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Promoting **Innovation in the Industrial Informatics and Embedded Systems Sectors** through **Networking**



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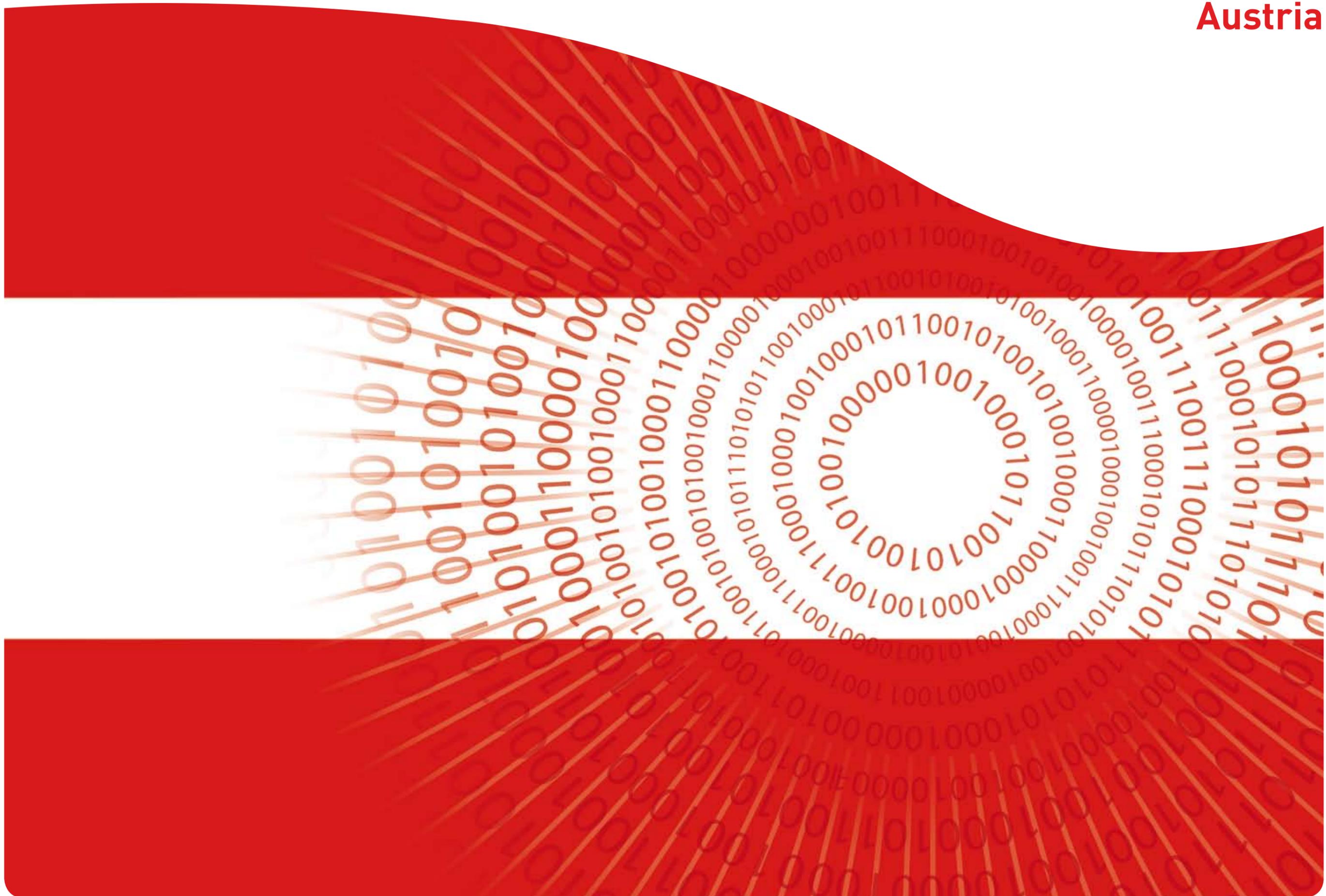
## EDITORIAL

The South East Europe has a high potential for innovation yet is suffering from missing synergy between stakeholders to enable and maintain innovation transfer. The ongoing integration process within Europe must be seen as a chance to overcome this lack.

To align research efforts of different research groups in the area towards commonly agreed directions in the embedded systems and industrial informatics sectors the I3E project developed a Strategic Research Agenda for South East Europe, which identifies synergies and potentials for the South East European region reflecting the strong confidence of stakeholders in the future of the region.

This document on National Profiles collects national specifics in the areas identified by the strategic research agenda. Each National Profile has been created by local experts seeking broad consensus with industrial, academic and political stakeholders of each country. It therefore gives valuable additional information on how to implement the strategic research agenda in each country.

The I3E consortium



“Austria achieved outstanding results in several application areas related to the Strategic Research Agenda such as highly developed public transport, waste management systems, green energy and private spaces.”

## AUSTRIA

### INTRODUCTION

Austria is a relatively small, highly developed and service oriented economy with a strong industrial sector that is characterised by high level of innovation and R&D development. In respect to the IT sector in general and embedded systems and industrial informatics in particular, Austria is represented by R&D branches of large multinational companies such as Siemens and ABB, but the majority of development is focused by the SMEs that correspond to roughly 90% of the companies in the country.

Austria achieved outstanding results in several application areas related to the Strategic Research Agenda such as highly developed public transport, waste management systems, green energy and private spaces.

On the government side, the R&D is characterised by the high level of investment, above the EU average and the

### FLEXIBLE MANUFACTURING

Austria's manufacturing sector is an important contributor to the national economy accounting for 18% of total GDP. Austrian manufacturing focuses on specialized high-quality products, mainly in the traditional industries such as iron and steel making. However high-technology production is on the rise due to the high spending on research and innovation in the country (highest in the SEE region).

Austrian companies typically build hydroelectric or thermal power stations, chemical plants, steelworks, and seamless pipelines as well as provide electrical and electronics equipment. Other important manufactured products include aluminium, industrial machinery, motor vehicles (especially industrial and rough-terrain vehicles) and automotive parts, chemicals, electronic goods and components, textiles, and such consumer goods as food, glass and porcelain, and highly prized handmade products.

The corporate structure of the Austrian economy is dominated by a large number of small and medium-sized enterprises. More than 95% of all enterprises employ fewer than 20 employees and only 0.4% of the companies are large companies with more than 250 employees, in which more than 40% of all employed work. Austria is characterised by high labour costs with the hourly rate of

highest in the SEE region. Austria has long lasting experience in participation in transnational cooperation programs. On the national level, two government agencies: FFG (Austrian Research Promotion Agency) and FWF (Austrian Science Fund) provide national funding mechanisms and coordinate activities on the international level.

Austria has a crucial position as a well integrated country in between established business and innovation culture of Western Europe and intensively developing East Europe in general and the SEE region in particular. Over the last 20 years Austrian companies established themselves in the SEE region in banking, energy, construction and IT sectors and serve as a integration facilitator of the region into the EU.

33.20 Euro which is among the highest in the EU (EU-15 average is 28.47 and EU-27 is 24.19).

Austrian economy is characterised of high importance of industry (it ranks third among leading industrial countries with 30.7% of GDP). National manufacturing has a high level of investment in R&D with the investment ratio of 5.7% (investment as a share of revenue). However the investment ratio depends on a particular industry with a relatively large variation: 1.9% in the vehicle industry and 14.1% in the glass industry.

In general Austrian manufacturing is characterised by the high productivity and labour intensity supported by excellent educational system especially in technical fields that provides stable ground for innovation. However the main challenges for Austria in manufacturing sectors are the dependence of imported fossil fuel and raw materials as well as a high labour cost that might threaten the labour intensive sectors to move their production bases.

Therefore, increasing the energy efficiency of Austrian manufacturing and integration of automation processes would considerably reduce production costs and make Austrian products more competitive on the global market.

## EUROPE GOING GREEN

Austria's domestic production of energy is dominated by hydroelectricity and smaller amounts of other renewables, mainly biomass. Austria remains an important importer of energy, in particular fossil fuels, with most of its remaining energy requirements covered to a large extent by imports of crude oil from Asian and African countries, natural gas from Russia and solid fuels from neighbouring Member States. Austria has a policy that excludes the use of nuclear energy in its energy mix. Industry and transport are the most energy consuming sectors.

Total energy consumption in Austria has increased by 38% since 1990. Transport and industry consume an aggregate 60% of total energy, while households account for 27% of demand (Figure 2). The shares of each sector in final energy consumption closely follow that of the EU-27 average. Demand from the transport sector has increased dramatically since 1990 (67%). Oil is the dominant fuel consumed with significant shares of gas and electricity (Figure 3).

Electricity generation has been increasing over the past 10 years. Generation is based mainly on renewable sources (hydro, biomass, and industrial waste), and to a smaller extent on natural gas and solid fuels (Figure 3). Renewable sources account for more than four times the corresponding the EU-27 average percentage. The share of wind power has been increasing and, in 2005, Austria was 8th among EU countries in terms of installed wind capacity with an installed capacity of 818 MW (source: <http://www.ewea.org/>).

Although, Austria has one of the highest environmental standards in the world, there is a potential in further development in all three directives of Lisbon agenda:

- 20% of renewable energy sources: diversification of the national energy profile which is dominated by large scale hydro power stations by focusing on other sources such as wind, solar, waste-to-energy and geothermal.
- 20% reduction of energy consumption: focus on popularisation of the use of public transport which is already of highest standards in Austria.

## GREEN ENERGY MARKET

At the moment Austria utilized the potential of large hydro power stations to the maximum. Further development is economically not efficient or environmentally damaging. The next step is development of small hydropower plants that are defined as power stations with a capacity of up to 10 MW. They have less environmental impact, but less efficient and as well as requiring much more efforts to connect to the grid which creates a large market for the embedded systems and industrial informatics development necessary for integration of large grid distributed systems. At the moment Austria has a total of about 1,900 small

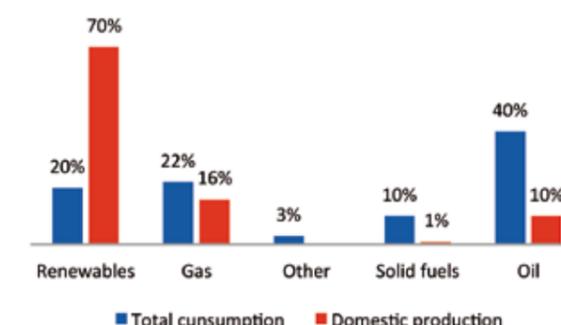


Figure 1: Total energy consumption in Austria by source

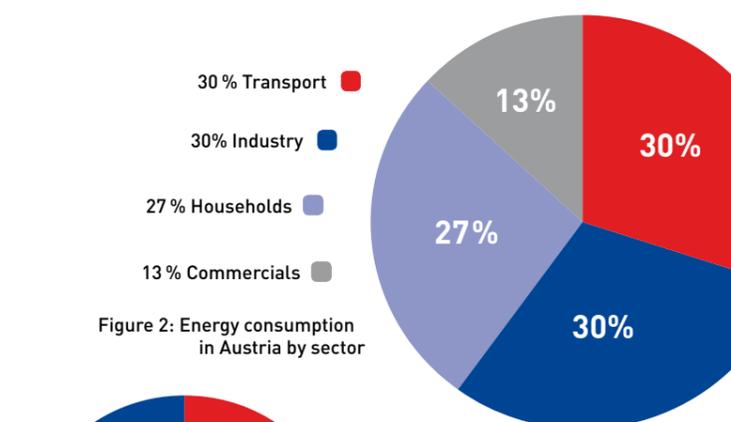


Figure 2: Energy consumption in Austria by sector

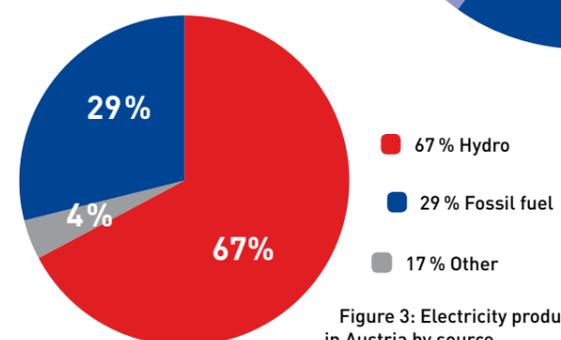


Figure 3: Electricity production in Austria by source

- 20% increase in energy efficiency: although, Austria is a leader in passive houses, there is still a large potential for further installations.

hydropower plants with an output of electrical energy of 4,000 GWh, that provide electricity to over one million households.

The relevant legal framework conditions are provided by the "Ökostromgesetz" (eco-electricity law) which also massively affects small hydropower. The new eco-electricity law limits the total volume of available subsidies for the Austrian small hydropower with an allowance of maximally 0.16 cent per kWh supplied to the final consumer and therefore provides an additional challenge for the industry.

In Austria, in addition to the market price every kWh from a small hydropower station can be subsidised up to 2 Cent per kWh on the average.

In spite of the principally elaborate eco-electricity law the OEVFK (Austrian Association promoting small hydropower) points to the fact that the constitutional limitation will hardly help achieve the targets of the eco-electricity law. Larger small hydropower plants will be able to do with 4.2 Cent, but for the 1,400 small plants, which account for 2.2 TWh of the total energy generated in small hydropower stations, this tariff is too low for effective competition.

## EFFICIENT USE OF ENERGY

Austria developed the First National Action Plan for energy efficiency that aims to reduce energy consumption by 80.4 PJ or 22.34 TWh by the year 2016 (Figure 4). In order to fulfil the goals of the plan the following measures are to be implemented: 1) government program, 2) energy concepts, programs and guidelines for the Austrian regions, 3) promotion schemes for residential buildings and 4) domestic environmental promotion schemes.

The 2020 goal is to reduce energy consumption by 93.55 PJ (source: Austrian Energy Agency). The following figure shows the main areas of potential energy savings.

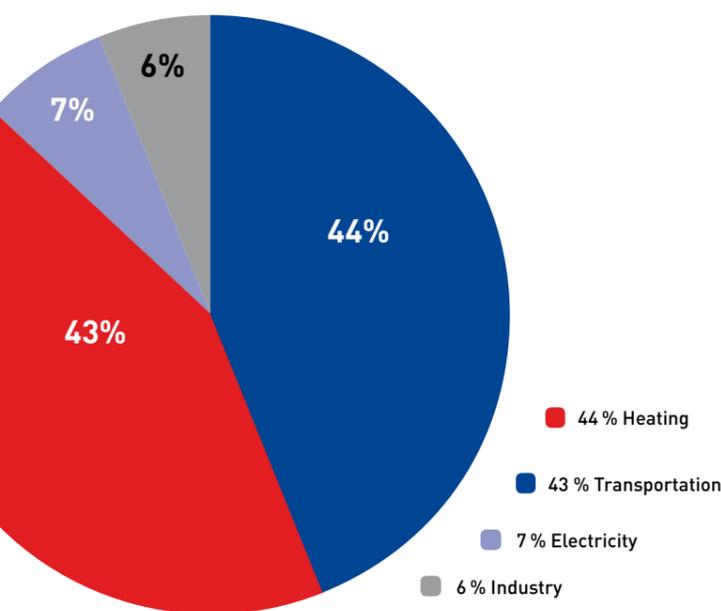


Figure 4: Potential for energy saving in Austria by 2020 by sector

The OEVFK considers small hydropower to be considerably disadvantaged when comparing them to the other eco-electricity producers under the eco-electricity law. The OEVFK demands an improvement of the situation of small hydropower in Austria as fast and as effectively as possible. The framework conditions shall be adjusted to those in the neighbour countries. There, the prices paid to small hydropower plants for electricity are 25 to 30 percent higher than those in Austria (<http://www.aquamedia.at/templates/index.cfm/id/3682>).

The Austrian government intend to implement subsidy programs for the energy efficiency for buildings based on the regional building code that requires minimum standard for construction of new buildings

- subsidy schemes for residential buildings ( 2,4 billion Euro per year) support construction of low energy buildings and passive houses
- “klima:aktiv“ is a standard that promotes ecological construction including building materials
- energy certification show up the quality of buildings
- only passive buildings until 2015 at the latest
- modernisation of all buildings from 1950 to 1980 until 2020
- modernisation of Federal buildings via contracting

Due to the already high standard of construction in Austria the extra costs for low energy consumption houses in Austria is only 6-8% higher than for an usual building. Considering at least 75% savings on heating costs that such houses provide, the benefits both for the customers and the environment are significant. Austrian has more than 2 million buildings at the moment with 75% of which are single family houses and 14% of non-residential buildings. The main criterion of energy efficiency is heating energy demand measured in kWh/m<sup>2</sup>.

Depending on the region there are minimal requirements that a newly constructed house has to meet (65 MWh/m<sup>2</sup> in Styria, 40 in Burgenland, 45 in Vienna etc). Additionally several levels of energy efficiency are introduced that are subsidised by the state: 1) Low energy house, 2) Super low energy house and 3) Passive house.

The described governmental strategies and programs heavily rely on the ability of the industry to provide monitoring infrastructure to control and adapt energy consumption in a flexible way. In order to achieve this goal, a broad deployment of existing embedded systems and development of new solutions in the area is required.

## HEALTH SUPPORT, MONITORING, DIAGNOSTICS AND LIVING ASSISTANCE

Austria has 16.5% of population over 65 years old, a number which is growing. Therefore, provision of efficient health care is of growing importance for the country. Currently, Austria spends 9.6% of its GDP on health, which is among the highest rates in the EU. However, the level of expenditure does not guaranty quality of provided care.

According the study compiled in 2007 by Health Consumer Powerhouse, a renowned Swedish organisation of health experts, based on the Euro Health Consumer Index, Austria has the best medical system in Europe. The study measured national health systems according to following criteria: patient rights and information, e-Health, waiting times, outcomes, range and reach of services and pharmaceuticals. According to this expert study, Austria not only has the most consumer-friendly health care system in Europe, but also performs better than countries like Switzerland or Luxembourg which spend considerably more money on medical care. Austria spends 2,186 Euros per head per year, Luxembourg spends 3,526 Euros, Switzerland and Norway roughly 2,820 Euros.

