waste incineration for district heating maintains high demand for waste, while composting and recycling rates are relatively low

Domestic water consumption 2008



Municipal waste treatment, 2010

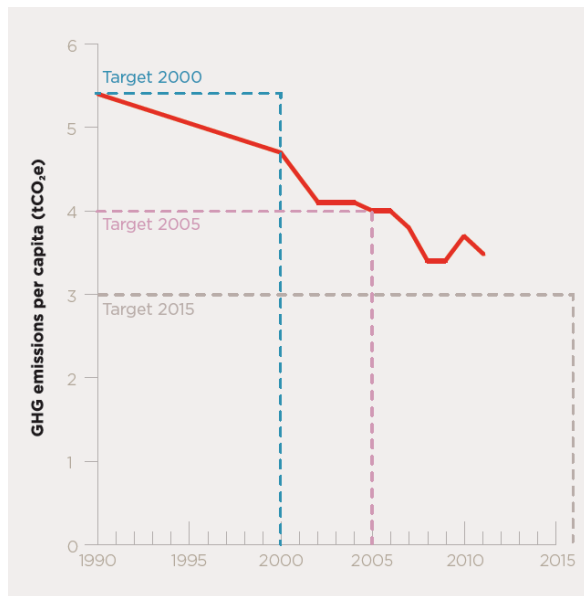


DRIVER 7: LOW CARBON

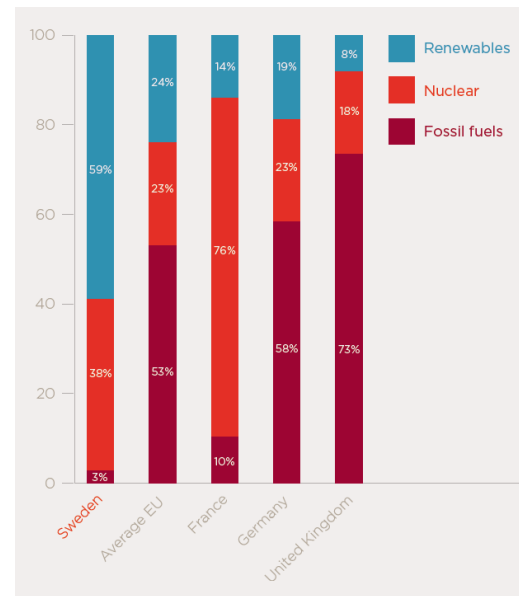
At 3.5 tCO₂e per person, Stockholm has one of the lowest levels of greenhouse gas emissions in Europe.

The national grid is 97% low carbon, while Stockholm's extensive district heating system increasingly uses waste and biofuels.

