INVEST:SWEDEN

Transportation Systems 2011

Innovation the Swedish way

Developing the vehicles of the future

Sweden has a unique position of strength to lead the development of the automotive technologies of tomorrow.

Sweden has for many years been among the leading vehicle nations with excellence through the complete value chain, from research and design to manufacturing and testing. This makes Sweden the ideal springboard from which to develop the green, safe, intelligent and connected vehicles that consumers will increasingly expect.

Sweden is one of the world's most automotive-intensive countries, with a long and proud history and a strong reputation for innovation and quality, who produce hundreds of thousands of vehicles each year. Sweden is also the birthplace of a number of leading suppliers to the industry, including Autoliv, Haldex and SKF, with all the world's major vehicle manufacturers among their customers. Sweden is one of the few countries that has the competence and experience to develop an entire premium vehicle, from its powertrain to complex electrical and electronics systems, from scratch. The nation's extensive automotive cluster encompasses all aspects of state-of-the-art car and heavy vehicle development.

Sweden can offer incentives to foreign actors looking to perform key technology research in Sweden. The Swedish state has a long history of financing R&D in the automotive industry, and its current initiative, Strategic Vehicle Research and Innovation Initiative (*Fordonsstrategisk forskning och innovation*, or *FFI*), also welcomes applications from foreign companies and organizations.

The Swedish way of collaboration between many stakeholders yields better overall results, and creates benefits in flexibility, time-to-market and costs.

Transportation brands of Swedish origin

Green vehicles

Be part of Sweden's cutting-edge development of electric vehicles and plug-in hybrids for passenger and commercial use. Work with the most demanding OEMs in close collaboration with innovative local clusters.

Safe vehicles

Benefit from Sweden's long and proud tradition in both passive and active safety systems. Foreign automotive actors are invited to participate in government-funded research programs within the safety area.

Intelligent vehicles

Learn from and contribute to Sweden's tightly integrated electronic systems cluster, which brings together innovative minds from the fields of telecommunications, aerospace and the automotive industry.

Connected vehicles

Get involved in the many large-scale projects already rolled out in Sweden, in areas like congestion charging, weather monitoring and speed control. Link up with the leading cluster Telematics Valley.

Tested vehicles

Why build your own facilities when some of the world's most advanced testing centers are available for you to use in Sweden? Advanced simulators and unmatched winter testing facilities in the arctic north are used by the major global OEMs and sub-suppliers. Tomorrow's electric vehicles can be tested charged with carbon dioxide-free and renewable electricity from Sweden's grid.

Excellence today, excellence tomorrow

Sweden is the home of cutting-edge innovation in the fields of green, safe, intelligent, connected and tested vehicles.

The technologies that tomorrow's motorists will expect are already well-established in Sweden, a country where environmental awareness, safety and connectivity are second nature, and complex systems design is a tradition.

Sweden's position at the forefront of vehicle technology is based on solid experience with both passenger and commercial vehicles in the premium segment, combined with a leading position within the telecoms, ICT, aerospace and cleantech industries. The country consistently ranks among the world leaders in indexes of innovation, international competitiveness and foreign direct investment (FDI) potential.

At a time of unprecedented upheaval for the automotive industry, new challenges will open up opportunities for the manufacturers able to respond to the new circumstances. While the industry faces many uncertainties, it is beyond doubt that an increasingly well-informed, technically-savvy and environmentally-aware motoring public will place new demands on their vehicles and on the industry. Those who can satisfy those demands will reap the rewards.

The natural choice for green vehicles

Vehicle manufacturers who want to sell in the premium market need to meet the demands of increasingly environmentally-aware customers. Sweden offers competence and experience in technologies and alternative fuels, from hybrids to bio-fuels derived from forests.

Starting out more than 30 years ago Sweden has stayed one of the forerunners in the development of alternative energy sources, thanks to a combination of a highly environmentally-conscious population and limited supplies of domestic sources of fossil fuels. Volvo Trucks, Scania, Volvo Car Corporation and Saab Automobile have extensive green technology programs and collaborate with each other and with small innovative companies to push the technology forward.

Volvo Trucks has so far produced engines running on seven different renewable fuels. Researchers at the country's universities are developing the fuels and technologies of the future.

Successive Swedish governments have invested heavily in fuel-efficient cars and renewable fuels through initiatives, such as the Green Car programs that started already in 2000. Today funding is also available to foreign companies established in Sweden. The country also has one of the highest rates of green car sales in the world.