## PUBLIC TRANSPORT

Today, Austria can be seen as a country of public transport. In no other EU member state is public transport used so extensively per head. In Vienna, the capital of Austria, more than one third of the city's passenger transport is covered by public transport. And when it comes to rail freight, Austria' performance is one of the best in Europe.

Approximately 5.5 million trips are made by bus and train in Austria every weekday. Public transport accounts for 27.5 billion passenger kilometres per year. The average per person per year is 3,362 kilometres, a figure which makes Austrians the most diligent users of public trans-

## WASTE MANAGEMENT

Waste management in Austria is characterized by a high percentage of recycling with more than 2500 facilities dealing with the process. The total waste production in Austria is higher than in Europe average but the processing of waste is way above average. As an example, 25% of heat in Vienna comes from the waste processing plants.

Within the past 40 years Austrian experts have developed internationally outstanding competence in sustainable waste management. Most of the successes were accompanied by some trial and error, thus valuable know-how is now available from senior experts in order to avoid similar mistakes in the urgently needed development of waste management in other countries. Due to a future oriented strategy adopted within the Environmental Protection Fund in 1984, environmental policy was gradually redirected towards prevention (Integrated Pollution Prevention and Control - IPPC) and environmentally safe

Key factors in Austria's top ranking were the extremely short waiting periods for visits to the doctor and emergency operations, direct access to doctors and good treatment results. Same day visits to a general practitioner are possible in Austria, the study's authors point out and the waiting period for the beginning of radiation therapy or chemotherapy for cancer is under three weeks. The chances of surviving a heart attack or cancer are also good in Austria: for heart attacks, they are more than 92%, and 60% of cancer patients survive longer than five years. Moreover, new drugs are adopted by the health insurance system comparatively quickly (within less than 150 days).

The Austrian health care system's greatest weaknesses, in study author Arne Björnberg's opinion, concern patient information. When a patient in Austria wants to know something about health, he is told to go to the doctor, according to Björnberg. He believes it would be more cost-effective and efficient to encourage the patients to get initial information over the phone or on the internet, as is the practice in Great Britain or Denmark. Therefore, advanced health monitoring and self-diagnostic systems can greatly improve the level of health system in Austria.

port in the EU. Without public transport, 4.4 million people in Austria – 54 per cent of the country's population – would not be able to reach their daily destinations. Public transport plays a leading role in fighting climate change. In 2005, emissions of carbon dioxide per passenger kilometre by rail were five grams, compared with 151 grams by road. Car traffic emits 23 times as much CO<sub>2</sub> as public transport. While greenhouse gas emissions from road transport have been steadily increasing, the railways in Austria have managed to significantly reduce their emissions over the past 15 years. (<http://en.vcoe.at/start.asp?b=152&ID=8083>)

treatment of any "reactive" (e.g. hazardous) wastes. One of the most effective measures in mandated future-oriented waste management policy is the introduction of a tailor-made "landfill tax", which should increase foreseeable over a period of at least 10 years (Neubacher, 1988). The subsequent legal development in Austria included a ban on new landfills for materials exceeding 5 % TOC (Total Organic Carbon) by the beginning of 1997 and a grace period for existing landfills until the end of 2003 (with some limited exceptions until 2008).

Since July 16 of 2001, the disposal of hazardous wastes in landfills has been banned in Austria (exceptions for specific inorganic wastes to be disposed in encapsulated form in safe underground caverns such as salt mines in Germany). The single most important measure in treatment of waste is controlled incineration in order to safely destroy potentially hazardous organic substances ([http://www.uvp.at/UVP-Dokumente/40\\_Years\\_Waste\\_Management.pdf](http://www.uvp.at/UVP-Dokumente/40_Years_Waste_Management.pdf)).



“Recently Bulgaria shows a potential to become a noticeable player on the future automotive innovation market.”

## BULGARIA

### FLEXIBLE MANUFACTURING

Recently Bulgaria shows a potential to become a noticeable player on the future automotive innovation market. Bulgaria is participating as a partner of ACSEE project which is co-funded by South East Europe programme and European Union funds. The project brings together universities, R&D institutions and SME support facilities from EU-15, NMS as well as IPA to prepare and create the first automotive network in South East Europe. The second level clustering activities proposed by the project are strictly oriented on the activities, which are improving the innovation capacities in the region and improve technology and know-how transfer-improving the innovation circle.

These top five companies represents the current condition in the field: Belchev Motors is developing Bulgaria's first electricity-powered automobile of the XCAR type providing the whole range of infrastructure for development including an equipped assembling line hall. Their main activities are focused on diagnostic and repairing, engine, suspension, and electronics.

- Tremol SMD Ltd.: Tremol SMD Ltd is an electronic manufacturing company founded as part of Tremol Group. Company capabilities utilize the potential of Tremol Ltd in R&D, electronic design, electronic testing, plastic parts design, plastic injection, mechanical parts design and production. Tremol Ltd has an additional production department for manual soldering and manual assembly.
- Yazaki Bulgaria: in recent years, automotive vehicles have undergone many technological changes in a short period of time making vehicles highly complex systems. Hence, this factor drives the Electrical Distribution Systems (EDS) continuously to undergo innovative processes in concept, quality and technological requirements. YAZAKI provides complete EDS solutions, using state-of-the-art-technologies for wiring harness & components, such as wire, junction boxes, fusing and connectors.
- EPIQ Electronic Assembly: its principal business is the production of electronic modules for automotive (Ford, General Motors, Daimler-Chrysler, Delphi, Valeo and others.), telecommunications (Sony), household (Tefal, Roventa, Seb Group, Calories etc.)

sanitary and medical equipment (IEM, Tefal), and sensors. Epiq's main fields include automatic and manual saturation of printed circuit boards, surface mounting and production of specialized sensors, interim and final electrical tests produced by measuring equipment, chip-on-board assembly and production tooling.

- Melexis develops and manufactures mixed signal semiconductors, sensor, and programmable sensor ICs. Melexis products are well known on the automotive market for over decade, today nearly all automotive brands worldwide rely on Melexis's safety and efficiently. Melexis has a wide range of products for both automotive and industrial applications. Melexis is also involved in many cutting edge new development areas such as: TPMS (tire pressure monitoring), acceleration sensors, solid state gyroscopes, automotive CMOS cameras, heads-up-displays (HUD), optical bus, integrated LIN microcontroller family, 360-degree position sensing, ultra high-voltage (650V) engine ignition IC's, and many others.
- Johnson Controls Research and Development: in terms of staff this is the biggest company in the Electronic industry – more than 500 engineers in the R&D center in Sofia. Most of the engineers are dedicated to embedded software development and testing, since a while company operates in the field of hardware and mechanical design. The company develops for car manufacturers like BMW, Daimler, Peugeot-Citroen Association (PSA group) etc.

Because of the potential of this market and macrosocio-economic reasons Bulgaria is well positioned to succeed in manufacturing sector. Especially in the automotive industry Bulgaria has a potential because of suitable macro-economical conditions, already establish excellent education in the field, availability of relatively cost-effective labour, etc. For instance, China's largest sport utility vehicle maker, Great Wall Motor Co, plans to start manufacturing cars in Bulgaria. The company is the first Chinese producer who certified their products for sale in EU members. The assembly factory covers an area of over 430,000 square meters with designed annual production capacity 50,000 units, including welding, painting and assembly workshops.

## EUROPE GOING GREEN

As of April 30th 2011, all 137 registered operators in Bulgaria met their carbon dioxide emissions obligations for the 2010 National Register of annual verified emissions and transfer of quotas according to the Ministry of Environment and Waters, which maintains the register. According to the most recent data from Bulgaria's Executive Environment Agency's annual verified report of the operators involved in emissions trading, the total volume of emissions in 2010 was 33 798 104 tonnes of CO<sub>2</sub>.

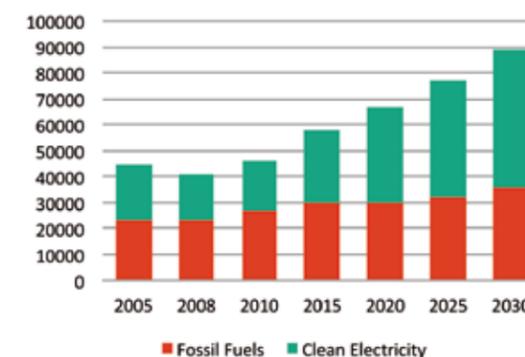


Figure 5: Bulgarian electricity production in GWh (Source: MEE, NEK EAD)

Bulgaria produces a significant amount of industrial products and raw materials (iron, copper, gold, bismuth, coal), electronics, refined petroleum fuels, vehicle components, weapons and construction materials.

Bulgaria's economy has already paid, in excess, the price of the so-called surplus emission rights, announced the Bulgarian Industrial Association (BIA). This position was voiced after a meeting between BIA Vice President Dimitar Brankov and EU Climate Action Commissioner Connie Hedegaard. "This price cost us a double contraction of GDP, job losses, low incomes and huge emigration of more than 1.6 million people over the last 20 years," said Brankov. This is why Bulgaria should now take advantage of the sale of its reserve and use the money to finance energy efficiency projects, the generation of electricity from renewable energy sources, taking into account the high energy intensity of the Bulgarian economy," pointed out Brankov.

## GREEN ENERGY MARKET

The development of the energy sector in Bulgaria over the past three years has been marked by one main objective - harmonisation of Bulgaria's steps and measures with the requirements and criteria of the European Union (EU). Bulgaria imports more than 70% of its primary energy sources. The Bulgarian economy continues to consume twice as much energy per unit of GDP as the economies of Western Europe. That is why the key strategic objective of the economy should be the rational use of energy sources. It is projected that the energy production from RES will increase from 1 Mtoe in 2005 to 2.3 Mtoe in 2020 (Figure 5).

The energy sector is the main contributor to the total CO<sub>2</sub> emissions of Bulgaria. Stationary combustion for heat and electricity production as well as direct end-use combustion amounts to 80% of the total emissions (Figure 5). The parts of the energy network that could have the biggest influence on green house gasses emission reduction are identified: rehabilitation of the combustion facilities currently in operation, repowering to natural gas, reduction of losses in thermal and electrical transmission and distribution networks, penetration of new combustion technologies, tariff structure improvement, renewable sources for electricity and heat production, waste-to-heat utilization and supply of households with natural gas to substitute for electricity in space heating and cooking.

An example that Bulgaria works toward improving this field is the existence of Business oriented innovative companies that aim for CO<sub>2</sub> reduction. In brief just a few of the list:

- Company for Energy Saving AD (CES AD): the company operates in the energy sector and its main activities include consulting, research, design, engineering and energy efficiency services. Their focus is to find the most modern technological, organizational and economic energy saving solutions.
- Dalkia Varna: provides customer support in management of energy effectively. From design and engineering to energy procurement, operation and maintenance, company's goal is to minimise environmental impact, reduce both fossil fuel consumption and greenhouse gas emissions and increase the percentage of renewable energies in the fuel mix.
- Overgas Inc. AD: Its main goal is to shape and develop Bulgarian gas market and to make natural gas accessible in Bulgaria. The company provides resources for the construction and operation of gas distribution networks. It is planning, financing and carrying into effect the complete cycle of marketing - designing - construction - operation - sale of natural gas and customer service.

The total installed electric power generating capacity of Bulgaria is 12,668 MW, including:

- 6556 MW in the thermal power plants (TPPs);
- 3760 MW in the Nuclear Power Plant;
- 2352 MW in the hydropower plants (HPPs) and the pumped storage HPPs.

In 1995, Bulgaria ratified the UN Framework Convention on Climate Change. In accordance with the Kyoto protocol signed under this convention in December

1997, Bulgaria made a commitment to reduce anthropogenic emissions of greenhouse gases by 8% during the period 2008-2012, compared to the 1988 emissions level.

The Bulgarian Energy Efficiency Fund (BEEF) has started its activity in early 2005, providing loans and guarantees for EE projects in almost all end-use sectors. The Kozloduy International Decommissioning Support Fund (KIDSF), established at the EBRD in 2002, focuses international support on essential investment projects for the Bulgarian energy sector development and improved energy efficiency. With KIDSF participation, the EBRD has designed the Energy Efficiency and Renewable Ener-

## EFFICIENT USE OF ENERGY

The key energy saving measures (outside the Emission Trading Scheme) in the generation, transport and consumption of energy include:

- Improvement of the efficiency in the generation of electricity and heat energy;
- Reduction of losses in energy transmission and distribution;
- Use of fuel efficient vehicles for transport and more intensive use of public transport;
- Introduction of stricter standards and better labelling for appliances and devices;
- Timely upgrades of the energy saving characteristics of existing buildings and introducing stricter energy standards for new buildings;
- Consistent taxation policy to achieve more efficient use of energy;

The Bulgarian economy is considerably more energy-intensive in comparison with average European Union. Therefore the national goals in this area are more ambitious: the energy intensity of GDP in Bulgaria will be reduced by 50% before 2020 more than twice of the European average.

Eventually the efficient energy use will favour economic growth and the well-being of citizens through reliable energy supply at affordable prices in the country.

## HEALTH SUPPORT, MONITORING, DIAGNOSTICS AND LIVING ASSISTANCE

Bulgaria faces similar challenges regarding health and aging population. Cardiovascular diseases are the leading factor in mortality that increased over the last four decades four times. One of the specifics of the health situation in Bulgaria is one of the highest proportion of the population aging 15+ years are regular daily smokers (32,7%) in the world.

gy Credit Line Facility to support the new strategy by overcoming market imperfections which hamper the energy conservation market in Bulgaria.

National or international funds and programmes that provide possibilities for loans or grants for energy efficiency or renewable energy sources projects include: the Enterprise for Management of Environmental Protection Activities, the National Trust Ecofund, the State Fund "Agriculture", the Social Investment Fund, the Global Environmental Facilities (GEF), and the international programmes of the EU (PHARE, SAPARD), the USA (USAID), or of Germany, Austria, Denmark, the Netherlands, the UK and Japan.

The main areas of energy saving potential in Bulgaria are:

- Energy saving at final consumption, including households, transport, industry and services;
- Energy saving in the processes of energy generation and transformation, including development of the gas distribution network, reducing the transmission and distribution losses, improving the efficiency of thermal power plants, increasing the share of energy generated from high efficiency co-generation.

The status analysis identifies differences with respect to the efficiency in generation, transport and use of energy, the market development and corporate management as compared to EU practices in these areas. Bridging these gaps is a necessary precondition that would give Bulgaria a competitive position in the European market. The actions are not influenced by external risks and circumstances – it fully depends on the mobilisation of internal resources and efforts at national level. This applies also to the funding needed for changes: The regulatory policy on prices will be important for the timely development of networks, the accelerated development of RES, co-generation and energy efficiency in the supply and consumption of energy. Along with this, the successful integration of the country in the European Emissions Trading Scheme will ensure the transfer into the state budget of considerable financial resources (EUR 1, 600 million per year by 2020) from operators covered by the scheme that can be entirely directed towards encouraging RES, energy efficiency and new technologies (including clean coal).

IT enjoys an ever-expanding application in outpatient care medical centres and in hospitals. Thanks to a financial donation from the World Bank, every General Practitioner has a PC workstation and all PCs report to a central database. The Ministry of Health together with the Ministry of Finance and the NHIF countersigned the so-called "road map" setting up the strategy of incorporation a diagnosis-related group (DRG) system within

reporting processes in hospitals. In accordance to the "road map", a pilot project with hospital beneficiaries was developed and implemented. The National Centre for Health Informatics is also currently working on a project related to the introduction of uniform information standards within the health system under which all regional health care centres were updated with modern IT equipment.

The Health Card is one of the key technologies currently being developed and introduced in Bulgaria for health sector optimization, more efficient transactions between the health care institutions, more secure, flexible and transparent exchange of information, standardization of services and activities, and ensuring future interoperability with other European countries and health systems.

There is no mechanism for technology assessment or for controlling the introduction of new technology in the health sector. At present decisions on the purchase of new equipment are left to the municipalities and other owners of health facilities. However, standardization mechanisms have to be implemented for better integration of new methods and technologies.

Electronic records of health care are a priority for future reforms. Much has already been developed and planned towards the goal of building an integrated information exchange system between those working in the field of health care, for increased standardization and information security. Future reforms aimed at

## NOMADIC ENVIRONMENTS

Currently Bulgaria lacks technology for smart phones production and cannot compete with established brands. However, there is an open market for software related to smart phones. That is already foreseen by the big brands and there are Bulgarian companies (e.g. Talent Outsourcing OOD, Nokia Siemens Networks Bulgaria EOOD) working as an outsourcing subcontractors for Nokia, Sony-Ericsson, Motorola etc.

MM Solutions AD is developing software for the leading manufacturers of smart phones, especially multimedia and imaging software. Partners of MM Solutions are companies like Nokia, Alcatel, Sagem, Texas Instruments etc. They have delivered imaging and multimedia software for over 100 million smart phones shipped on the market.

ESOF OOD – is a software development company with experience in smart phone software development for iPhone and Android.

## PUBLIC TRANSPORT

The geographic location of Bulgaria on a cross-road is a natural relative advantage for the attraction of transit traffic. The relatively well-developed road and rail networks are an additional advantage but they need infrastructural and technological modernisation. The railways need to overcome their lagging behind other countries. Among the disadvantages are the insufficient

developing electronic health care in Bulgaria include: 1) the introduction of electronic accounting for medical providers; 2) the introduction of electronic health cards; 3) and the introduction of software applications for real-time comprehensive processing, which includes electronic medical referrals, electronic prescriptions and other laboratory tests. With this goal in mind the government has set aside 3,5% of the 2007 health care budget for the introduction of electronic technologies.