*GHG emissions,
City of Stockholm*



*Low carbon electricity
generation, 2009*

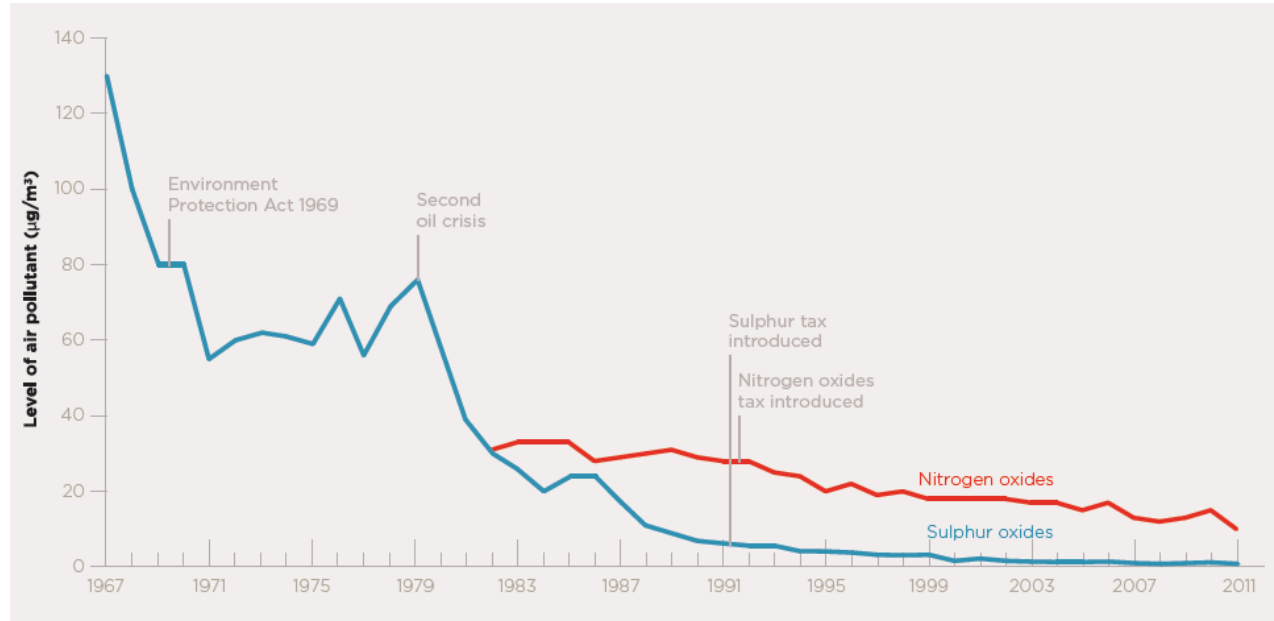


DRIVER 8: ENVIRONMENTAL QUALITY

Policies have successfully reduced SO_x and NO_x in the air, as well as phosphorus and nitrogen in the surrounding lakes.

But PM_{10} levels remain above World Health Organisation guidelines.

Air pollution, Stockholm, 1967 - 2011



City of Stockholm 2012

OVERALL, STOCKHOLM'S 8 GREEN ECONOMY DRIVERS RANK HIGHLY

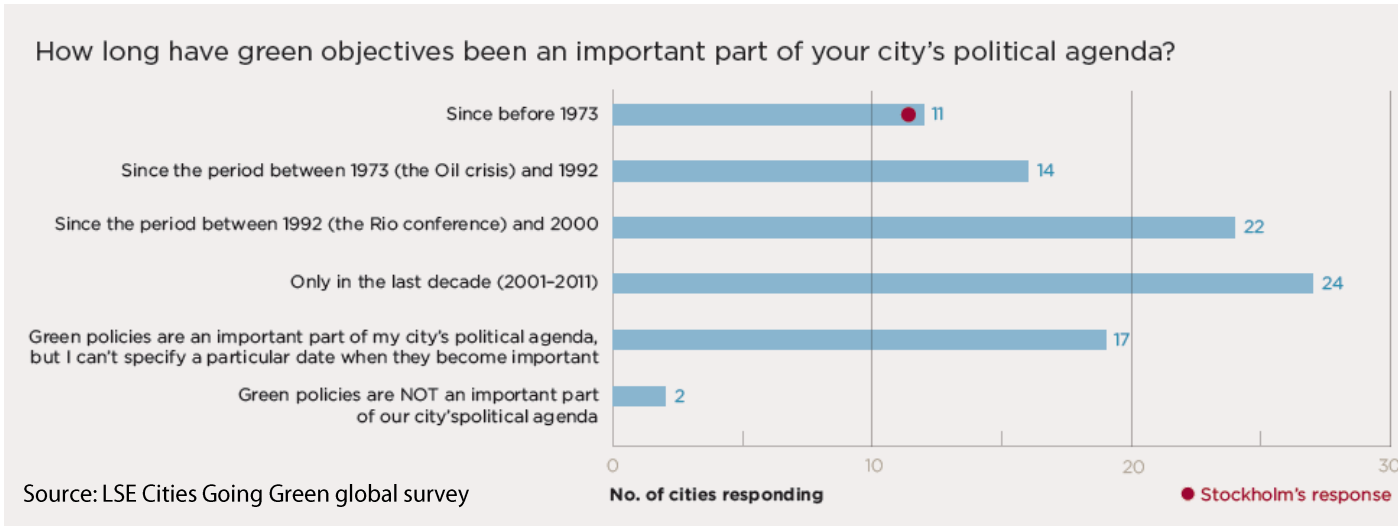
Seven of Stockholm's drivers rank among the best in Europe and the world.

One driver - energy and resource effectiveness - has significant potential for future policy support. Particularly, energy efficiency, waste management and water efficiency.

Barriers to clean technology start-up companies and small and medium-sized enterprises (SMEs) are worth further investigation.