Fuel from forests

The Swedish Energy Agency is a major investor in energy efficiency and renewable energy for vehicles. The agency is unique in the world in having its own investment portfolio of green technology companies. Among them are ETC Battery and Fuel Cells, a development company and competence center which forms the link between Swedish research and industry. The Swedish Energy Agency part-finances the BioDME project which produces vehicle fuel from a by-product of the pulp & paper industry, in conjunction with the Volvo Group, and is one of three government bodies behind the SEK 450 million-per-year Strategic Vehicle Research and Innovation Initiative.

Electric visions of the future

The Swedish Electric Mobility Initiative (SEMI) project, run by the Power Circle cluster, is working for the widespread introduction in Sweden of vehicles powered by electricity from renewable sources.

It aims to have 600,000 electric vehicles on the nation's roads by 2020, and 50 demo sites for the vehicles will be established around the country. The project is already well on the way towards that target.

The vision: no one should be killed or injured

Sweden is the birthplace of innovations ranging from the three-point seatbelt to the laminated windshield and the side airbag. Thanks in part to state-sponsored initiatives Sweden is at the forefront of safety innovation.

Sweden's safety consciousness is summed up in the so called Vision Zero, the revolutionary road safety initiative which aims to reduce to zero the number of fatalities and serious injuries on the nation's roads. Vision Zero and its new way of thinking about traffic safety are now being exported extensively around the world.

Sweden is home to cutting-edge research into the causes of traffic accidents and technologies for minimizing their effects and preventing them, and offers foreign investors the ideal environment for pursuing the vision of safer roads everywhere. In fact, Sweden is probably the only country in the world with a law stating that nobody should be killed in road traffic.Recent statistics show that the numbers of casualties in road traffic have been reduced record low numbers despite increasing road usage.

Crash prevention through research

How do drivers react to particular traffic situations? What sensors could warn them of these situations in advance? And what technologies could help them avoid the impending crash?

At the SAFER Vehicle and Traffic Safety Centre in Göteborg, 22 partners from the public and private sectors and academia collaborate on analyzing all aspects of how and why accidents and injuries occur so that technologies can be developed to prevent them.

At this international hub, the research is divided into four programs: pre-crash, crash, post-crash and traffic safety analysis. The overall aim is to enhance Swedish international competitiveness in the field of vehicle and traffic safety.

Real-life safety saving lives

Volvo Cars has one of the world's most advanced automotive safety test facilities with more than 160 technicians and engineers working towards the company's extremely ambitious safety target. The vision is that by 2020 no one should be killed or injured in a Volvo, and in the long-term to have no collisions at all.

Volvo's safety specialists carry out crash simulations, test new components and systems, investigate real-life crashes, as well as analyzing them and recreating them in-house.

They aim not only for the highest EuroNCAP and US NCAP ratings, but also for what they call real-life safety – which means going even further than the ratings and the legal requirements.

Just relax and let your vehicle do the thinking

Ten years from now vehicles will be even more intelligent, equipped with systems that will transform the driving experience. Scores of embedded systems will help the driver, and offer personalized infotainment features, advanced chassis management, and intelligent safety systems that constantly scan the vehicle and its surroundings. Electronics and electrical systems already account for about 30 percent of the cost of a modern vehicle.

Sweden has a solid tradition of complex systems design and integration from the defense, aerospace and telecoms industries, and vehicle safety today is supported by state-funded programs such as Vehicle Information and Communication Technology (V-ICT).

Strong clusters centered on the nation's vehicle manufacturers and characterized by the Swedish desire for cooperation across organizations and across sectors provide a rich environment for the development of tomorrow's electrical and electronics systems, for both on- and off-road vehicles.

Volvo's leading role

Volvo Cars' successes with its fourth generation of electric and electronics systems can be seen in the fact that it was singled out to lead the development in this area for Ford, Jaguar and Land Rover in Europe. Its engineers were also chosen to represent Ford within Autosar, the partnership for open and standardized automotive software architecture.

"We have been pushing Autosar to the next level within some specific areas," says Lennart Lundh, director of electrical system design at Volvo Cars.

The Swedish research initiative Software Automotive Platform (SWAP) has designed an Autosar-compliant development and prototyping platform with involvement from Swedish companies such as QRTech and Systemite, as well as Volvo Cars and Saab Automobile. The SWAP platform allows users to tailor and integrate their software, tools and other components to Autosar.