In modern concepts for development of e-health one of the main directions in research is the employment of Internet technologies, Web technologies and Web services. This tendency is enhanced in the last ten years and it is emphasized in Lisbon' strategy 2010 and EC initiatives for development of e-health systems.

Personal Health System (PHS) is one of the supplementary directions in the e-health concept. PHS is a relatively new concept, introduced in the 1990s. PHS places the individual citizen in the centre of the healthcare delivery process. PHS can bring significant benefits in terms of improved quality of care and cost reduction in patient management, especially through remote monitoring and management applications. PHS are seen as key components for bringing continuity of care in terms of location (extending care outside hospital settings to ordinary living environments) and time (continuous, anytime monitoring) and assisting the shift towards preventive, personalized and people-centred care.

As a potential we can depict not the production of smart phones but rather their development, more specifically in terms of software development. And the focus should be made on own development instead of working on the outsourced projects.

The development of the ITC industry is one of the key priorities for the government of Bulgaria. It has stable growth of around 30% per year. Bulgaria ranks 3rd in world for certified IT professionals per capita and 8th in the world in terms of absolute numbers. Among key advantages of the industry is highly qualified workforce, competitive pricing, many talented youngsters majoring in IT and long traditions. Positive factors for the continual growth and stable development of the industry are the strategic geographic location and stable political and macroeconomic environment.

spread of road networks to the West and North-West, the border status of the Danube and its rare usage as internal waterway, as well as the relative isolation of the Black Sea and its peripheral role in transcontinental transport from Europe. Among the system disadvantages are the lack of common infrastructure management, lack of logistical cooperation in the environment of intermodal

competition and common management of the networks for urban, suburban and intercity passenger services. The national transport network as a whole is rather a sum of separate transport modes than a system of mutually complementing transport networks for services.

It has to be pointed out that recently has been completed one of the most important infrastructure projects - Reconstruction, Development and Extension of the Sofia Airport which included building of a new passenger terminal and new runway system. The total cost was € 226 million. Reconstruction and modernization of the other Bulgarian international airports – Varna, Bourgas and Plovdiv are planned as well. A very important factor for the successful development and modernization of the transport infrastructure in the country is the financial support of various international and national institutions. During the pre-accession period Bulgaria took advantage of EU ISPA and PHARE Programs, European Investment Bank, Japan Bank for International Cooperation, French Development Agency and some other institutions.

Now, as EU member the country can take advantage of the Cohesion Fund and European Regional Development Fund for development and modernization of transport infrastructure of nation-wide, EU and cross-border importance. The programming of the financial recourses in transport sector for the period 2007-2013 is taking form of Sectoral Operational Program on Transport (SOPT). On 27.11.2007 in Brussels has been approved the budget of the SOPT for Bulgaria amounting to € 2 003 million. Since the transport system is one of the big energy consumers in the country, certain efforts are made and in order to improve the energy efficiency through incentives for using new cars. This measure shall also contribute to limit polluting emissions. At the same time a national program has been adopted for enhancing biofuel usage. By strategic planning of the national transport network efforts are made in order to improve the transport mode balance, putting accent on: 1) priority development of the public transport; 2) increasing the role of the environmentally friendly modes, especially of the rail transport; and 3) stimulating the development of combined and intermodal transport services.

The development of the Bulgarian transport system in the last two decades is going in active cooperation with the EU and with the countries from the region. It concerns not only the joint economic efforts, but also the coordination by setting up various programs, carrying out development projects and harmonizing legislation.

## WASTE MANAGEMENT

Bulgaria faces serious waste management challenges. The current infrastructure is old, fractional and insufficient. Addressing the issue constitutes a major priority for the Bulgarian government and the planned areas for development include the creation of regional waste disposal systems, as well as the construction and exploitation of large scale waste and waste-water treatment plants (WTP). By the year 2014 the country has to comply with EU regulations and to dispose with new WTP in all agglomeration areas with population over 10,000 people (120 agglomeration areas, 54 WTP are due to be built), as

There are good prospects that this positive trend will strengthen in the future and will contribute to the further development and modernization of the global European transport system.

A series of actions are planned in order to achieve this priority goal:

- Systematic replacement of the obsolete public transport rolling stock, especially in the railway sector;
- Increasing public transport speed within and outside cities;
- Improving passenger information systems through implementation of modern information and communication technologies;
- Developing priority intermodal connections for both passenger and freight transports;
- Implementation of more energy efficient and environment friendly rail and road vehicles that meet the EU requirements;
- Improving the access to various transport modes for disabled people;

Although security and safety is a priority issue for all transport modes, the main problems appear in the road transport. There is a general trend of increasing number of car accidents. There are several factors which are influencing this process: increasing number of vehicles, especially of the private cars (they are involved in about 72% of all accidents), underdeveloped infrastructure, poor technical condition of a large part of the vehicle park (about 39 % of all road vehicles are over 20 years old and only 3 % are under 5 years), inadequate fines and penalties for the violators etc. A long term measure is considered to shift a part of the passenger traffic back to the public transport, especially in Sofia and in the other big cities. It has to be noticed that the public transport system in the capital city still has relatively good capacities: since in 2005, 753442 thousand trips have been registered, in 2000 they have been 1142436 thousand which means that some reserves are available. For Sofia it is of utmost importance to accelerate the enlargement of metro – from just one 9.1 km long line up to a network with a total length of 52 km and 47 stations. The project will cost € 185 million.

well as in all agglomeration areas with population between 2,000 and 10,000 people (928 agglomeration areas). Additionally, 55 regional waste collecting depots and processing plants also need to be build and set in operation by 2010 (28 of 55 have not been built yet).

As of 2009, there is only one municipal solid waste separating & processing plant in Bulgaria located in the village of Shishmatnsi, Plovdiv. The plant's full capacity is approximately 125,000 metric tons annually. There are 25 plastic-recycling plants in Bulgaria, which share a total load capacity of approximately

74,580 metric tons yearly, eight paper and cardboard recycling plants, with load capacity of 138,000 metric tons yearly, and four glass processing plants with a total recycling volume of 206,000 metric tons yearly. The numbers clearly show that Bulgaria still has a long way to go until reaching the point of responding to the country's needs in the area.

Sofia as the biggest city and the capital of Bulgaria still does not have proper waste management facility. However this opens a lot of opportunities for private waste management companies. A good example for such is Ecobulpack - the leading National packaging waste recovery organization. It provides sustainable, reliable and environmentally friendly waste management solutions. The current team creates and maintains efficiency in the process of managing packaging waste from the industry, commercial facilities, as well as the Bulgarian households through collecting, sorting and recycling packaging waste.

According to data of the Ministry of Environment and Water, the state's gross waste output accounts to more than 2.5 million metric tons a year. Industrial waste represents approximately 70% of the total waste generated, municipal waste accounts for 25% and the remaining 5% is hazardous waste. In perspective - The European Environmental Association (ETC/WMF – UN-PS) estimates, that by 2015 approximately 150,000 cars will be due to undergo recycling annually in Bul-

## EMBEDDED SYSTEMS IN AGRICULTURE

Agriculture continues to be a major part of the Bulgarian economy. The country enjoys a number of favourable geostrategic, climatic and natural endowments, which have significantly contributed to the development of century long traditions in both plant-growing and livestock breeding. Recent political and economic changes and reforms, including joining the European Union in 2007, promise large growth potential of the sector.

Agriculture, which accounts for 11%-13% of GDP, has become an important sector within the Bulgarian economy. After the financial crisis of 1996, agriculture was the only sector that grew (30% in 1997 compared with 1996). Agriculture is also an important source of employment in Bulgaria, 23% of the working population employed in the agricultural sector. Therefore, it is very important to utilize the latest technologies and state-of-the-art embedded systems serving the field.

As of 2007, the total area in agricultural use accounts to 5 666 336 ha. 59.8% of it, or 3 057 740 ha, is arable land. Bulgarian crop production encompasses wheat, maize, sunflower seed and rye growing. Recently neglected, but otherwise strong and promising sectors are the growing of roses, cotton and tobacco in the South Central parts of the country. Underdeveloped because of econo-

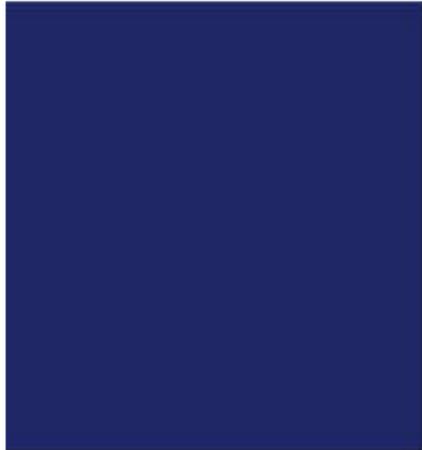
garia. This tendency outlines prosperous investment opportunities in the sector, as currently the number of cars recycled annually is less than 15,000.

The positive and the negative environmental, social and economic effects of each available waste treatment option are subject to many publications and studies. In general every human activity has some kind of environmental impact. The WMS should not be looked at as means to get rid of something that is not needed but as a way to recover as much as possible from what people just have no use of. There will be impacts both negative and positive but sooner or later waste management will become a synonym of resource extraction. As Bulgaria is relatively poor on resources it is an excellent approach to establish and manage successful waste management systems.

The foundations for the development of the sector have been laid: an established broad framework in coherence with the Environmental Protection Act (EPA) and the Water Act (WA) raised public attention and awareness. The separate waste collection proves to be an expanding and a promising initiative. Furthermore, the sector benefits from several financing sources: national funding, OP Environment, programs for Rural Development and Regional Development, as well as from loan funding from the World Bank, EBRD, and EIB.

mic factors remain pepper, tomatoes, grapes and apples production, which are otherwise favoured by climate. In terms of livestock breeding and livestock products processing, the country has excellent outlooks for increasing the exports of specific high quality milk and dairy commodities, as well as meat products. Predisposed by climatic and natural conditions, organic farming is also gaining speed in recent years. Investments in organic production are strongly encouraged by both Bulgarian and European authorities. With approximately 0,4% of the arable land used for organic farming, compared to 4.7% across Europe, the potential of the sector still remains high.

Today, agricultural entrepreneurs in Bulgaria enjoy a number of competitive advantages and investment favourable factors. As a member of the EU, the country benefits from free access to the growing European market and is a subject to financial and technical support by the EU. Within the framework of the Common Agricultural Policy (CAP) and other cohesion funding policies of the EU, Bulgaria is due to utilize more than €7 billion for the period 2007-2013, of which a total of €3 241 million are for rural areas development. Finally, the country offers access to skilled and inexpensive workforce, sector supporting institutions, food and research centres, agricultural colleges, etc.



“Solar energy appears to attract quite high interest in the last years. This interest follows the widespread utilisation of solar thermal technologies in Greece.”

## GREECE

### EUROPE GOING GREEN

Greece is characterised by a 20,3% annual increase of the totally installed capacity of RES units for the production of electricity in the period 2002-2010. Thus RES-Energy represents a dynamically growing sector. With the exclusion of big hydroelectric power plants, the RES-Energy pie is attributed by 78% to wind energy, by 12% to small hydroelectric power plants, by 7.4% to solar energy and by 2,4% to biomass/biogas plants.

Share of RES in gross final energy production in 2008 was 8%. The total net installed capacity of solar electric power plants was 9MW in 2008. The total net installed capacity of wind electric power plants is 846 MW in 2008. The total net installed capacity of hydro electric power plants is about 3.15 GW in 2008. Current figures show a considerable increase of RES for electricity production with a capacity of 1900 MW excluding hydro in 2010. This figure corresponds to about 17% of the total consumed electrical power in Greece.

Greece has introduced two mechanisms to stimulate growth of RES-E sector: application of feed-in tariffs and

liberalisation of RES-E development. Interest is higher for wind parks due to the more mature technology in comparison to solar energy. However, solar energy appears to attract quite high interest also in the last years. This interest follows the widespread utilisation of solar thermal technologies in Greece, being the third EU country after Cyprus and Austria with reference to installed solar thermal capacity per capita.

The right mix of public interest in RES, supporting policies and development of an ecosystem of RES manufacturers and installers, has created the necessary elements for the development of this market sector in Greece.

77 companies are currently active in Greece either as RES vendors or as RES-E producers. Small scale solar investments are also promoted in private homes stirring a high interest to the relevant technologies.

Greece ranks 3rd in Europe with reference to the utilisation of solar thermal energy per capita. Photovoltaic market is still lacking in development, yet the potential is great.

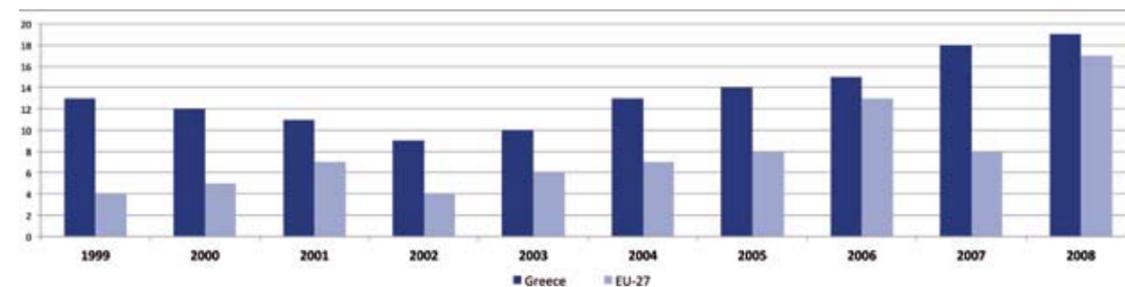


Figure 6: EU and Greece new solar thermal installations per 1000 capita (source: ESTIF)

### GREEN ENERGY MARKET

The situation in Greece with reference to RES for electricity production is improving rapidly. There is an extensive support of the Greek government to the “green” economy and new laws that made this improvement possible. Currently the percentage of electricity produced by RES in Greece is about 17% of the total electricity consumption. Wind energy occupies more than 70% of the total RES capacity, but solar energy has also made considerable improvement. It should be noted that although Greece is developing

its PV market, it is a market leader in the solar thermal market with about 18 KWth per 1000 capita installed in 2008. Although this does not appear in electricity production statistics, it contributes to significant energy savings for water and heating that would otherwise require some other type of energy (Figure 6, 7).

RES for electricity as a percentage of total electricity consumption is expected to be 21% in 2011. This denotes an increase of about 24% in a year that is mainly

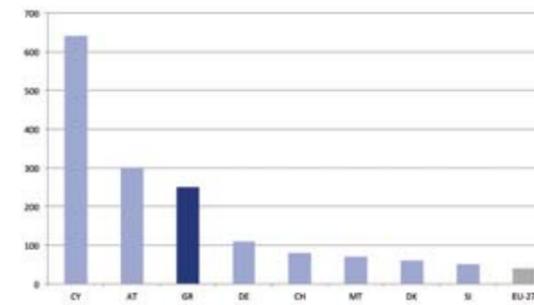


Figure 7: Solar thermal production per capita in kWh (source: ESTIF)

### EFFICIENT USE OF ENERGY

Energy savings and efficient use of energy is a quite important goal for Greece. With reference to energy savings different policies have been implemented focusing for example to the promotion of solar thermal technologies for building usage, or the installation of sensors in public spaces that would reduce lighting in the advent of non presence. With reference to buildings / homes Building Management Systems provide tools for energy savings in buildings / homes without reducing the level of comfort of the occupants.

Such systems rely on sensors that communicate their data to special applications that elaborate scenarios for reducing energy consumption. Research on demand side management has also led to some prototypes but this is not yet provided as a service by power companies. With reference to the industry, energy efficiency is a goal similar to resource efficiency, and may lead to process re-engineering or product re-design so that the new products and services offered by the industry are possibly produced with less energy.

Different projects on building management systems (BMS) that involve private homes, large public buildings and hospitals are elaborated showcasing different aspects and capabilities of a BMS such as monitoring of

attributed to a boom in solar energy (400 MW in 2011 from 198MW in 2010 – 102% increase) stirred by law 3851/2010, while an increase in wind parks of 18,5% is also expected.

Wind and solar energy are considered quite important for Greece. The overall legal framework is relevant to removing barriers that inhibited so far the development of PV market. Wind energy market is more developed. Emphasis is given not only to electricity production but also to the support of manufacturers that could create an ecosystem for this market in Greece.

real-time or historical data, elaborations of scenarios for more energy efficiency.

Bundle of services provision in buildings: the idea is that a common platform can provide different services to buildings based on different sets of sensors. One such service could be Energy Management.

Promoting energy savings and energy efficiency is quite important in Greece. Embedded systems may contribute towards this goal providing the necessary infrastructure in buildings for a higher degree of energy efficiency without losing comfort for occupants. Furthermore such systems could probably create a more ambient living environment thus accomplishing two goals at the same time.

Currently the country has passed a law making it mandatory for buildings to get energy certificates. This creates a huge potential for public and private buildings to install systems that enhance the level of energy efficiency. Furthermore, there is an ecosystem relevant to building management systems and building automation in Greece, currently mainly driven by surveillance / security services. The provision of energy management services looks promising.

### HEALTH SUPPORT, MONITORING, DIAGNOSTICS AND LIVING ASSISTANCE

Greece has an ever increasing aging population. Changes in the social behaviour in bigger cities often result in older people living alone without the support of their offspring. Furthermore, moving away from mountainous areas and small islands towards bigger cities, has led to elderly people living alone in these areas that in many cases lack the presence of medical services. Finally, high levels of car accidents leave a lot of handicapped people or people in need of assisted living. Major effort in Greece with reference to this area was relevant to telemedicine services, i.e. medical services provided remotely upon receiving measurements of the physical parameters of a patient. This is usually provided by medical centres and hospitals to remote rural or island areas. Furthermore, special devices make it possible for patients to communicate their patient

data to doctors. This idea is exploited in several projects with an eye to special cases of patients, e.g. patients in the phase after a cardiac surgery, or patients having suffered a stroke.