III. STOCKHOLM'S POLICY PROGRAMMES

STOCKHOLM TOOK EARLY ACTION ON GREEN POLICIES



Triggers prompting early action green policies over the last 50 years:

- population growth and building the city's metro system
- pollution and the rise in environmental awareness
- oil crises of the 1970s and expansion of district heating
- 1992 Rio Earth Summit
- 2004 Olympic bid

...BUT WHAT ABOUT THE FUTURE?

If Stockholm is to maintain its international competitiveness, high levels of environmental performance and long-term sustainable growth, it will require integrated policy programmes that can deliver effectively and efficiently.

Three broad strategic areas are of particular importance to Stockholm's future as a green economy leader:

- Low carbon, energy and resources

- Urban form, transport and accessibility

- Innovation, business and eco-districts

LOW CARBON, ENERGY AND RESOURCES

KEY CHALLENGE: MEETING STOCKHOLM'S 2050 LOW CARBON GOAL

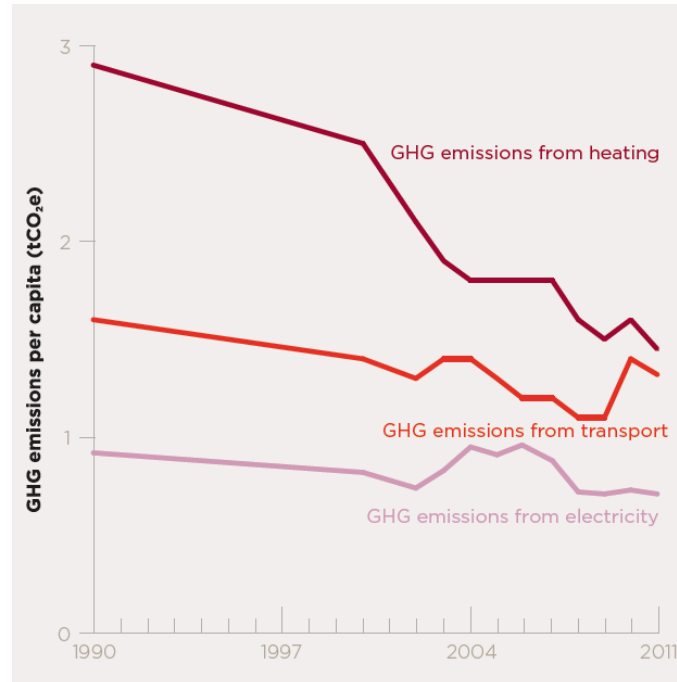
Stockholm's 2050 goal to become fossil fuel free is long-term – but it is also ambitious.

Requires strong and early policy action over the next few years to overcome long-term lock-in of high carbon infrastructure, systems and technology.

Key strategic areas for decisions:

- Energy for heating
- Energy for transport
- Electricity

GHG emissions, Stockholm, 1990 - 2011



ELIMINATING FOSSIL FUELS FROM HEATING

Requires an integrated approach to:

- energy efficiency of buildings
- district heating
- energy from waste incineration

Strategic pathways include:

1. switching district heating fuel sources from coal and waste to biofuels and other renewables
2. a mixed waste and biofuels approach with carbon emitting plastics being phased out of waste incineration
3. carbon capture and storage
4. carbon offsetting
5. replacing the district heating system entirely with a combination of electric heating and micro-renewables on buildings



ELIMINATING FOSSIL FUELS FROM TRANSPORT

Requires an integrated approach to:

- public transport
- clean vehicles
- electric mobility.

Strategic pathways include:

1. investing further in sustainable transport modes
2. incentivising biofuels for vehicles
3. incentivising electric or hydrogen vehicles
4. incentivising a mix of vehicle technologies