Volvo's presence at the heart of Sweden's automotive cluster has attracted many of the most innovative companies and leading researchers in the field to Göteborg.

"Systems engineering is part of Swedish society, and that gives us an advantage," says Lennart Lundh

Scania famed for reliability

At Scania the number of electronic control units has grown from only a few 15 years ago to up to 30 today.

And that development will only continue as the company pushes forward in its drive for safer, more fuel-efficient and more intelligent vehicles.

"Our processing power will just keep on going up, especially on the heavier, more complicated control units," says Lars-Gunnar Hedström, head of systems development at Scania.

"We can always make better functionality if we have more processing power." Lars-Gunnar Hedström states.

Joined-up approach to connected vehicles

Vehicles will get more connected to each other and to the transportation infrastructure. This will lead to safety and environmental benefits, increased transport efficiency and new entertainment and media services.

With a long history in both the automotive and telecommunications sectors, Sweden play a key role in the development of the connected vehicle. Strong clusters in the fields of Intelligent Transport Systems (ITS) and telematics have evolved where these industries overlap, and attracted a significant number of foreign actors eager to take advantage of Sweden's lead in areas like fleet management systems and intelligent speed adaptation.

Business in Sweden is characterized by openness and cooperation between companies, government agencies and academia. Because connected vehicles are all about establishing cooperation between systems, between vehicles, and between vehicles and the surrounding infrastructure, Sweden is a natural focal point for this development.

First use of number plate recognition

Sweden is among the global leaders in the implementation of ITS. It has the world's most extensive network of weather measurement stations which monitor road conditions and send out salting vehicles before the surface has a chance to freeze. Stockholm's congestion charging system, based on full automatic number plate recognition (ANPR), was the first wide-scale use of the technology in the world. Sweden has done the biggest and most advanced experiments in intelligent speed adaptation, and Volvo Cars is in the absolute lead when it comes to the implementation of distance-keeping and lane-keeping systems in vehicles.

Wireless emergency service

Implementation of telematics services and solutions will be influenced by environmental and safety considerations spurred by political decisions. A driving factor behind telematics will be eCall, the European Commission project to bring assistance to motorists involved in collisions by wirelessly sending information to emergency services, due for implementation in 2012.

There is also big business for vehicle manufacturers in extracting diagnostic data from which to do analysis. Volvo Trucks was early out with a system – developed in Sweden and implemented in the US – which uses telematics to send vehicle data to a control center to help minimize downtime.

The closeness of major telecoms and IT players like IBM, Ericsson and Telia Sonera with Sweden's vehicle manufactures and suppliers, make Göteborg home to Telematics Valley, one of the world's largest telematics clusters and to Lindholmen Science Park.

Eco-driving saves on fuel

The use of technology to influence driver behavior to reduce fuel use and emissions is increasingly coming into focus. Swedish ITS company Thoreb's real-time traffic information and traffic planning systems are markedly improving the fuel efficiency of bus fleets around the world.

Pushing innovative technologies to the limits

The cleaner, safer, more intelligent and more connected vehicles in the future will also require new levels of quality and reliability. Vehicle manufacturers need to be sure that their electric lithium ion batteries function during an unusually cold winter. Rescue services and the environmental impacts of a serious accident involving a vehicle powered by such a battery need to be fully investigated.

Sweden is among the world's leading automotive testing nations. Test facilities throughout the country offer the full range of resources, from an artificial sun at SP Technical Research Institute of Sweden in Borås, to advanced simulators at the Swedish National Road and Transport Research Institute (VTI's) state-of-the-art labs in Göteborg, to cold-weather endurance testing on the frozen lakes of the far north.

A number of major automotive players have already established their own tailor-made testing facilities in Sweden. There are also a number of independent testing companies with highly experienced engineers working in the strictest confidence that can be contracted to conduct tests on a freelance basis, employing cutting edge testing technologies.

Crash testing; track testing; winter testing; electromagnetic compatibility testing. Sweden offers automotive manufacturers and suppliers unmatched infrastructure and facilities for the testing of vehicles. Sweden hosts test sites for the EU Cooperative Vehicle-Infrastructure Systems (CVIS) and Safespot projects, among others.

"Sweden is the ideal test country," says Peter Öhman at Test Site Sweden, the national test and demonstration arena offering testing opportunities at virtual, full scale and reality labs, with a focus on traffic safety, logistics and the environment.