A project offered by Vodafone in 10 Greek regions under the coordination of the Intermunicipality Health and Welfare Network, whose members are the participating Municipalities, employing the Athens Medical Group as the central hospital, and with the technical support and training of Vidavo. Municipalities are equipped with Vidavo's vital signs tele-monitoring devices.

Different telemedicine and patient parameter monitoring system projects employed at the University of Patras with public and private hospitals.

The aging population of Greece, the geographical division and the large number of road accidents are three major reasons why assisted living systems and health monitoring and diagnostic systems are important for Greece.

Research in Greece on this field is of quite high level both in academic / research organisations and SMEs. A large

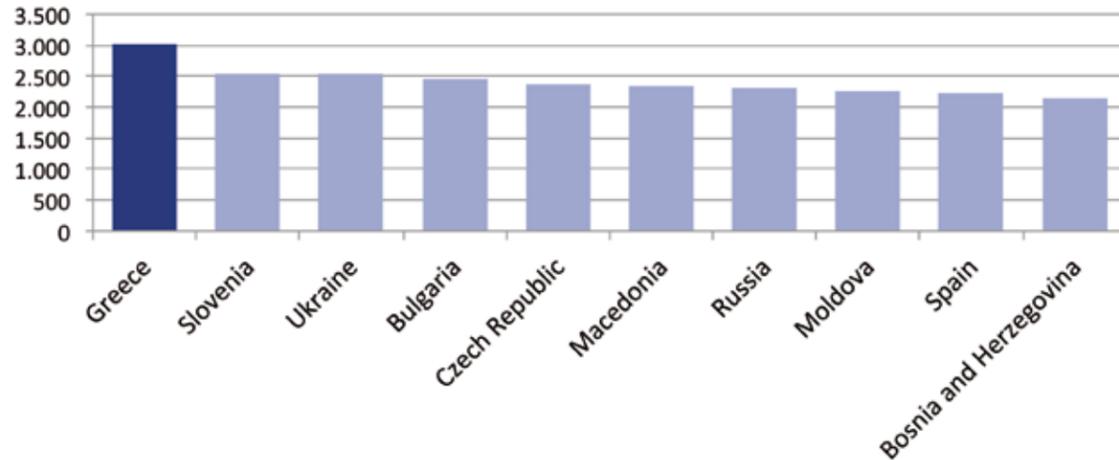


Figure 8: List of countries by cigarette consumption per capita (source: economist.com)

## HOME APPLIANCES

Percentage of households with broadband access in Greece is 23% while the EU27 average is 49%, while percentage of enterprises with 10+ employees that has broadband access is 79,8% close to the EU27 average of 81% (Figure 9).

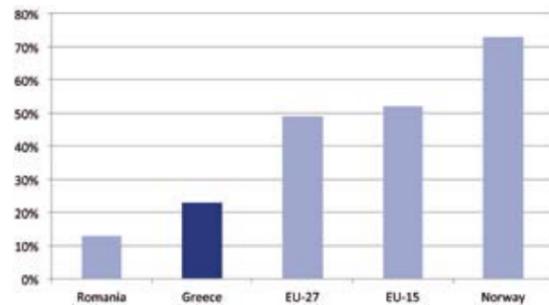


Figure 9: Broadband penetration in selected countries in Europe (source: eurostat)

## SMART HOUSES

Common standards are needed in order to seamlessly integrate different systems / appliances / platforms through a common communication infrastructure. Usually a structure followed utilises the internet and provides an entry point for the provision of services to the home environment. Different appliances, devices, embedded systems; sensors in the home environment are then networked and seamlessly integrated to provide the necessary infrastructure for home scenarios.

Bundle of services provision in buildings: the idea is that a common platform can provide different servi-

ces to buildings based on different sets of sensors. One such service could be Energy Management.

number of SMEs are doing research in this area creating the necessary ecosystem for its development. It is worth to note that Greece ranks number one in the world as the most smoking country (Figure 8). That causes long term challenges in term of two main causes of death: heart related diseases and cancer, both of which are related to smoking. Preventive diagnostics and monitoring are vital for the successful treatment of these diseases.

Most of the Greek home appliances companies have been acquired by international competition. Currently the Greek home appliance market is mainly a market of imported goods. This sector of economy is mainly a commercial sector since most of the household appliances are imported. The broadband market is quite different.

The broadband market has a high potential for Greece. Both broadband access companies and SMEs providing telecommunication equipment exist in Greece. There is also substantial expertise in this area in academia. Moving the broadband market to the EU average creates a large potential for this market.

Construction is an important sector for the Greek economy. Many houses are built for investment and are thus quite luxurious. This type of houses could easily adopt the necessary equipment for being smarter.

There is a number of companies that deal with equipment relevant to the smart home principle as well as companies that do the integration of different off-the-self solutions. Furthermore different research teams deal with this issue with important research results.

ces to buildings based on different sets of sensors. One such service could be Energy Management.

## NOMADIC ENVIRONMENTS

It seems that the world undergoes a revolution from the PC era to the smart phone / intelligent device era. Increasingly smart phone's computational resources are comparable to PC's while the existence of a ubiquitous infrastructure allows their staying continuously on line and exchanging information with intelligent devices in their environment. In Greece ubiquitous environment is a reality since all Greek territory is fully covered by 3G while WiFi hotspots are existent in all major points in cities. Yet, adoption of smart phones and ambient environment applications are still in a pilot phase.

Ubiquity of the infrastructure will allow different applications to follow their users and provide informati-

on for him in the context of the environment that he goes through. Different objects might help towards this goal.

There is a solid research base in this field that could deal with the different parameters of the nomadic environments area.

There are numerous sectors that might be influenced such as tourism e.g. novel guidance services in archaeological sites, commuting e.g. getting personalised information on what is nearby, industry e.g. RFID enabled agent based systems for an ambient industrial environment.

## PUBLIC TRANSPORT

Major transportation infrastructures in Greece comprise roads, a poor railway network, ports and airports. The main means of transport include car and bus, ships, airplane and railway. Metro exists in Athens leading to a traffic decrease in the centre of the city. Use of private cars is extensive, yet doubling the price of gasoline has led to a 30% decrease of consumption and traffic by private cars.

The place of Greece between Europe and Middle East, Turkey and Western Europe has resulted in a boom of the logistics and transportation sector. Problems and solutions for public infrastructures thus affect both these sectors.

Improving transportation infrastructures in Greece is quite important. Embedded Systems can help towards offering advanced services both with respect to information as well as with reference to security.

Greece has two major advantages. It is a transportation hub due to its geographical position, so any advances in the transportation infrastructures may directly affect the logistics and transport sector as a whole, and being part of an integrated supply chain they may affect indirectly the overall spectrum of the economy. On the other hand Greece is a leading ship owner country. The Greek fleet represents a large transportation infrastructure. Innovative solutions in vessels are thus expected to find a big market.

## EMBEDDED SYSTEMS IN AGRICULTURE

Agriculture is quite important for Greece. Embedded systems in agriculture can provide innovative solutions that may increase the quality of the agricultural products and thus make them more competitive.

The improvement of agricultural production, the promotion of organic agriculture, the promotion of new innovative cultivations are important parameters for the

restructuring of the agricultural sector in Greece.

Greece has many areas that live from agricultural activities. Furthermore, there is expertise in this field from the point of view of agricultural experts that can provide the problems and ICT experts that can find potential solutions.



“It is important for the Italian economy to improve and strengthen the manufacturing sector, due to the fact that a large number of companies have a rigid structure and management mentality.”

## ITALY

### FLEXIBLE MANUFACTURING

The industrial sector in Italy is characterized by some weaknesses:

- It is mainly composed of small companies. About 90% of companies have less than 20 employees and the number of companies with more than 250 employees is half that of France and Germany. This “industrial dwarfism” limits companies’ capacity to invest in research and to produce new innovative and high-added-value products.
- The investments in research, both public and private, are not enough to sustain competitiveness of the Italian economy. The total expenditure in R&D amounts to just 1% of the national GDP and only 50% of this is made by enterprises.
- Most of the companies are excessively specialized in sectors with a relatively low rate of development (such as fashion, furniture, traditional mechanics etc.) and, even the biggest ones, have a rigid structure, rarely having a “lean” approach to manufacturing.
- The weight of the Italian manufacturing industry in the international markets is equal about to 4.5%. The first five production sectors, in order of market share, are the footwear industry (15%), furniture (14%), domestic appliances (14%), glass and ceramics (12%) and mechanical engineering (10%). By contrast, the weight of the products of the Information and Communication Technology, i.e. the pro-

ducts with a higher technological content, amounts to just 1%.

- Other factors that influence the competitive capacity of companies are the inefficiency of the public administration bodies, the regulatory system, the lack of the infrastructure system and the credit market.

Despite these weaknesses, the Italian production system presents some undeniable strength.

Italy stands out for the organization of the industrial districts, for economic tradition, for branding policies, for very high inclination to entrepreneurship (there is a high rate of new entrepreneurial activities), for the creativity of entrepreneurs and for the particular Italian style and design.

In addition, a well developed automotive sector (FIAT group and others) with many allied industries presents a considerable strength and potential with high level of innovation and research.

It is important for the Italian economy to improve and strengthen the manufacturing sector, due to the fact that a large number of companies have a rigid structure and management mentality.

The goal is to cultivate a business culture that focuses on the importance of acquiring a new approach, where the keywords are innovation, research and a lean mentality.

able due to the peninsular geography of the territory), could have a higher potential, both cost- ecology - wise. In comparison 62% of freight in Italy is made by trucks (Germany 21,4% France 15,7% UK 11,8%) and only 10% by rail transport.

This is mainly due to the following reasons:

- The dependence of Italy on non-renewable sources particularly on fossil fuels;
- The Italian freight transportation is mainly done by trucks, in a country where the railway network is not fully developed and the shipping (theoretically favoured)
- Italian industries significantly contribute to the greenhouse gases emission (mainly steelworks, refineries and cement plants). Selected industries that contributions in million tons of GHGs: thermoelectric - 146,6, cement production - 31,4, refining - 26,0, steel production - 13,9, paper production - 5,0, glass production - 2,9.
- Significant CO<sub>2</sub> emissions are related to the city traffic

### EUROPE GOING GREEN

Italy exceeds the limit of CO<sub>2</sub> emissions established by the Kyoto protocol causing heavy penalties. It is estimated, in fact, that in the five-years period between 2008-2012, a debt between 1 and 2 billion dollars will be accumulated, that corresponds to a debt of 0.7 million Euros per day.

due to the deficiencies of the public transport and of the lack of a more sustainable mobility. Local public transport in Italy is used by only 15% of the population.

Investing in new technologies and infrastructures that would allow a drastic reduction of emissions, is vital for Italy, not only to improve the life quality and limit the huge environmental damages, but also to face the heavy sanctions deriving from the non-compliance with the Kyoto protocol targets.

The possibility of exploiting the renewable energetic sources (wind, photovoltaic and thermal solar), expending the railway network as well as technologically enhancing,

### GREEN ENERGY MARKET

Italy has an emblematic situation. The country, where the geographical and meteorological conditions would easily suggest a massive use of photovoltaic, wind and hydroelectric energy, produces 77.5% of its energy by non-renewable sources and only 22.5% by renewable sources (mainly by hydroelectric power). It is to consider also that the energy produced covers about 80% of the national demand, while the remaining 20% is imported from abroad (Table 1).

Such a reliance on fossil fuels established Italy as the 13th place in the world ranking of the most pollutant countries according to the World Resources Institute and International Energy Statistic. It is important to notice that Italy does not use nuclear energy that in some countries provides up to 30% of the energy.

It is important to guarantee higher energy autonomy to

and finally the improvement of the quality and efficiency of public transport, are all issues that offer a opportunity of growth and improvement.

The sectors of potential development mentioned above strictly depend on the new technologies development and on improvement of the existing ones.

For example, innovative embedded systems would allow an efficient and sustainable management of the dial-a-bus service, or informative systems that permit the users to know, in real time, the position and the waiting times of the public service vehicle, exploiting GPS systems and smart phones.

the country, decreasing the dependence from the foreign imports (at the moment that Italy has few fossil resources).

The Italian potential for an improvement in the sector is related to solar energy that could guarantee a wider development of photovoltaic systems, as well as more efficient Concentrating Solar Power (CSP), mainly in the southern regions.

However, it is important to note a progress made in the growth of solar and wind energy production in the last years. This growing trend of wind and photovoltaic is, in fact, encouraging, thanks to the National government policies and to the commitment of big public research centers (ENEA).

Statistics:

	2000	2005	2006	2007	2008
Hydroelectric	9725	7935	8139	7219	9157
Wind	124	515	654	888	1069
Photovoltaic	4	7	11	26	99
Thermal Solar	11	21	29	39	56
Geothermal	1248	1384	1429	1438	1427
Waste	461	1501	1672	1734	1784
Wood	2344	3153	3328	3710	3883
Biofuel	95	172	155	174	567
Biogas	162	343	383	415	459
<b>Total</b>	<b>14173</b>	<b>15033</b>	<b>15798</b>	<b>15641</b>	<b>18501</b>

Table 1 Renewable energy sources, installed capacity in MW (source: ec.europa.eu)

A sector with high growth potential is the geothermal energy. It has been estimated that the production of geothermal energy could grow by a factor of 10 in the next 40 years. The energy produced could supply 3.5% of the annual world production of electricity and the 3.9% of the heating. But this target may be achieved only through research and development activities since new technologies are required to advance this energy sector.

But the future, according to IEA (International Energy Agency), is in the exploitation of heat from hot rocks using the “enhanced geothermal system” (EGS).

By 2050 more than half of the expected potential may derive from the use of deep hot rocks – available anywhere – through the use of EGS geothermal systems. To take advantage of this technology it is however necessary to accelerate the research activities, to ensure its commercial availability as early as 2030.

Italy is in a unique position from a geological point of view, second only to Iceland. Italy possesses a virtually inexhaustible energy source that could guarantee the nation’s energy independence.

## EFFICIENT USE OF ENERGY

Italy is lagging behind the European climate policy objectives, but advancements in energy efficiency, such as the low total energy intensity.

An example is the agreement between the Ministry of Economic Development and Enel Distribuzione (an Italian company that handles distribution of medium and low voltage) for the initiation of the testing of smart grids.

## HEALTH SUPPORT, MONITORING, DIAGNOSTICS AND LIVING ASSISTANCE

Italy established a good research system in the field of life sciences in general and in biomedical sciences in particular. The Italian biomedical sector, despite lack of necessary investments, presents brilliant examples of entrepreneurship and has a good potential for further expansion.

Biomedical sector employs approximately 17,000 people in Italy, mostly in small-size companies. Italy ranks eight in medical devices and electro medical equipments exports.

The importance of this sector is related to the good level of research achieved. It is a sector where Asian competition is not yet at alarming level. In addition, as the experts in the sector agree, the turnover should raise in the next years.

The growth potential of the sector is good, thanks to the presence of public research centres and to the already established on the market. It must be highlighted that the average size of the companies is small, resulting in a difficulties to establish a position on the markets dominated by the big multinational companies. It also causes significant difficulties in carrying in R&D activities. If R&D activity will not be carried

## HOME APPLIANCES

The situation in Italy is different from the rest of the SEE countries. Italy has high level of penetration of household appliances, as well as the penetration of broadband connections is significantly higher than the SEE countries: 41% of Italian households have a dishwasher; 97% washing machine, 95%TV percentage and 21%.

Concerning the broadband, the values are still under the European average (EU average: 25%) and much lower than in some countries (e.g. Netherlands: 40%), but are much higher than in the SEE region (e.g. Bulgaria: 13%) (Figure 10).

An undoubted strength is the presence of big companies in the sector (Smeg, Rex, Indesit, Candy) that have achieved considerable results in the past decades, enough to make the appliances sector the second largest Italian industry after the automotive sector and to reach a leading position in Europe. However, these companies suffer

It would reduce the environmental impact and create a strong stimulus for the technological progress of Italy, through the development of new technologies with high environmental compatibility.

The ultimate goal is the implementation of an economy with low energy consumption, more secure, competitive and sustainable.

on in the medium-short period, the Italian production would focus on the less technological part of the biomedical sector, thus exposing itself to the Chinese production competition (traditionally with a lower technological content).

The Italian export must focus on expanding into alternative markets, at the moment almost 50% of the exports in the sector go to other European countries.

A good example of the Italian excellence in this field is the biomedical district of Mirandola, one of the largest in Europe. It is situated near the city of Modena and is an industrial district which hosts many medium and small enterprises and some big multinational companies, specialized in Medical Device Technology as well as plastic production for medical disposables. The production of disposables is the main sector (80% of the overall turnover of the district) and is characterized by low technological content and therefore it is more exposed to the Asian competition. The improvement of the R&D activities and the opening of new sectors such as health support, monitoring, diagnostics and living assistance are both concrete possibilities to boost the development of the whole district.

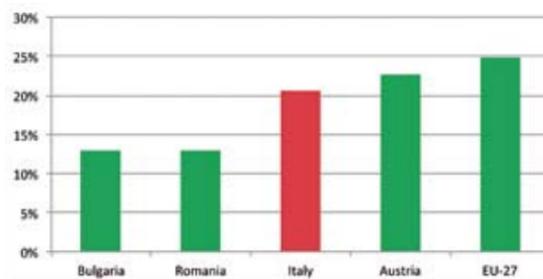


Figure 10 Broadband penetration in 2010 (source: ec.europa.eu)

from the competition of countries with a low labour cost. Globalization, EU enlargement and also the increasing costs of raw materials cause the inexorable decline of the sector. The decreasing of the sector profitability, mainly due to the most standardized activities with a less technological content, show alarming results (for example

the refrigerator production is declined from 7.5 million of 2002 to about 4 million of 2007).