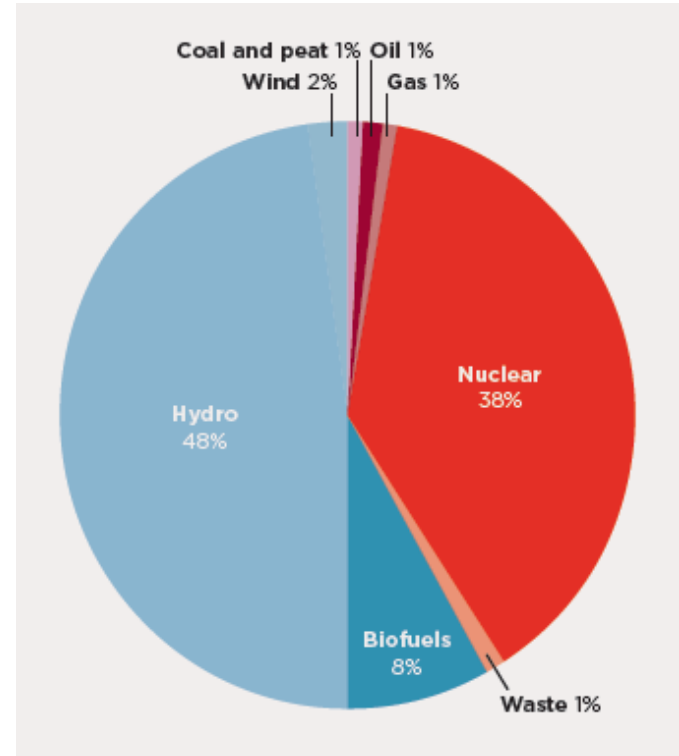


ELIMINATING FOSSIL FUELS FROM ELECTRICITY SUPPLY

Decarbonisation of Stockholm's electricity supply will depend heavily on national level policies.

Development of smart grids will be needed for more variable electricity supply from renewables.

Sources of electricity generation, Sweden, 2009



URBAN FORM, TRANSPORT AND ACCESSIBILITY

KEY CHALLENGE: **maintaining a compact city and** **strengthening public transport**

Benefits for the green economy:

A transport system that is low-cost, low-carbon and resource efficient

An accessible region facilitating agglomeration economies:

- job matching
- larger labour pools
- knowledge spill overs
- firm clustering

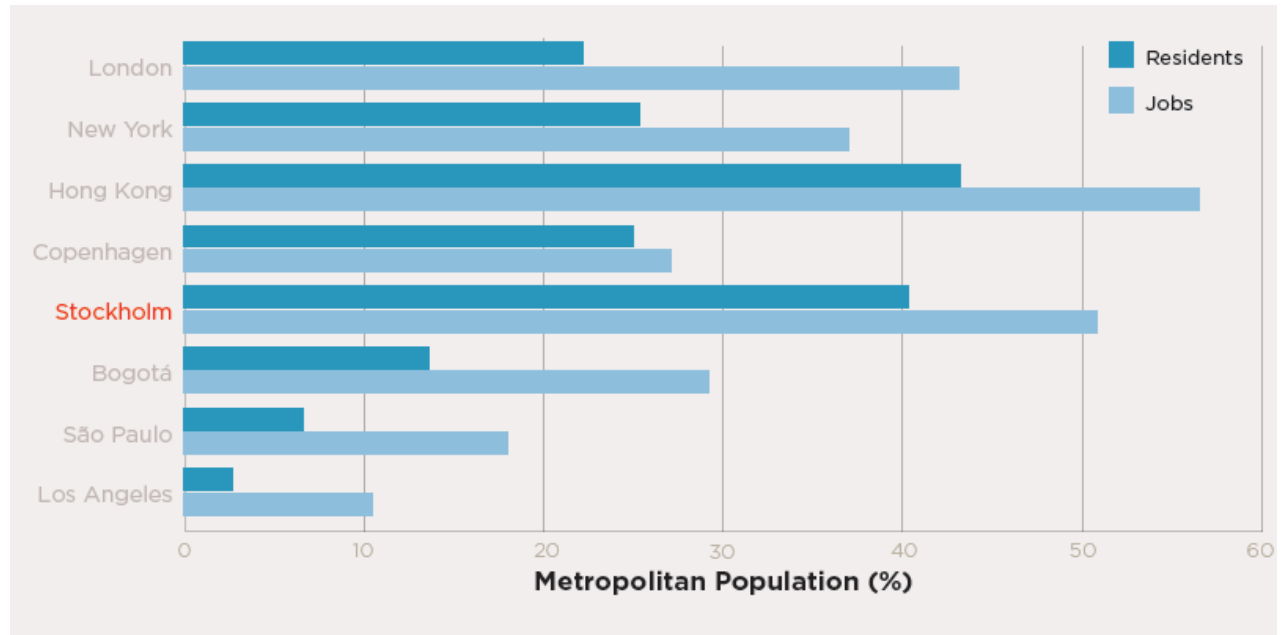


PUBLIC TRANSPORT ACCESSIBILITY IS RELATIVELY HIGH

Public transport accessibility is exceptionally high for both workplaces and residents.