Keeping unwanted spectators away

All European OEMs, plus several from Asia, choose Sweden for their winter testing. Together with guaranteed arctic temperatures, the north of Sweden offers decades of testing experience in a sparsely populated area with few noise restrictions, and empty roads ideal for sensitive testing assignments away from prying eyes.

"There's nothing you can't do in Sweden when it comes to winter testing," says Öhman.

"It is no surprise that the likes of BMW, Volvo, Bosch and others have invested heavily in their own facilities here. "

Besides the well-established cold-weather stress tests, drivability tests, mileage collection and comfort tests, northern Sweden now also offers a full infrastructure for testing of electric vehicles at sub-zero temperatures.

State R&D funding available for foreign actors

Foreign automotive companies setting up in Sweden are invited to apply for research funding under a program run by the Swedish state in collaboration with Swedish vehicle manufacturers.

The Strategic Vehicle Research and Innovation Initiative *(Fordonsstrategisk forskning och innovation, or FFI),* which runs from 2009 to 2012, funds research within the areas of energy/environment and safety, and has an annual budget of SEK 450 million. A similar amount will come from industry.

The overall aim is to reduce the environmental impact of road transport, reduce the numbers of people killed and injured on the roads, while strengthening the competitiveness of the automotive industry in Sweden.

Financing and collaboration

The program gives foreign companies the opportunity to receive funding for research, plus the chance to tap into Sweden's world-leading knowledge and experience in the safety and green technology areas. The initiative follows similar successful programs where the Swedish state and industrial partners have come together to provide funding for research in key strategic areas.

Funding is available to any company from any nation which has entered into some kind of agreement with a Swedish company within the automotive or automotive supply industry. The foreign company must establish a presence and a business in Sweden. Research eligible for funding can be anything from basic research to late development, but must be business-based, that is lead to business or applications on the open market.

The criteria assessed are the relevance to the FFI program; the quality of the project proposal; its feasibility; and usefulness of the research.Projects can receive up to 50 percent funding from the Swedish state. Universities or research institutes from abroad can receive up to 100 percent funding if they have unique knowledge.

Open collaboration

The parties involved in the FFI programs are the Swedish Energy Agency, Vinnova (the Swedish Governmental Agency for Innovation Systems) the Swedish Road Administration, the Volvo Group, Saab Automobile, Scania, Volvo Car Corporation and the industry organization Scandinavian Automotive Suppliers.

Applications for funds from the FFI programs can be made through a portal on the Vinnova homepage.
www.vinnova.se

The priority research areas within FFI:

- **Energy and environment:** projects will deal with increased energy efficiency, changeover to renewable fuels, reduced local and regional environmental impact, and so on.
- **Transport efficiency,** with a focus on more effective intermodal transports, developing systems for communication and administration, logistics, vehicle fleets, and vehicle maintenance.
- **Vehicle and traffic safety,** covering areas such as intelligent safety systems, crash safety, human cognition and tolerance, field studies, unprotected road users and security.
- **Vehicle development:** vehicle electronics, integrated systems and software, vehicle hydraulics, development methods and construction materials for more effective vehicles.
- **Sustainable production,** including component manufacturing, virtual manufacturing, chassis manufacturing, logistics and material handling.

Contact information - cluster collaboration

Academia and industry building vehicle clusters for the future

The Lindholmen Science Park lies at the very heart of Sweden's automotive cluster. Located on the north bank of the Göta River across from downtown Göteborg, the science park builds on the strong automotive heritage in the West Sweden region.

Companies at Lindholmen range from small innovative spin-offs from Chalmers University of Technology through to large automotive consultancies such as Semcon and Consat, to the likes of Volvo Car Corporation and Volvo Trucks. A number of organizations with links with the industry, such as the Swedish Road Administration- and Invest Sweden also have a presence on site.

Lindholmen Science Park is home to Test Site Sweden with its extensive testing and demonstration environments, and was chosen as a test site for the major European research and development project Cooperative Vehicle Infrastructure System (CVIS). The SAFER Vehicle and Traffic Safety Center also operates from here.

Lindholmen Science Park has three overlapping focus areas: intelligent vehicles and transport systems; mobile internet; and modern media and design. This brings the automotive industry into contact with companies like IBM and Ericsson.