Italy has the necessity of recovering that leading position in the appliances market that represents, even nowadays, one of the biggest industrial sectors of the world. The engagement in research and in innovation is already considerable in this sector. The real challenge is to convince the customers, the institutions and the distributors to prefer a reliable and innovative product (above all regarding energy savings) to of a cheap product, often characterized by a doubtful efficiency and quality.

## SMART HOUSES

It is a growing industry but still marginal compared to other European countries.

The market situation presents obvious contradictions: 1) there is a growing interest shown by the continuous end-user requests for new comfort and efficiency 2) however only a few projects that have made a major investment in automation.

In 2003, in Italy the home automation market was still a reserved market.

Security systems and wire services still represent about 80% of the investments made in the home automation. The trend is a growth of the overall market.

In the face of current demand, however limited, the prospect of the market potential is very high. For example it is expected to build, over the next decade and a half, 1 million new homes and this will involve installation of home automation systems.

There are several eco-homes projects in Italy:

BTicino with Telecom Italy has implemented a project that allows having a remote control of the energy consumption by a PC and a smart phone. The two companies have partnered for the "intelligent" home automation system through innovative solutions in order to make more complete the range of technology services for home. Specifically, through a simple smart phone, or a PC, it is possible to perform the functions of remote control of lighting, security and comfort, optimizing energy consumption.

Telecom Italy's Green @ Home system is a prototype of a domestic energy monitoring system to improve energy efficiency in home. In addition to reducing consumption and monitoring the consumption of various household appliances and lights, it allows the user to identify virtuous behaviours.

The system is based on intelligent sockets that allow monitoring of energy consumption and the remote control for feeding the electrical devices plugged into the sockets. After the field tests, Telecom Italy has signed an agreement with Electrolux, Enel and Indesit to research and develop innovative services based on communication between next generation domestic appliances and the

Another important goal is to make production processes more flexible and innovative.

Concerning the saturation of the internal market, as said above, it is useful to do some considerations. It has to be distinguished the northern market of Italy from the southern one. The last one has still values lower than the European average, regarding to the penetration of the most innovative products.

Another possible consideration regards the product typology. There is still an unutilised market in some products as such dishwashers and broadband connection.

electrical infrastructure (allowing the remote control and management of electricity consumption). The aim is to create a system in which "smart" domestic appliances are able to manage themselves by regulating the consumption of energy in the entire home, avoiding network peaks and surges, without compromising the comfort of the users.

Energy saving of 15%, improving indoor comfort and quality of life are two objectives of the "Intelligent House" at the ENEA Casaccia Research Centre.

The project, started in 1996 and completed in 2000, is constantly evolving. Home automation technologies are progressing day by day especially with regard to components and design, but the function remains the same. The heart of the house are the field devices, which are sensors that can 'govern' a program for household heating, a theme that is monopolizing the attention of many companies, from Microsoft and ENEL to Echelon.

The market has some inhibitors: 1) The lack of awareness on the topic of the end user demand growth, but even more problematic is 2) the lack of know-how of installers from a technical point of view, about the lack of standards. Therefore the need for technical training is vital. Also the cost is still perceived as a sign of obstruction.

However, the expansion of the market and the standardization will allow the reduction of prices.

To summarise the user needs a house needs to be 1) comfort and relax, 2) secure, 3) save energy, 4) be easy to install and 5) be "user friendly".

Recent market research shows that the current range of home automation systems is directed towards middle-class customers. Finally, the consensus is that the driving force is not the technology but the functionality made available by the technology itself. Respond to new needs expressed by users is an important business opportunity for companies and for the economy of the country. Also fundamental is the impact of automation on environmental management, equipment management, communication and information security.

## NOMADIC ENVIRONMENTS

Cloud computing is mainly used by the small and medium Italian enterprises and with a rate slightly lower than the European enterprises (Italy:55%, Europe:60%). There is still certain reluctance towards this technology, mainly due to problems related to safety and privacy, for budget problems, but above all due to the absence of a strong infrastructure, able to guarantee an adequate broadband connection. The sector, however, will show strong expansion in the near future. The smart phones penetration is very high, Italy has the highest number of users of these devices (Italy: 15 millions, UK:1, Spain: 10, Germany: 8.5, France: 7).

60 % of Italian SMEs use cloud computing for data storage or for e-mail services, 40% of SMEs have transferred the Office applications, 33% also the computing resources and 27% the desk computing. The rate of the interest is significantly growing, in 2009 only 12% of companies looked positively at cloud computing, but 41% of 2010. The importance of this sector lies in the big competitiveness that cloud computing can give, thanks to the reduction of the

## PUBLIC TRANSPORT

The situation of transport infrastructures in Italy is characterized by a contrast between the North with comfortable and modern highways, railways, airports etc. and the South with undeveloped areas. A common characteristic is the high prevalence of private cars.

Public transport in Italy is used by a low percentage of the population that complains about the low flexibility of the service and the low speed of the means (average of 18.6 Km/h), to the point that Italians are the most unsatisfied in Europe.

The Italian public transport system is inadequate the following reasons:

- Lack of preferential lanes for buses inside the urban road network
- Lack of interchange parking
- Undeveloped of the subway network

The shortage of the subway networks in the Italian cities is obvious in comparison with other major European ones: Milan (84 Km), Rome (36.5 Km) Naples (28 Km) London (408 Km), Madrid (296 Km), Paris (213 Km), Berlin (144 Km), Barcelona (107 Km), Munich (101 Km) etc.

## WASTE MANAGEMENT

The Italian situation is in line with the European average (MSW: 550 Kg per capita, per year) accounting to 32 millions of tons yearly, of which only 8.8 millions are recycled (27.5%), but with evident geographical variations (North: 42.4%, Centrum: 20.8%, South: 11.6%). In Italy there are 5884 recovery plants of non-dangerous wastes, of which 4102 in the North, 1005 in the Centrum,

costs of hardware infrastructures, to scalability of the demand and to the frequency of the software updating.

Italian managers have a good predisposition to technologies (a proof is the high rate of virtualization). This fact, together with the potential offered by the cloud (above all to obtain savings in a medium term) and by the high penetration of smart phones, guarantees a good potential for growth for this application area. An important prerequisite is the enhancement of penetration, reliability and speed of the broadband on the country.

A great potential for Italy is the possibility of exploiting ubiquitous environment for tourism to find use of huge artistic, religious and archaeological heritage. Some examples may be, on the one hand, innovative guidance services and touristic info, given to tourists through smart phones, Wi-Fi points, Bluetooth and other useful multimedia technologies and services, and on the other hand, some virtual reality services, such as the reconstruction of ancient places.

There is also a deficiency of initiatives for the revival of the use of bicycles that require an adequate network of bicycle paths, bike sharing systems etc.

The benefits obtainable through a valid and efficient public transport service are the following:

- Environmental benefits (reduction of emissions, reduction of noise, increase of zones free from the obstruction of cars etc.)
- Social benefits (increase of road safety and reduction of accidents)
- Economic benefits (reduction of fuel consumption, reduction of parking costs etc.).

Increase of a number of clean vehicles, additional information services (waiting times), alternative paths, interchange parking, transports on-demand, mobility management measures, promotion activities, are all issues to work on, in order to provide users with a competitive service. Specifically, it would be necessary improve the infrastructural situation (subways lines, enhancement of preferential lanes, bicycle paths etc.) but it would also be necessary to intervene with purely technological and innovative measures that would have various objectives: eco-friendly, higher automation, informative systems and safety systems etc.

and only 777 in the South. This underlines the strong gap existing between the North and the South of the country. The levels of recycling collection are lower than the ones of the major European countries. From 2003 to 2007 it has been recorded a reduction of landfilling from 53.5% to 46.7%, but, at the same time, an increase of the incineration (in 2007 more than 3.9 millions of tons incine-

rated, equal to 12%). The production of special wastes is growing: 72 millions of tons of non-dangerous, 9.2 of dangerous and 52 coming from construction and demolition activities. In general, 47% of waste is disposed in landfills, 10% is incinerated, 23% subjected to a biologic/mechanical treatment and the remaining 20% to other treatment. It must not be noted that, in some regions, the waste disposal is an activity that has relevant infiltrations of organized crime, that has set up a considerable business through the abusive disposal, causing huge environmental damages. This makes the situation, in these areas, very delicate and needs policy initiatives to fight against these criminal activities, more than technological or procedural interventions.

The separating, composting and recycling of wastes is a more sustainable approach than the traditional disposal, because reduces the environmental and health impacts, reduces the management costs and can create new jobs. In the scope of an overall development of an "integrated management of the waste cycle", technological innovation plays a primary role. The research of new technical and scientific solutions allows to implement a set of strategies aiming at recovering and reusing wastes, reducing the quantity intended to landfilling and, moreover, allowing to upgrade the industrial productive processes with the aim of a higher overall level of eco-sustainability. The definition of new and innovative systems to manage waste at household level, systems able to facilitate the se-

## EMBEDDED SYSTEMS IN AGRICULTURE

Even if, nowadays, this field employs just 5% of the active population, agriculture in Italy is one of the most important in Europe. Italy is among the first countries in Europe in production of wheat, rice and corn. wine and olive oil production are well developed. In general Italian agriculture consists of two types: an intensive one, modern and very productive (in the Po Valley, in plain Me-tapontina etc.) and one, widely scattered, more extensive and less modern, where the component of tradition is still dominant and where the technological component is barely present.

A great development is having bio-production, where Italy is the leader in Europe with a production that affects approximately 6.9% of agricultural land. However, the Italian agricultural entrepreneurial world is reluctant to invest in new technologies, sometimes preferring cheap labour made up by migrants from North Africa.

The agricultural sector despite of the excellence and high specialization achieved, represents a minimal percentage of the national economy. It must be noted that having a predominantly mountainous shape, Italy is not very suitable for agriculture, As of 2009 Italy in this sector employs a workforce of approximately 1.05 million people.

Italy stands out, at a European level, for the production of cereals such as wheat (8,951,590 tons), corn (9,789,401 tonnes) and rice (1,388,927 tonnes, the largest producer in EU) soybeans (353,761 tons) and sugar

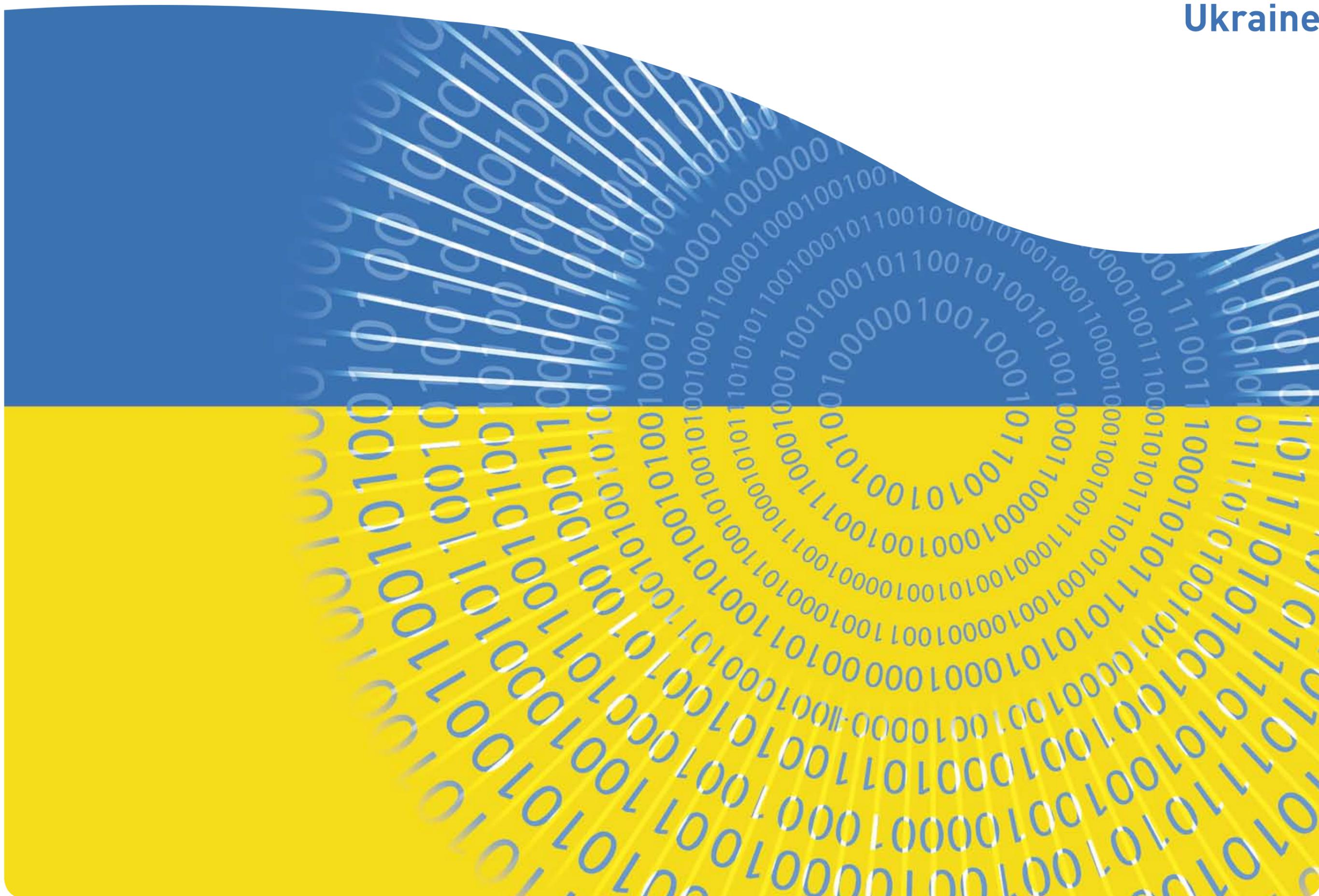
paration and the collection, systems for the traceability of wastes, systems useful to simplify the operations of decoupling of material laminated, technological systems for reduction of pollutants of energy plants, etc.

An example of innovation is SISTRI - an initiative of the Ministry of Environment that allows tracing special waste in a telematic way, because of the system specifically developed for this goal. Another example is THOR (Total House Waste Recycling) that is a technology developed by CNR (National Research Council) and by a private company for the mechanical treatment of waste and for fuel from waste production (powder). It is based on a process of cold refining of the undifferentiated material. In short, it is a system that allows to recover and refine waste and turn it into an indistinct homogeneous mush, purified by the harmful parties and that can be used as fuel by the high calorific value, bypassing the differentiated collection. Yet another example is the "infrared spectrograph". The scraps of paper or plastic are usually distributed on a conveyor belt in a single layer. When hit by the beam of light from a halogen lamp, any material reflects a specific colour scheme that allows to identify it. Therefore, a jet including the air separates from the rest. This system allows separating various types of materials with accuracy close to 98%. In short we can say that the fields of application of new technologies are indeed many.

beet (3,845,791 tons), all grown mainly in the North. Italy together with France is the world leader in wine production and is second only to Spain in the olive oil production. The South is specialized in the cultivation of vegetables (tomatoes, lettuce, fennel, peppers, cauliflower, celery).

The lack of work in Italy is a question that plagues much of youth, which sees agriculture as a backward and disparaging sector, not as a possible job opportunity. The raising of the technological and innovative level in this sector could provide a reassessment of agricultural activity, providing new job opportunities. This is particularly valid in the southern part of the country, which has a centuries-old tradition of farming and herding, and where food and wine productions have especially high levels. However, this system should be revised from a more modern point of view, concerning marketing and promotion.

Italy has certainly a high potential for growth and innovation in the food industry, given its tradition and the international reputation of its products. The geography (long and narrow, mostly mountainous) benefits a modern, more intensive agriculture, which is achievable only with a change of mentality concerning the small farmers, that must adopt an approach based on innovation and technology, with a more entrepreneurial thinking.



“Recent events made it clear that Ukraine has no possibility to place a bet on oil and gas based energy system.”

## UKRAINE

### EUROPE GOING GREEN

To the present time Ukraine has faced a dilemma, what power generation should be in Ukraine? It is obvious that power generation is not only a basis for real politic independence of the country today, but a precondition for a stable development of Ukraine tomorrow, an essential condition for forming modern and strong post-industrial economy.

Recent events made it clear that Ukraine has no possibility to place a bet on oil and gas based energy system (Figure 11). There is no sense to be relying on nuclear power until issues connected with safety of nuclear power stations and organization of long-term nuclear waste depositories will be solved. Besides, as in case with oil and gas, Ukraine supports foreign economics buying nuclear fuel and equipment for nuclear power stations.

Ukraine has determined its new purposes in development of power generation from renewable sources. Corresponding amendments in State program of energy efficiency are approved by Cabinet of Ministers in April 2011.

This program for the first time establishes mid-term purpose for Ukraine - to achieve 10% of energy generation from renewable sources to 2015 (and 30% by 2030). This means that for the next 3,5 years support of investments in "green" power generation will be maximal. Updated program suggests to establish 5,61 GW of generating capacities of wind-stations, 1,45 GW of solar plants, 75 MW of small power plants, 791 MW of solid biofuel plants, 111 MW of bio-gas plants, 461,5 MW of capacities for production of electrical and heat energy from biomass and 200 mW - from geothermal sources to 2015 (Figure 12).

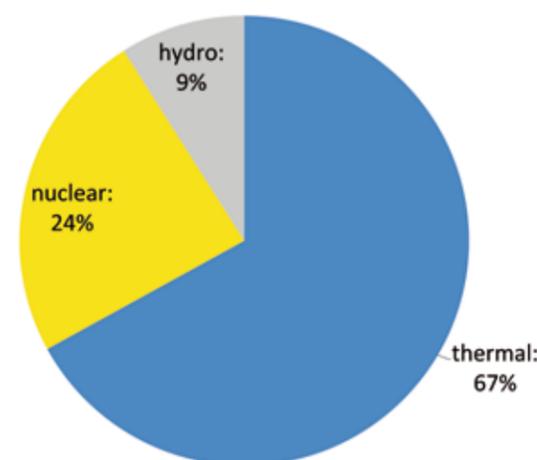


Figure 11: Installed electricity capacity in Ukraine (source: Austrian Energy Agency)

MW and started generation. This object is situated in Crimea, near Simferopol. At the moment of its start this plant consisting from 33,8 thousand panels was the biggest on the territory of CIS.