Stockholm profits from strong agglomeration advantages and labour accessibility with peak values of 440,000 economically active people that can be reached within 30 minutes - compared to, for example, 365,000 in Copenhagen.

Residents and jobs in walking distance (500 metres) of public transport stations



...BUT COMMUTING TIMES AND COSTS COULD IMPROVE

Travel survey journey-to-work times (minutes)

Commuting costs may be impacted by segregation of work-places and residential areas. This facilitates workplace clustering but compromises proximity.

	Metropolitan Region					Municipal				
	Public Trans.	Car	Walk	Bike	All	Public Trans.	Car	Walk	Bike	All
Stockholm	46.2	35	16	25	37	38.4	33	16	20	31
Copenhagen	44.8	20	11	15	20	36.2	15	9	12	17
London	-	-	-	-	48	-	-	-	-	43

Total annual value of time costs, journey-to-work (2010 prices)

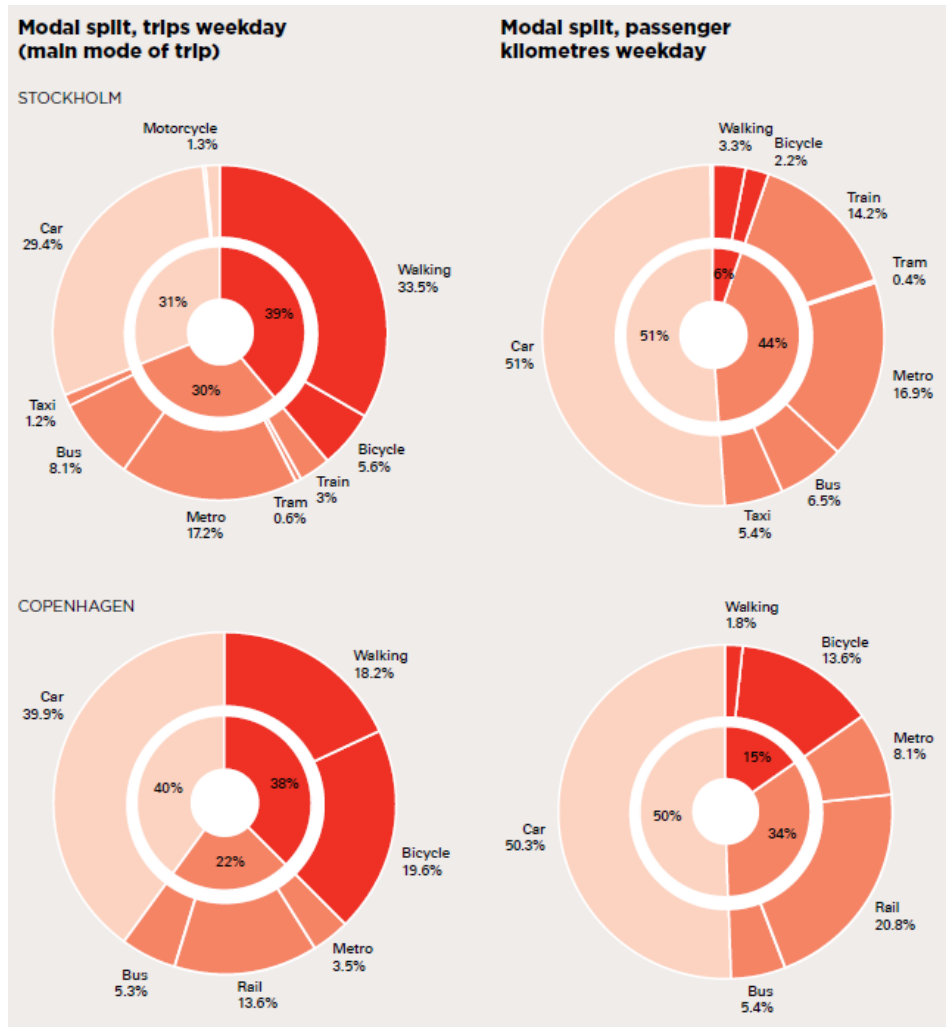
	Cost per commute €	Annual cost per capita €	Metro total annual cost (€millions)	% of GVA
Stockholm	4.62	2,264	1,945	5.84
Copenhagen	2.49	1,224	1,027	3.41
London	6.00	2,937	23,712	8.36

...AND PRIVATE CAR USE STILL DOMINATES

Average distance travelled by car is higher than Copenhagen – contributing to higher transport carbon emissions: 1.4 versus 0.76 tCO₂ per person.