About 16,000 people commute to the science park each day. 9,000 work at about 180 companies at the site, with the remainder attending university and high school. With its focus on safety and environmental issues within the automotive sector, Lindholmen Science Park will continue to play an important role in the vehicle industry in the future.

www.automotivesweden.se

Competence and confidentiality at a chilling temperature

The northern Swedish province of Norrland provides optimal conditions for the winter testing of vehicles. Guaranteed subzero temperatures during the long arctic winter and world-leading know-how and experience in testing are combined with a sparsely-populated location that ensures the all-important confidentiality.

The region offers several months of subzero temperatures often hovering around the –30C mark. Undulating hills create microclimates where the mercury can dip to –40C and below.

During the more than 30 years of winter testing in the region, an extensive infrastructure has grown up around the industry. Test tracks are marked out on frozen lakes while thousands of kilometers of deserted forest tracks provide ideal conditions for endurance testing. Besides the infrastructure and local competence, visiting test teams can get access to workshops, office space and accommodation.

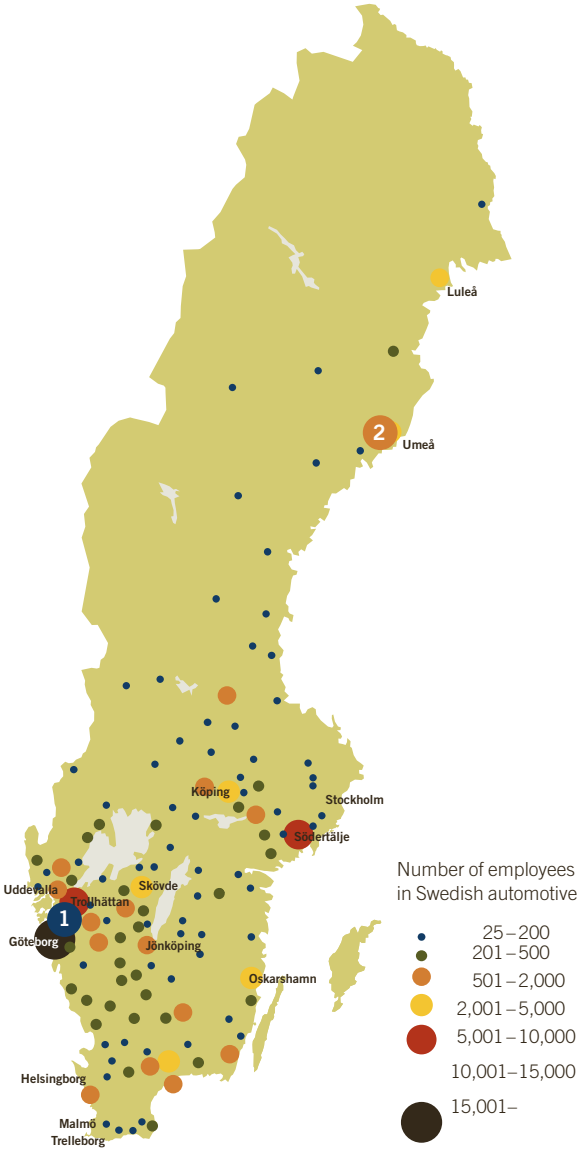
Its northerly location means that testing can be carried out in secrecy. For instance at Arjeplog, one of the world's top testing locations, just 3,300 people live in an area the size of Belgium. But still the Norrland region is well served by air, road and rail connections which keep it accessible to the big European manufacturers.

All the major European OEMs, from Bentley and Bugatti to Seat and Skoda, test in Sweden, as do the leading components suppliers, such as Pirelli and Bridgestone, Haldex and Bosch.

www.spga.se/testregion

We assist you through the entire investment process:

Invest Sweden and regional partners offer information and professional assistance free of charge to foreign companies and organizations. Our automotive experts and regional colleagues can connect you with potential partners and help with contacts with the authorities.



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INVEST:SWEDEN

Invest Sweden is the official investment promotion agency of Sweden. We connect international companies with the best business opportunities in Sweden and offer one-stop comprehensive investment consultancy services, free of charge and in full confidentiality.

Our services range from data colletion, opportunity search, entry planning, networking and establishment support everything to make your business successful in Sweden. Since the in-ception in 1996, our experts have supported over 3,000 international companies in doing business in Sweden. Invest Sweden has international offices in China, India, Japan, North America and Brasil.

We also work through Swedish embassies and consulates around the world, as well as with an extensive regional network in Sweden.

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