Solar park "Okhotnikovo" with determined project power of 80 MW which the Austrians are installing in Saky area of Crimea, will be one of the biggest in the world. First phase of "Okhotnikovo" with 20 MW capacity was connected to the energy grid in August 2011. The remaining 40 MW are planned to be finished at the beginning of 2012.

Big projects also are installed in the field of wind energy. In Donetsk region construction of the two phase wind park "Novoazovskiy" has been finished in 2011. The whole project provides installation of 43 generators (107,5 MW). Equipment supplier for this project is German company Fuhrlaender. Development of these projects demonstrated that laws in stimulation of electrical energy from renewable sources work in practice. In particular, German company Managess Energy has already announced construction of photovoltaic power plant in Zaporozhye region, and Greek company ENECO - of wind parks in Crimea.

Another aspect of green energy that shows potential by the level of investments is the small hydro power plants. Historically, before atomic energy boom in 1970-80, Ukraine had 1800 small hydro power plants. Nowadays, companies install new equipment on these old plants, or build complete new objects. From 74 projects with green tariff, 61 are small hydro plants. Amongst the most successful Ukrainian companies in this field - Novosvit, having about 14 hydro power plants, Akvanova and Sibeks, also having in possession some hydro power plants. These companies successfully use "green" tariff. Swiss company Alter Energy Group AG (AEG) is interested as well in development of small hydro. These projects are supported by EBRD and International Finance Corporation (a branch of the World Bank). German company RWE is going to enter Ukrainian market of alternative energy. It was historically interested in development of small hydro.

Ukraine has powerful agricultural sector, therefore its third direction is biofuel from plant or cattle breeding waste. For example, company Zorg Biogas AG works in this field, which in time of processing of raw material into bio-gas uses patented German technologies.

The third category, in which Ukraine actually has potential, is the energy of biomass from plant production waste.

Every year Ukrainian agriculture produces approximately large quantity of biomass, and if it is not used, it is thrown on the scrap yard. But in harvest time it may be compressed into pellets which can be used whole year. For instance, there are many heat power plants using coal, and it will be easy to change it into biomass pellets. For the last 2 years a growth of the new SMEs companies which work in the field of alternative energy and energy-saving technology has been observed. For example, such companies as LLC "GREEN ENERGY", which is one of the leaders on the market of alternative energy of Ukraine. The company provides services of implementation of complex decisions in alternative energy and energy-saving technologies on social and industrial objects in following directions: 1) Hybrid systems on electricity production (solar collectors, solar batteries and wind power generators), 2) Solar collectors for water heating and 3) Heat pumps.

Alternative power generation in Ukraine attracts investors partly because of politics which are carried out by the government for supporting this sector. On the one hand, these are tax benefits for the companies which are involved in projects for renewable energy (according to new Tax Code, incomes from sale of electrical energy

### GREEN ENERGY MARKET

Ukraine has potential for development of fourth basic directions of green energy. From the global point of view, the biggest investments are directed towards solar energy today in the world. In this field several companies have already achieved considerable results. In particular «Activ Solar», which has build a solar plant in Crimea. This company establishes high standards for other solar industry projects in Ukraine.

Ukraine has great possibilities for organization of solar batteries, as in the soviet times their basic manufactures were located here: pure metal plant in Svetlovodsk and titanic-magnesium factory in Zaporozhye, which worked for "space" needs. Today interests of the photovoltaic industry include solving social issues - energy supply of buildings, security systems, alternative and uninterrupted power supply of the objects which are located at great distance from power lines. At Kiev plant "Kvazar" industrial production of solar batteries has been established with total volume of 2 MW annually, and 120 MW of photovoltaic polysilicic plates were produced in 2005 (today the production base allows to achieve level of 500 MW per annum).

During 2010, a number of companies which produce electricity from renewable sources had increased more than 1,5 times - from 20 to 36, and quantity of correspondent power stations - from 53 to 70, as National Commission on Regulation of Electric-Power Industry informs. In particular, last year first in Ukraine solar plant has received "green" tariff. Its determined power amounts 35 kW, and the company "Vinnitsa-energосervice" operates this object.

Year 2011 was marked by a transition from quantity to quality. For first six months the number of market members increased only by 28% - to 46 companies. But in win-

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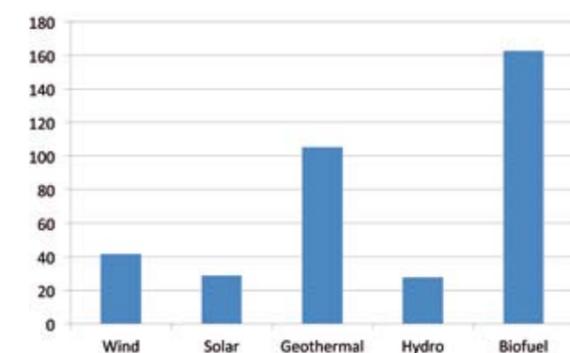


Figure 12: Energy potential in million MWh (source: unece.org)

In the nearest decades it will be possible to solve issues of electrical and heat supply of the country only by means of sun energy, wind, biomass waste, heat of the soil and water power resources, as well as taking measures for energy saving and energy efficiency.

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## SMART HOUSES

The concept of Energy Active House (EAHouse) - the house using energy of an environment, accumulating its surplus within the warm period of year, and spending in cold shows potential for utilization in Ukraine.

Energy Active Houses are equipped with the complex system of power supply including energy active protecting constructions on the basis of solar-profile, thermal pumps, season heat accumulator, using alternative energy sources and electricity. The system provides hot water supply, heating, ventilation and air-conditioning for the house. Used alternative energy sources usually are sunlight, ground warmth and air.

Concept of EAHouse is based on average climatic conditions of Ukraine, quantity of solar heat, which is received by the surface of the house constructed according to modern requirements for energy saving, 10 times exceeds its annual heat demands for heating and hot water supply. According to it, the energy of a sunlight entering during the warm period of a year on the energy active roof and house facades is transformed by them into heat of the heat-carrier, and reserved in heat seasonal accumulator, raising its temperature. During the cold period of the

saving technologies on social and industrial objects in following directions: 1) Hybrid systems on electricity production (solar collectors, solar batteries and wind power generators), 2) Solar collectors for water heating and 3) Heat pumps.

Alternative power generation in Ukraine attracts investors partly because of politics which are carried out by the government for supporting this sector. On the one hand, these are tax benefits for the companies which are involved in projects for renewable energy (according to new Tax Code, incomes from sale of electrical energy from renewable sources are exempted from income tax to 2010 inclusively).

On the other hand, there is one more effective instrument for supporting of developing projects - "green" tariff, established by NCREPI (National Commission on Regulation of Electric-Power Industry).

Rule of "local element" acts in Ukraine. According to the law "On electric power industry", specific gravity of the raw products, materials, basic funds, works and services of Ukrainian origin in the value of power plants construction of renewable sources should be 30% from January 1, 2012, and from January 1, 2014 - 50%.

This measure is directed on stimulation of high technology sector in Ukraine and has long-term perspective. But for the nearest period it will not favor foreign investments in this sector.

year the accumulated heat is used for heat providing of the house or directly ("direct heating"), or by means of geothermal (as a rule) thermal pump. As a result, annual consumption of energy carriers of EAHouse from external networks is less in times than of the house equipped by a boiler.

House technical security systems (HTSS) are developed and produced also for houses in the sector are also available in Ukraine. HTSS is focused on timely discovery and liquidation of engineering systems accidents, such as gas loss, flooding, temperature differences (fire threat). Special sensors pass the information in the form of digital signals and further processed by notification systems. The technical security system also provides connection to the security signal system.

Such systems can reduce the energy consumption in Ukraine, which is at the moment is equal to 0.5 kg of oil equivalent per \$1 of GDP per capita. In comparison, EU average is three times lower making it not only more efficient and environmentally better, but cheaper. A factor of high importance in Ukraine that heavily relies of imports of energy.

## NOMADIC ENVIRONMENTS

The basic technological tendencies that apply to Ukraine are:

- Virtualization and "cloudy" calculations: more effective resources use and translation of applications for work on remote computers in a mode of rent or outsourcing.
- Introduction of mobile decisions at a corporate level: use of smartphones and tablet computers for execution of corporate applications
- The remote launching of office applications with use of Internet network: use of Internet for access to office applications
- Visualization: appearance of available 2D and 3D tools for visualization of processes, phenomenon, behaviour of the objects, including in a web-environment.

Situation from the viewpoint of the consumer

- Life "on-line": possibility to be constantly «in touch» and to have access to information sources
- Life without mediators: barriers between information source or the goods and the consumer are removed - direct dialogues of the author and the reader, the seller and the buyer, the teacher and the pupil are possible.

## WASTE MANAGEMENT

Waste management, especially of large industrial chemical plants, is the problem for Ukraine. So it is necessary to have, first of all, legislative measures which would encourage business for the organization of manufactures on processing waste.

For example in ONPU has developed and patented a new way of processing of phosphogypsum into nitrogen fertilizers which provides possibility of fertilizers manufacturing from chemical plants waste. This way presumes implementation of built-in systems into technological equipment on phosphogypsum processing. Phosphogypsum is a volumetric and very harmful waste of the phosphoric fertilizers industry.

- Life in the virtual environment of likeminded people: use of services of social networks and blogs for communication in interest groups, joint creation a web-resource (wiki-wiki), on-line games.
- All in one: combination of services and content in one device, vast possibilities for knowledge access.

At the present moment real demand for training "at any time and in any place" has formed. This reality requires reconsideration of traditionally built model with lectures and practical studies in high schools and lesson model at school. It is necessary to pass to the mixed model when the part of a traditional load is moved into virtual mode. And for this purpose training environments, qualitatively filled by materials, testing systems, portals, services of streaming video broadcasting, Webinars, SMS delivery, etc. are necessary. Besides tutors, instructors who will work in such environments are also needed.

Being a developing country, Ukraine can greatly benefit both for industry and academia from the new developments listed above. SMEs in Ukraine do not possess enough computational resources and can use the "cloud" that is considerably cheaper in the short term. Academia can benefit from including itself into the already established knowledge that is required for Ukraine to be integrated in the different political and economic system that it used to operate.



“The development of Serbia is aimed on the integration process into the European Union.”

## SERBIA

### FLEXIBLE MANUFACTURING

Strategy for energy development of Republic of Serbia up to 2015 is based on the aim for rational harmonization of energy development with economical progress in the country and with further inclusion in European integration processes. This Strategy defines the following five priorities: (1) continuation of technological modernization of existing energy objects/systems/ sources in the sectors of oil, natural gas, coal, etc.; (2) rational usage of quality energy and increasing energy efficiency in production, distribution and energy usage; (3) using of renewable energy sources and ecologically reasonable technologies and devices/equipment; (4) urgent investment into novel energy sources; (5) building new energetic infrastructural objects including capital objects in the framework of regional and pan-European infrastructural systems connected with the Serbian system. Above-mentioned priorities will open new areas for wide application of embedded systems and industrial informatics.

One of the growing industrial sectors in Serbia where embedded systems and industrial informatics found in various applications is the food production or generally in the food industry mainly in the new concept of smart or intelligent packaging. Requirements to improve food product quality and safety, enhance or stabilize food composition and nutrition, extend shelf-life product stability or build confidence, information or consumer convenience into food packs are fast becoming market demands. Future packaging formats must be designed with these requirements in mind. The future smart packages will contain embedded sensors (gas sensors, organic or polymer sensors) and cost-effective display to inform customer about expiry date or other conditions during the life cycle of one product or can contain embedded RFID tag and a simple chip with memory and all important information on the product as well as theft protection, branding, etc. Furthermore, application of different type of robots in food production can significantly improve productivity and quality of the products.

Automotive industry and automotive systems are a specific application area for embedded systems and industrial informatics. These systems are formed by an integration of mechanical, electronic, software and control system components.

The electronics in a system is interacting with the physical environment through sensors and actuators. Software, electronics, sensors and actuators constitute key

implementation technologies in automotive industry. The standard solution today is to use software with microcontrollers (highly integrated electronics devices that include a microprocessor, communication facilities, and digital/analog inputs and outputs). The use of electronics and software within products has given rise to the term embedded systems. Embedded control systems are increasingly used in a variety of applications and they are radically changing the products they are embedded into. The added dimension of explicit and flexible information transfer and processing, implemented through electronics and integrated into the mechanics, enables improved performance and entirely new functionality to be implemented in modern automotive industry. Modern automobiles use a number of electronic embedded systems and devices. Today's low-end cars often include 40 microprocessors while high-end cars can contain around 100 microprocessors. These devices can be organized into several networks.

Regarding the equipment production, Serbia has a recognizable role and one of leading positions in the region in the following fields: military equipment production, medical equipment production, production equipment for processing fruit and vegetables, etc. Serbia has following industrial capabilities and facilities in the defence industry: casting of precise and large-dimension parts from ferrous and nonferrous metals, manufacturing of parts and components for the communication equipment, manufacturing of optical components and devices. There are a few companies offering a range of advanced, diagnostic imaging and informatics solutions (especially in the production of digital radiography systems based on latest generation of flat panel acquisition technology and the universal robotized radiographic system for examinations both for standard radiographic imaging practice and specialized digital radiography applications). Agricultural products (fruit and vegetables) are one of the main export sector of Serbia and also there are companies dealing with production equipment and machines for this sector and further investment in its will be very important and beneficial.

Rubber and plastic production. The chemical industry and the processing of plastics and rubber represent infrastructural branches of the economy. Their products are used in almost all segments of the economy and strongly represented in consumer products used in all vitally important aspects of living. In the pro-

ducts based on caoutchouc, production of tires for car industry and for agriculture machines is dominate in Serbia (in the recent period production of wearfoot is also in progress in Serbia). Plastic production is based on production of polyethylene, polystyrene, PVC, PET, PMMA, etc. Further development and application of plastic components in optical products is very important in Serbia, especially for a number of SMEs dealing in this sector. Almost all technical faculties in Serbia have subjects devoted to the polymer materials and research in this field will be a key enabler of new solutions in this sector and transfer to the industry.

Metal production is one of the leading industrial activities of Serbian economy. Iron and steel production in Serbia is related solely to steelworks US Steel Serbia in Smederevo. It is an integrated factory with a technological process starting from raw materials (iron ore, coke and limestone) and finishing with hot rolled strip and/or cold rolled sheets, at one location. The annual produc-

### EUROPE GOING GREEN

Republic of Serbia is the leading country in CO<sub>2</sub> emission among the neighbor countries (Romania, Bulgaria, etc.). Republic of Serbia has accepted the Kyoto protocol on 24. September 2007. Since that time only few things have been done.

Ministry of Environment and Spatial Planning has successfully finalized implementation of the project „Development of National strategy for incorporation of the Republic of Serbia, into Clean Development Mechanism (CDM) under the Kyoto protocol“. Implementation of this project has been realized with the financial support received from the Government of the Kingdom of Norway.

Government of the Republic of Serbia adopted National strategy for incorporation of the Republic of Serbia, into the Clean Development Mechanism under the Kyoto protocol for sectors of waste management, agriculture and forestry.

The government of Serbia, has approved financial support for development of project Feasibility study: "Efficient ways for GHG emissions reduction under the post-Kyoto framework" proposed by Ministry of Environment and Spatial Planning. The project objective is preparation of a comprehensive national mitigation program, through upgrading GHG future trends projections for all relevant sectors (energy, transport, ag-

### GREEN ENERGY MARKET

Consumption of energy in Serbia is growing. Of the total consumption of energy the majority (about 58%) is provided by coal. The rest (about 48%) is provided oil and petroleum products, natural gas and coal which are mostly imported. Domestic production of electricity almost completely meets needs. However only 5-6% of all this energy is green energy (Figure 13). The Republic of Serbia uses less than 60% of potential hydropower. Over 25% of the remaining technically

tion is around 2 million of tons of final products (steel sheet and strip). Copper mines and Smelting Complex, Bor, is the only Serbian producer of copper and copper alloys. The production of primary aluminium is not present in Serbia, but the production of aluminum alloys based on recycling shows considerable capacities, approx. 115000 tons. The mining and metallurgical production of lead has a very long tradition, too. Due to the very important role of metallurgical industry in Serbian economy, a further development and market competitiveness have no alternative but to follow the principles of the cleaner production. The road to the sustainable development will require modifications of activities concerning all three pillars: environmental protection – implementation of acceptable technologies; economic development – opening of new jobs and social cohesion – awareness that further development, leading to the devastation of the environment, is unacceptable in spite of possible profits.

riculture, waste and forestry) for the period until 2020, elaboration of GHG mitigation possibilities, assessment of costs for different options for GHG reduction, as well as elaboration of overall reduction potential within the country based on different factors.

For the purchase of vehicles with emissions of carbon dioxide (CO<sub>2</sub>) less than 100 grams per kilometer, the citizens of Republic of Serbia will receive subsidies to 1000 EUR through the Fund for Environmental Protection Statistics.

For the Republic of Serbia it is very important to be part of the European community. Reducing pollution is one of primary ecology objectives in that direction. The reduction of "greenhouse gasses" can increase development of local industries and create new jobs.

Implementation of the Kyoto Protocol in Serbia can significantly encourage foreign investments, because developed countries whose firms invest in clean technology gather quotas for the emissions in their own countries.

Hybrid vehicles, eco-farms and factories can reduce the pollution and still be very productive. In the year 2010 1132 hybrid vehicles were sold in Republic of Serbia. Even for this effort, the hybrid vehicles contribution is around 0,2%, which is little.

usable hydropower potential relates to the potential for small hydropower plants (with a power of up to 10 MW). It is foreseen that at least 45 MW small hydro power plants will be constructed in the period up to 2012.