Very high walking rate. Cycling rates are lower than leading cities, though high by global standards.

Potential for more Bus Rapid Transit.



FUTURE CHALLENGES AND OPPORTUNITIES

Mature policy programme to reduce urban sprawl and promote higher density and brownfield-oriented developments. Land use policy well integrated with public transport infrastructure and sustainable transport policies.

But...

- relatively low levels of cycling and bus travel
- car use continues to dominate
- higher distances travelled than comparator cities (eg. Copenhagen)

Potential to...

- focus more directly on strategies to reduce overall travel demand
- strengthen the mix of land uses particularly for new employment nodes
eg. Norra Station and Värtan/Royal Seaport
- introduce further 'push' policies to reduce car ownership and car use
- redistribute public street space from private car use to buses and walking

INNOVATION, BUSINESS AND ECO-DISTRICTS

KEY CHALLENGE: GROWTH OF CLEAN TECHNOLOGY INNOVATION AND INVESTMENT

Stockholm's green growth requires:

- maintaining a competitive business environment
- providing effective support for clean technology innovation, inward investment and enterprise

Policies for stimulating all types of innovation should be encouraged.

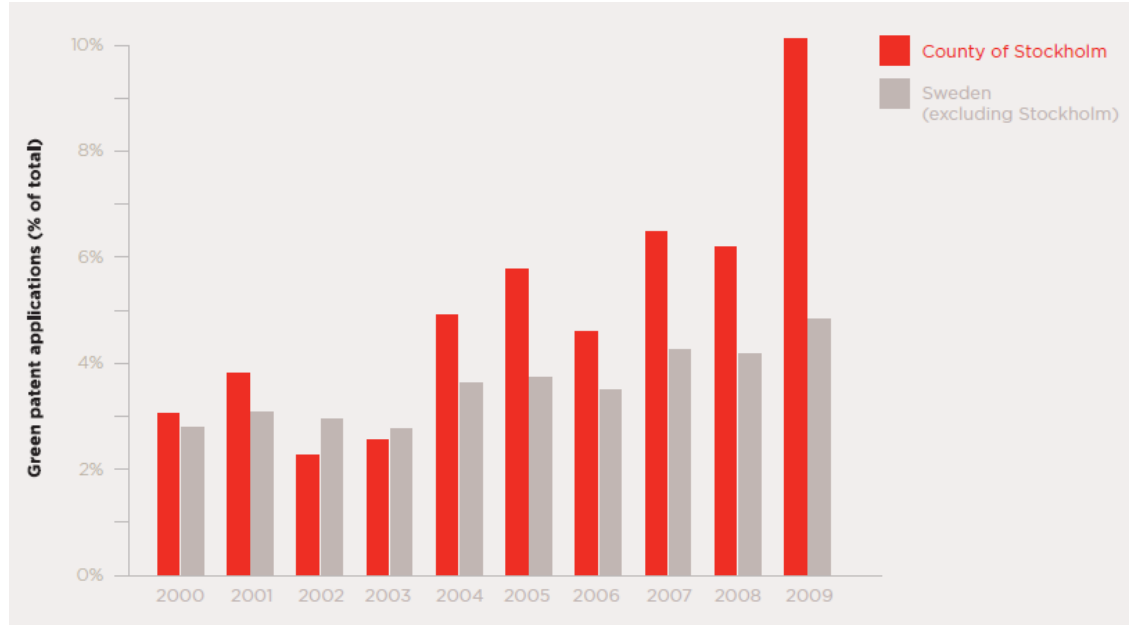
Governments also have a role in supporting green innovation more specifically, as it contributes not only to total factor productivity in the short to medium term but is also necessary for the transition to a low carbon, resource efficient economy – one that delivers higher rates of growth over the long term.

STOCKHOLM IS A RESEARCH AND INNOVATION HUB

Between 1997 and 2008, Sweden spent an average of 3.7% of GDP on R&D compared to an average of 1.8% across Europe.