Bioethanol: The production of ethanol in the Republic of Serbia today is derived from molasses (cca. 50%) and crops (cca. 50%). The available amount of molasses does not meet the demand for bioethanol production:

the total capacity in already constructed sugar factories generate cca. 200.000 tons of molasses annually, of which 50.000 tons are used, whilst the remaining 150.000 tons can be used in other ways, such as the production of bioethanol. The needed amounts of molasses for the production of bioethanol would need to be imported, in the condition of great fluctuating prices and available amounts on the world market.

To produce 100.000 tons of bioethanol, 330.000 tons of crops are needed, which represents one third of the market crop surplus or a total of 2-4 % of total crop production.

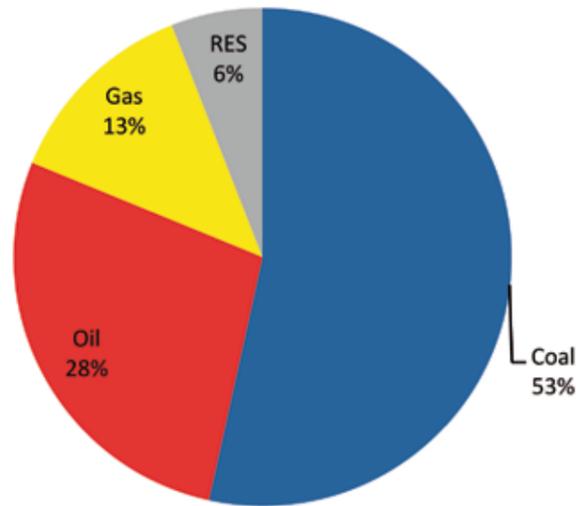


Figure 13: Energy consumption in Serbia in 2008

The consumption of energy from renewable sources (RES) contributes to more efficient usage of domestic energy production potential, the reduction of "greenhouse gasses", the decrease in the import of fossil fuels, the development of local industries and creating new jobs.

Technically utilizable energy potential of the renewable energy sources (hydro-energy, wind energy, unaccumulated solar energy, biomass, geothermal energy and other sources) in the Republic of Serbia is very significant and estimated at over 4.3 million tons of oil equivalent per annum - of which 2.7 million toe per annum lies in the production of biomass, 0.6 million toe per annum in the unused potential of hydro-energy, 0.2 million toe per annum in already existing geothermal sources, 0.2 million toe in wind power and 0.6 million toe per annum in solar energy.

The overall biomass energy potential in the Republic of Serbia is estimated at 2.7 million toe. It is composed of wood waste and forestry remains (cca. one million toe), and remains in cattle farming, fruit farming, vineyard remains and primary fruit processing (cca. 1.7 million toe). The biomass energy potential in cattle farming, which is suitable for biogas production is estimated at 42.000 toe.

Biodiesel: Raw materials such as oilseed (made from sunflowers, soya beans and turnips) and edible oil waste are suitable for the production of biodiesel in the Republic of Serbia.

The total surface under oilseed crops is estimated at 668.800 ha, of which the growing of oilseed crops used for the production of biodiesel could be achieved on a surface of 350.000ha.

Republic of Serbia has the objective to increase electricity production from RES by 7.4 %- from 9,974 GWh in 2007 to 10,713.1 GWh in 2012. Most of the growth is expected to come from the small hydro and biomass generation (Figure 14, 15).

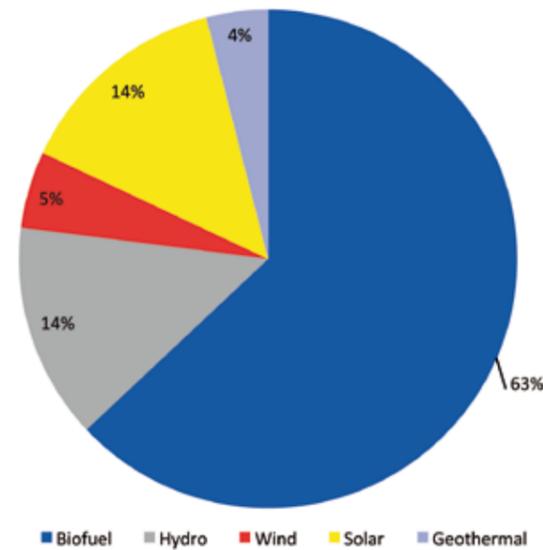


Figure 14: Technically utilizable energy potential of the renewable energy sources in Serbia (source: mre.gov.rs)

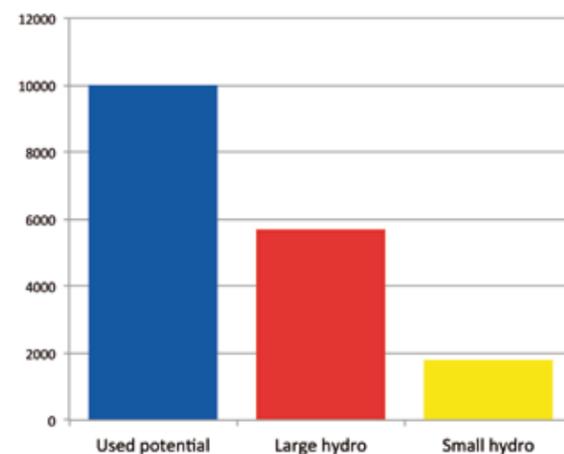


Figure 15: Hydro power potential in GWh (source: mre.gov.rs)

## EFFICIENT USE OF ENERGY

Energy Efficiency Agency of the Republic of Serbia (SEEA) was formed by new Energy Law put in force on 1 August 2004. Energy Law defines the establishment (Article 146), duties (Article 147) and beginning date of the regular operation of the Agency (Article 167).

Agency's mission is to promote and encourage the rational use of energy within all consumption sectors and the use of renewable energy sources. The establishment and the work of the Agency has been supported by the European Union, through the CARDS program, upon Grant Agreement, signed on August 12, 2002, between European Agency for Reconstruction and Ministry of Mining and Energy.

### The Energy Efficiency Agency carries out activities related to:

- drafting proposals for incentive measures aimed at enhancing energy efficiency in the drafting of the Energy Development Strategy;
- drafting and proposing programmes and measures for stimulating rational and efficient energy use; and monitoring their implementation;
- drafting proposals for implementing energy efficiency, renewable energy sources exploitation and environmental protection;
- drafting and proposing technical and other regulations for increasing energy efficiency;
- drafting criteria for equipment efficiency evaluation in use of energy and method of marking them in line with adequate international regulations and standards;
- providing financial and technical support in the preparation and implementation of priority energy efficiency projects;
- consultative, advisory and educational activities in promoting energy efficiency;

Only in one year period Agency implemented thirty nine investment projects from Energy Efficiency Program in

## HEALTH SUPPORT, MONITORING, DIAGNOSTICS AND LIVING ASSISTANCE

Since the year 2002 within the Ministry of health of the Republic of Serbia, Sector for international cooperation and project coordination was founded, that cooperates with the World Bank and European Union. The basic aim of this Sector is starting the projects that are supposed to enable the development of informational technologies in the health sector of the Serbia. GSM and GPS communications are useful on the streets accidents reaction activities. At home it is possible to use both wired and wireless communication for sending medical data to the health center. In the near future embedded systems will ward over our

Serbia. Twenty nine of those projects are under responsibility of local self governments and rely to public building stock, street lighting, water supply, district heating and renewable energy sources. Eleven of them have been executed in municipal energy sector, wherefrom two in water supply infrastructure, four in district heating and five in street lighting field. They have been cofinanced by the Agency from European Union donations. Another sixteen projects rely to public buildings and are under the responsibility of local self governments. Eleven are completely finished, three in final phase and two in beginning phase. Two co-financed demonstration projects (biomass and small hydro power station) under the Program for Renewable Energy Sources are under realization, as well as feasibility studies for four projects. They comprise one small hydro power station, study for the use of solar energy, biomass in district heating and the use geothermal energy for spa heating. Ten projects rely to Serbia Energy Efficiency Project funded by IDA Cred.

Although many things has already been done there is a lot of space for future work. The applications of embedded systems can increase energy efficiency by 20%.

In the Republic of Serbia major consumption of energy is by the private sector. In this sector energy management is quite low. Therefore, there is a lot of space for improvement.

Great example of efficient use of green energy are Earthships, which is a concept of eco-friendly smart houses that incorporate a close loop system that integrated into the natural environment.

Another example, the Strawberry Tree is the public solar charger for mobile phones invented by a group of students from the University of Belgrade, Serbia. The invention was for the first time represented to Serbia and to the world in the October of 2010 when it was installed in The City Square in the centre of Obrenovac, Serbia. This technological giant, that regularly charges mobile phone batteries with clean and ecological energy produced from sun, represents the unique technological innovation. It is important to mention that for the short period of time it is already awarded on the national and international levels.

lives and health. It enables both reductions of costs for a patient in a hospital and increasing the level of the health care in such a way that the critical states of patients that require hospitalization are found out more quickly.

Sensor platforms integrated into clothing provide the possibility of enhanced reliability of accident reporting and health monitoring. Home care systems are able to measure several parameters including ECG, blood pressure, oxygen saturation (SpO<sub>2</sub>), blood glucose, heart rate, temperature and respiration. By using ambient intelligence technolo-

gies transform the detailed interaction between healthcare processes and the home-care systems and the deep embedding of wireless sensor and actuator technologies into the environment. This one is of particular importance for embedded systems because these systems provides technological infrastructure for the implementation of ambient intelligence.

Regarding health and social care systems and devices, cost and need for more care and monitoring of the growing group of the elderly people should involve ICT technologies and especially embedded systems.

Today, life expectancy at birth is estimated to be 69.8 years for males and 74.5 years for females in Serbia. When looking at causes of death, the picture is clearly one of a developed and transitional country with high levels of heart disease, strokes, and cancer. Smoking is estimated to cause 30% of the mortality in Serbia. Poor nutrition is another major risk factor.

The overall health and wellness of elderly people in Serbia can greatly benefit from the use of information and communication technology, especially for the homebound. Wireless communication tends to be one of the major trends in medical applications to increase usability and

## HOME APPLIANCES

In the Republic of Serbia number of home appliances is constantly growing. Therefore, there is a probability for reaching the level of EU average.

In the field of embedded electronics, the R&D company RT-RK in Novi Sad, Serbia has achieved significant results in automatization and low power consumption for full comfort, safety and energetic efficiency of home electronic appliances. For example, "Home Light Control" presents innovative yet simple, low-cost solution for changing lighting ambience at home or office. "Smart Outlets" are remotely controlled outlets that also measure active power and provide usage statistics to the Home Server. User can access all information and control connected devices through the TV, PC, mobile phone from home or any other place with access to Internet.

Currently, there is no manufacturer of home appliances in Serbia. Thus, there is a constant need for import of these products. More than 60% of households in Serbia own a refrigerator and a freezer, and 9% own more than three such appliances. But these appliances tend to be old, small

## SMART HOUSES

There are some buildings in Serbia that can be called smart houses. One of the most successful companies dealing in this field is the Ion Solutions from Novi Sad. This company develops central building control systems (Building IT, Building Management Systems) with integrated and opened system solution TotalObserver™ and with some auxiliary program applications Property Management, Space Management, Maintenance Management. "Airport City" building in Belgrade, Master Center of Novi Sad Fair, Complex Panorama Dedinje, Impel Group

comfort in the long time patient monitoring.

In Serbia, there are many successful SMEs (Elektromedical, DEM, Visaris, etc.) dealing in the field of medical equipment with complete in-house development, production and sale.

The two most recognizable products, which are brands in Serbia, are the system "HELEC" featuring long term recording and universal electrotherapeutic device. In the near future it can be expected extension of the R&D activities especially in the field of nanotechnology (gold nanoparticles - nanoshells application for cancer treatment), application of flexible electronics in medicine (measurement of blood pressure using sensors on flexible substrates) and consequently development of wearable technologies (e.g. medical vest for the detection of possibly fatal heart problems, specifically unstable angina pectoris or ischemia).

In the new cycle of the research projects in Serbia (from 2011 to 2014), there are two projects that have envisaged application of ES and II for improving the health of people especially children: "Design of Robot as Assistive Technology in Treatment of Children with Developmental Disorders" and "E-speech therapist".

and inefficient. Their average age is more than 14 years; only 16% of refrigerators and freezers were purchased in the past five years.

It is in human nature to want to make life as pleasant and comfortable as it can be. Serbia has middle quality of living. Therefore, there is a lot of space for improvement. The majority of today's household appliances employ old means of energy conversion as linear transformers, fixed-speed motor drives or resistors. The adoption of power inverters/converters permits important margins to save on the energy consumption and still covers a marginal fraction of the overall market volume, due to cost and complexity of the newest power conversion technologies.

Impacting millions of products by the superior performances in low-end products will bring tangible and worldwide benefits in terms of overall energy save and CO<sub>2</sub> emissions by reducing and reusing the dissipate heat and water: as consequence, it will help and support the global goal of limit the Earth temperature increase below the 2°C.

building are typical examples of smart building in Serbia, which achieve 40% of energy saving.

ION SOLUTIONS™ has a well recognized concept of a Smart house (PAMETNA KUĆA™). They have one of the most inovating solutions in this field. Partners in this program are companies MARMITEK and TAC.

The following FP7 project is currently implementing in Serbia in this field: ICT-2009.6.3.b, "Smart Control of De-

mand for Consumption and Supply to Enable Balanced, Energy-Positive Buildings and Neighborhoods" (Smart-CoDe - no. 247473, coordinator: prof. Veljko Malbaša, Faculty of Technical Sciences, University of Novi Sad, Serbia), 2010-2013.

Smart house makes ones life easier and transparent to use. We all live in a hurry and every minute costs. So, owning such smart houses and buildings make up more free time. Above everything these houses are more secure and safe. Smart house systems are not extremely expensive and they can reduce energy consumption. Small services can implement partial or even full smart house systems. This is also an opportunity for qualified workers to stay and work in their own countries.

Some of smart house embedded systems including the software tools can be easily implemented in a regular house:

## NOMADIC ENVIRONMENTS

The territory of Serbia is fully covered by mobile signal. There are three mobile operators (MTS, Telenor and Vip). These operators have very favourable rates of smart phones. Servers for cloud computing are international (easy available). There are also the companies which develops High Performance Computing (HPC) as a precursor of cloud computing.

The members of AEGIS (Academic and Educational Grid Initiative of Serbia) are researchers and academic institutions in Serbia that use, provide and/or develop grid resources. AEGIS seeks to unify HPC in Serbia integrating it into robust national, regional and pan-European infrastructures. The initiative represents one of the focal points for the development of national policies related to HPC. AEGIS organizes dissemination and training activities, helps the Serbian research community to develop and deploy grid applications, and coordinates related fund raising activities.

Since 2006 the Scientific Computing Laboratory (SCU) (Institute of Physics Belgrade - IPB) has been recognized as a EU Centre of Excellence for modelling of complex systems. Its researchers use state-of-the-art HPC resources to conduct numerical simulations and visualizations

## PUBLIC TRANSPORT

In Serbia there has already been developed some interesting solutions in the areas such as: traffic management, automated vehicle location, automated number plate recognition, etc. A traffic control system is based on implementation of various ITS (intelligent transport systems) applications. These ITSs usually use some of the available technologies in order to detect certain events in the traffic process (high traffic density, long queues of vehicles, small or high speeds of individual vehicles or the whole traffic lines, arrival of mass transportation vehicles).

The company VLATACOM (Belgrade) has the system for automated number plate recognition. This system records vehicles that passed the location with the entran-

- outdoor light can automatically turn on and off depending on the natural light,
- remote control can regulates light brightness, adapting it to your activities,
- at the selected time, the gardening irrigation will start, monitoring the water consumption hours,
- by a daylight sensor, it is possible to automatically open or retract the blinds, according to changing of weather condition,
- heating and air conditioning can be controlled throughout house in any living zone
- blinds can be operated by daylight sensors, remote controls or timers.

of classical and quantum many-body systems. The main research topics covered include numerical evaluation of path integrals, study of strongly correlated quantum systems, investigation of granular compaction, and modelling of transport in nano-porous materials.

SCL-IPB is at the focal point of the development of high-performance computing in Serbia and South East Europe. It coordinates the Academic and Educational Grid Initiative of Serbia (AEGIS), participates in pan-European (EGI-Inspire) and regional (HP-SEE) grid projects, and represents Serbia in the Partnership for Advanced Computing in Europe (PRACE). In 2008 SCL-IPB helped launch Serbia's ambitious seven-year supercomputing initiative. The centrepiece of this initiative will be the new National Supercomputing and Data Storage Facility (NSDSF), to be located on the IPB campus, and housing the Blue Danube supercomputer.

Serbia is republic in transition. There are many foreign investors. They expect to manage their business in their own way, like they do in their own countries. They can do that in easier way using the concept of cloud computing or using smart phones.

ce control point. High resolution camera photographs the number plate, the computer recognizes letters and digits and the exact time of passing and sends the data to the command-control centre. This data can be used for instant calculation of average speed of vehicle passing that distance, for locating stolen, unlicensed or in any other way suspicious vehicles, etc.

Having processed the information and generating the appropriate command, the system uses some of the VMS (Variable message signs) to notify the users about the actions taken. VMS messages can be of either informative or demanding character, depending on the actions. The main purpose of the AVL (Automated Vehicle Location) system is managing commercial vehicle

fleets (passenger vehicles, cargo vehicles, special vehicles etc.), which is based on the vehicle position and condition assessment and communication between the vehicle and control centre. The communication between the control centre and the vehicle locators is conducted by GSM network, using GPRS, SMS and DATA service. In Serbia, during previous years, there is a trend towards migration of young population to big cities in the country such as (Belgrade, Novi Sad, Niš and Kragujevac). This situation causes traffic problems, problems with parking places, etc. Therefore, it is very important to have intelligent systems for controlling traffic remotely and in the efficient way.