Among OECD Countries, only Korea, Finland and Israel are investing a higher percentage of GDP in R&D.

Green patent applications from Stockholm companies, 2000-2009



ECO-DISTRICTS HAVE HELPED DEMONSTRATE NEW INNOVATIONS

Hammarby Sjöstad and Royal Seaport make Stockholm a leading city for developing and demonstrating innovative green solutions at the district level.

Further opportunities:

- roll out eco-district innovations in publicly owned buildings
- roll out innovations across existing districts in the private market
- develop additional eco-districts with higher energy efficiency results
- expand export promotion, e.g through Symbiocity

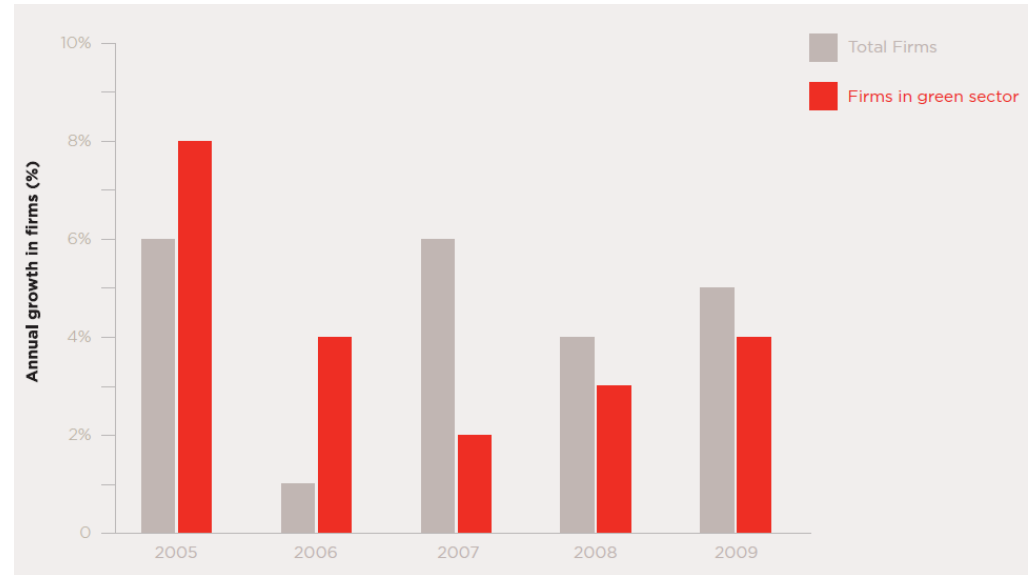


...BUT NOT YET TRANSLATING INTO STRONG BUSINESS GROWTH

Need to examine why policy support for green enterprise from city and national governments has not yet translated into strong growth in the green business sector.

The global market for green goods and services is currently estimated to be around US\$6 trillion. Capturing activity in this large and growing green sector represents a major opportunity of future growth for Stockholm businesses.

Growth of green firms in the City of Stockholm 2005-2009



FUTURE CHALLENGES AND OPPORTUNITIES

Cleantech cluster

- Stockholm's ICT and life sciences clusters are well known.
- Potential to assess benefits and costs of building a stronger, more centralised cleantech cluster.

Green procurement

- The City of Stockholm's spending on goods and services - US\$2.86 billion (2012).
- Green public procurement has substantial potential for shaping green markets.
- Opportunity for more comprehensive green public procurement policies.

Capturing opportunities in growing global markets

- Global market for green goods and services - US\$6 trillion.
- Low carbon building technologies alone - US\$650 billion annually.
- Opportunity to use Stockholm's expertise in green building and eco-district development.

CONCLUSIONS

Stockholm's drivers of green growth are strong

7 of Stockholm's 8 green growth drivers rank among the best in Europe and the world. Energy and water efficiency could be improved.

Policy programmes have supported green growth

Early policy action (with both intended and unintended green consequences) has shaped Stockholm as a Green Economy Leader.

Future challenges and opportunities need a long-term strategic approach

Meeting Stockholm's zero carbon goal by 2050 – integrated policy programmes needed for (1) heating & waste, (2) transport, (3) electricity to avoid carbon lock-in

Maintaining a compact city and strengthening bus routes and cycle lanes

Supporting growth of clean technology innovation and enterprise – undertake an economic impact assessment on a dedicated clean tech cluster