Currently, there are intensive activities in the country for making new highways and other public infrastruc-

## WASTE MANAGEMENT

Production of thermal energy from waste is one of the priorities of the Government of Serbia. Rational use of secondary raw materials from the resource could produce up to 5 % of electricity from that resource. Serbia has legal regulations and incentives for the use of waste as a permanent source of heat and electricity.

During the year 2011 plans for the construction of several power plants (waste to energy) is planned to be finalized. One of the protocols is already signed between Užice and Power Industry of Serbia. The protocol is about building power plant (waste to energy), and the future plan is to include more municipalities in similar projects. Instead agricultural residues burned in the fields, farmers in Serbia could use the waste to produce energy from biomass. The forest residues end up in landfills but they could be used for producing electricity or thermal energy. Estimated amount of wood biomass in Serbia, which can be used as fuel, is about 5.5 million m<sup>3</sup> per year.

Cities Kraljevo and Novi Pazar together with German companies are working on a specific project: building a regional centre for municipal waste to generate electricity. Investment is worth 350 million EUR.

The forecasts of experts indicate that the world in the next 20 to 30 years will face shortage of energy. So, projects to develop energy efficiency and independence are vital to any country, including Serbia. One of the main ways to ensure energy efficiency is the development of renewable energy resources and proper management of waste. When it comes to managing packaging waste at first place is to

## EMBEDDED SYSTEMS IN AGRICULTURE

Current trends in agricultural production are based on advanced technologies, including the extensive application of information technologies. In particular, the usage of wireless sensor networks (WSN), embedded systems and remote sensing (RS) can ensure timely in-field access to data and enable prompt reactions. The modern agriculture requires interdisciplinary approach and applications of new technologies. To ensure better harvests it is neces-

sary to have information about all important parameters of the environment. With implementation of embedded systems and software tools it is possible to achieve the concept of precise agriculture.

These applications are from design and development of different sensors (gases, moisture, pressure, temperature, CO<sub>2</sub>, N<sub>2</sub>, etc.), and wireless sensor networks up to geo-

reduce waste, then reuse and recycling of packaging. In fourth and fifth place are energy reutilization and disposal. Plan for year 2011 was to recycle 5% of waste, the following year 10% and by 2014 year at least 30% of waste should be recycled.

Energy experts agree that Serbia has the requirements to be a key player in Europe in the field of renewable energy, and if the conditions for the use of these resources, not only in the form of law but in practice, will be the cornerstone of "green" energy in the region. These processes must be accelerated, because it is a chance to secure energy independence and reducing the country's energy imports. If in the next few years Serbia manages to use only half of the capacity of renewable energy sources, about 17% of electricity needs are going to be satisfied in this way. These numbers best illustrates how important it is to provide an adequate way to faster and greater investment in the sector.

Legal obligation of collecting and burning landfill gas imposes the right solution: burn gas for energy purposes while creating economic benefits. This concept involves setting up of vertical perforated pipes into the landfill body (wells, pins, probes) and their horizontal connections. Through a compressor plant, landfill gas is sucked out, compressed, dried and oriented towards the gas engine. One of systems Serbia can use is: Green Power Inc. Waste to Fuel system. This system provides conversion of waste to fossil free fuel "Diesel, Kerosene, Fuel Oil and Naphtha" as well as excess electricity. The fuel can be used without any adjustments to existing engines.

However, Serbia still lacks a reliable and diverse public transport system.

referred databases and geographic information systems (development information systems capable of efficiently storing and searching large quantities of data from multimodal sensors).

Measures can be administered with more precision and effectiveness, thus providing higher food quality, environmental protection and considerable savings. In addition, a better understanding of underlying processes, and validation and adjustments of the used models can be achieved. Agriculture is one of the principal sectors in the SEE region. The Province of Vojvodina is a regional leader in this sector and the agriculture represents 40% of GDP in this region.

BioSense Center at the University of Novi Sad is a multidisciplinary research centre devoted to development and application of ICT concepts (including embedded systems and industrial informatics), methods and tools in agriculture, forestry, ecology and environmental engineering

(figure below). The centre is formed to address different research and technological challenges: from development of novel sensors for detection and measurement of specific pollutants, to the integration of measured data into a unique data base.

Serbia has well-recognized centres like BioSense which can provide services for acquisition and analysis of data needed by the large number of different users in the region. Wide availability of reliable data will foster accelerated development of contemporary research in ecology, environmental engineering, forestry and agriculture.

For further development it is important to note that in the framework of the FP7 project „EXPEER - Distributed Infrastructure for EXPERimentation in Ecosystem Research“ pilot site of BioSense center on Fruška Gora (mountain near Novi Sad) with developed and implemented wireless sensor networks has been chosen among top 30 HIOS (Highly Instrumented Observational Sites) sites in Europe.

Slovenia



“Manufacturing sector is very important for Slovenia. Pharmaceutical, automotive, food industry are some of the most important.”

## SLOVENIA

### FLEXIBLE MANUFACTURING

**M**anufacturing sector is very important for Slovenia. Pharmaceutical, automotive, food industry are some of the most important. To be competitive and flexible enough an efficient industrial informatics technologies need to be implemented.

#### Agile and flexible manufacturing

New SW solutions should enable maximal flexibility and adaptability of a production company to current customer's demands, market conditions and technical capabilities of a shop-floor. The general goal is improving of shop-floor control, production flexibility, production efficiency, resource exploitation, safety of production, profitability, lower maintenance costs, improved product quality and in the final stage to reach lean and “100% available factory”.

#### Integration of systems

There is a need to develop different SW products to support holistic management of a production company taking into account not only technical aspects of production but also organisational, financial and other aspects of production. This includes a support for decision making (decision support system for production management, supply chain management systems, on-line assessment of production performance indicators) as well as the use of advanced control methods on at the shop-floor and integration of all information and DCS systems in a factory. The integration of various DCS and information systems (SCADA, MES, ERP) into holistic information system assumes an on-line access to all data stored in various databases. On the basis of various data new useful information about a current status of a company can be

### GREEN ENERGY MARKET

**S**lovenian energy agencies support the transition to more sustainable energy with the global aim to support sustainable development in the energy context, making a balanced contribution to achieving the general objectives of security of energy supply, competitiveness, and environmental protection. Energetic system should become more flexible and able to respond to customer's demands, dynamic consumption and unpredictable failures of its subsystems. Due to

### EFFICIENT USE OF ENERGY

**P**rivate houses are relatively big consumer of various energies. The consumption can be effectively lowered also by constant monitoring and control of energy consu-

extracted and used for more efficient and correct decision making on different management levels.

#### Advanced control systems

The complexity of production processes is rising and this fact requires new solutions for control systems. For efficient, reliable and safe control of industrial processes new control methods should be implemented. Various advanced theoretical concept as model based control, adaptive control, fuzzy control, predictive control, gain scheduling and various methods for on-line fault detection, estimation of degradation, etc. could together with new hardware platforms (DSP, FPGA) contribute to a great extent to more dynamic control and higher adaptability to the changes on shop-floor and to more efficient, reliable and safe production control.

#### Energy management in manufacturing

Industrial production is a big consumer of electric, heat, water, gas, coal and other energies provided either from a public infrastructure or from internal energetic plants. On the other hand, industry can provide significant amounts of waste energy in the form of steam, hot water or hot flue gases as the output of its technological processes. New technologies based on exploitation of renewable sources and industrial wastes are also emerging. For all these reasons, new industrial informatics solutions need to be developed; systems for total on-line monitoring of energetic flows in a company, systems for energy consumption smoothing, systems for reducing peak energy consumption and new concepts of energy management (e.g. smart grids) can significantly reduce energy consumption and costs in industry.

the growing consumption, new classical energy objects are currently built in Slovenia together with the installation of new renewable sources of energy (photovoltaic installations have reached in Slovenia in 2010 10 M Watts). As the energy management is becoming more and more complex, new concepts and systems of on-line management of all energy consumers and sources in an intelligent way are needed, for example using the concept of “smart grids”.

mers, reusing waste heat energy, intelligent heating and ventilation systems (HVAC), use of effective combined heat and power cogeneration systems and new types of

energy sources (e.g. solar panels, wind turbines, fuel cells, geothermal energy). An implementation of new solutions requires the design of new kind of embedded systems, sen-

sors and algorithms being capable of on-line management of all energy consumers and sources in an intelligent way, for example using the concept of “home smart grids”.

### HEALTH SUPPORT, MONITORING, DIAGNOSTICS AND LIVING ASSISTANCE

**T**he population of the SEE region is ageing. In Slovenia the share of the population over 65 year is currently 17,5%. Many elderly live alone, some live with their children, but most younger adults work during the day. For many old people their quality of life is also affected by poor health. There is a need to ensure the elderly people can monitor their health condition and have adequate medical or social treatment and support in case of emergency. Contemporary technologies have enormous potential to help elderly people live more independent.

New personal systems and sensors for monitoring blood pressure, cholesterol levels, pulse and respiration rates, weight and height, pain levels and mood have to be developed. The personal data can be dispatched to special medical centres for further analysis and eventual taking adequate measures. New communication media and newly developed easy-to-use SW products can also be helpful to stay connected to public services and active within society.

### SMART HOUSES

**T**he Smart house application area deals with an emerging practice of increased automation of household appliances and features in residential dwellings, particularly through electronic means. The techniques employed in Smart house include the automatic or semi-automatic control of lighting, doors and windows, Heating, Ventilation and Air Conditioning, security and surveillance systems, control of home entertainment

systems, houseplant watering, pet feeding, changing the ambiance “scenes” for different events (such as dinners or parties), and the use of domestic robots. Wireless communication systems and a central controller are essential parts of a smart house control system that should provide increased functionality, accessibility, reliability, security and good ambient atmosphere/living comfort in a residential house.

### PUBLIC TRANSPORT

**M**odern societies heavily depend on efficient and reliable services in public infrastructures and administration (governmental offices, railway/bus stations, airports, public buildings, entertainment facilities, city parks, car parking locations, sport objects, etc). The services and control of existing infrastructures is nowadays often inefficient and too often people are confronted with long queues, capacity problems, unreliability of services and even dangerous situations. To give faster and more comfortable public services these objects should have different user friendly information desks/panels, intuitive interfaces to naturally respond to user's needs, a variety of sensors for tracking of visitors, various alarm systems, systems for emergency evacuation control, etc. There is obviously the opportunity for embedded system society to provide new intelligent solutions.

In Slovenia and SEE region there is a need to for improvements of logistics in public transport systems (trains, bus transport, traffic information, maritime transport...) in order to assure fast, efficient, safe and accessible transport and mobility of people and goods. Slovenia currently works on the project for road taxes accounting using GPS system and has already installed full traffic information system on its motorways, but a lot of effort has still to be done in the railway system, traffic in the cities and parking facilities. This is an opportunity to facilitate new intelligent solutions from the area of embedded systems will can assure improved traffic monitoring and control, better controlled road infrastructure (active road safety support, traffic management systems with more cooperative vehicles, active bridges, secure tunnels ...), automatic parking facilities, efficient toll collecting, efficient access control.

### WASTE MANAGEMENT

**W**aste management (collection, transport, processing, recycling or disposal, and monitoring of waste materials) is becoming serious problem in Slovenia. The latest data show that in Slovenians contribute around 400 kg of waste/resident/year. The existing waste deposits and waste treatment plants are old fashioned and don't meet the regulations of EU community. Nearly the same problem is with the existing wastewater treatment plants. For

these reason, there is a strong governmental initiative to stimulate waste selection, establish on line monitoring and to build new waste treatment and recycling facilities. Both industrial informatics and embedded systems can contribute to this aim with new intelligent solutions on the fields of waste monitoring and advanced control of new waste treatment and recycling facilities.



“The Romanian economy is marked by great micro and macroeconomic instability generated by the transition to a functional market economy.”

## ROMANIA

### FLEXIBLE MANUFACTURING

The Romanian economy is marked by great micro and macroeconomic instability generated by the transition to a functional market economy. The direct foreign investments play an extremely important role among others in the formation of fixed capital necessary for the optimum operation in the framework of organizations and innovation by which the production costs are lowered and implicitly the improvement of their quality achieved.

Two of the most important characteristics of the present development and research in industrial systems in Romania are:

- The support for the development of micro-enterprises, co-financed by the European Union. Through this initiative, the micro-enterprises are able to acquire new equipment and technologies, new IT systems (hardware/software), to build/ expand/ upgrade production facilities;
- The initiation of regional, operational programs for providing support structure for businesses, to ensure there are facilities for the operation of economical activities (production). The purpose is to attract investments in order to take advantage of the material and human potential of the area in which these facilities are placed.

SC Siemens SRL, SC Thermo-Invest SRL, SC Technosam SRL, Satu Mare, Electronic April constitute representative examples of micro-enterprises which includes their activity profile, design, software, implementation, assembly and deployment of industrial automation systems. Tenaris (Silcotulb Zalau), Emerson (Cluj-Napoca Romania), SC BETAK SA Bistrița, Mechel S.A. Câmpia Turzii, are only some of important foreign companies which invested in the local production activities.

The application area is a target included in the national Program 4 –partnership in the Priority domains- which has to create a better collaboration between economic agents and public administration units to create and implement new technologies, product and innovation services.

The development of this area represents an efficient solution to valorise by technological upgrade of the old, existing industrial enterprises to create and expand new firms and to create new jobs.

Most of the small and medium sized enterprises in Romania are in early stage of business networking as they have recently started adopting integrated information

systems as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and Supply Chain Management (SCM). Business problems like: high lead time in business processes, high cycle time in business transactions, high inventory, poor utilization of financial as other enterprise resources, poor productivity, high stock outs, poor utilization of enterprise capacities and resources, unsatisfied customers and suppliers, the inability to handle competitiveness, poor flexibility in demand supply management, the inability to plan growth and future, poor dynamism appear due to lack of enterprise integrated transaction information systems and lack of planning and control oriented information systems.

Considering that Romanian SME's resources are limited (human resources, money, etc.) and most managers do not possess critical knowledge of modern ERP software and it's implementation, change process management is weak, operation development and Business Process Reengineering (BPR) are weakly supported, the ERP project is not given enough attention (it is seen as a simple software purchasing problem)- to conclude: SME's managers need expertise in ERP projects.

In what regards the situation of adopting ERP software solution in Romanian companies, this is situated still at a low level. According to the study made by Agora Media in partnership with Sensimark, 42,9% from the companies which are over one million dollar worth, had an ERP solution implemented, whereas 14,9% of them were in different stages of implementation of such a solution, the biggest concentration being in Bucharest. The rest 42,2% of the companies did not have such a solution. This high percentage is due to the fact that 23,2% of the companies that did not implement an ERP system, never acknowledge the existence of them, and approximately 18,8% have heard of such solutions but do not understand the utility, functionality or importance of such products. Excepting the banking and pharmaceutical system, the most companies who have implemented an ERP system, 64,8% are in production area, 57,6% in distribution area and 53,3% in retail.

This classification is normal taking into account that generally, the emergency of implementing an ERP is mainly for companies that are confronted with high data fluxes. What is extremely relevant for the development of the ERP market in Romania is the fact that only 20% of the application cases cover all the functions of the business. Where the functions are partially covered, the highest degree of coverage is by far that of financial and accounting. The accounting and financial activities are found in approximately 80% of all ERP implementations. There is a second echelon which is payment, analysis and reports,

production, retail, marketing. A weaker implementation of strategy modules is noticeable which demonstrates

### EUROPE GOING GREEN

Almost 15% of Romania's energy consumption relies on green, renewable sources, 3% more than ten years ago. This means that Romania's green energy consumption is way above the European 9% average. 29.9% of the energy is represented by natural gas, 25.8% by oil, 21.3% by fossil fuels and 8.6% by nuclear power (Figure 16).

Romania's total energy consumption (primary consumption) per capita is almost twice as low as the EU average. Primary consumption decreased dramatically between 1990 and 2000 (-3.1% per year) and increased slightly until 2008 (+1.1% per year). In 2009, because Romania was hit by the global crisis, primary consumption fell by 2.5%.

The share of industry in final consumption collapsed between 1990 and 2009, from 60% in 1990 to 36% in 2009. That decline is explained by the rising share of the residential sector and the rapid growth in the energy consumption of transport (21% of final consumption, compared with 9% in 1990).

In 2010, Romania's electricity generation cumulated to a total of 59,14 TWh, 4.3% more than the previous year. Coal is the dominant fuel used for electricity generation. The share of oil fell from 18% of power generation to 1% over the last two decades. Due to hydro and nuclear power plants, the share of CO<sub>2</sub>-free power production increased strongly, from 18% in 1990 to 46% in 2009. Romania emitted 40% less CO<sub>2</sub> than its Assigned Amount Units (AAUs) of CO<sub>2</sub> emission. In 2008 Romania is said to be emitted 94660 metric tons of CO<sub>2</sub>. This represents 0.31% of the emissions in the entire world (Figure 17).

CO<sub>2</sub> emissions per kWh produced decreased in the last 10 years, from 550 gCO<sub>2</sub>/kWh to 410 gCO<sub>2</sub>/kWh, but they still remain 21% above the EU average.

### GREEN ENERGY MARKET

Historically, Romania's domestic energy production from coal, lignite, oil, gas and hydropower, covered about 70% of the energy needs. In 2002, the share of renewable energy sources (RES) to the primary energy consumption was less than 1%, excluding large hydro facilities (> 10MW). In 2010, almost 15% of the consumed energy came from RES. The implementation of green sources projects will reduce the imports and the balance of payments in the energy production sector.

Small hydro plants (<10MW) represent the most promising source of clean energy. It has been estimated that more than 2000 locations in Transylvania mountains alone, are suited for the development of small hydro plants. Romania has a total of at least 767 hydroelectric power plants, 621 of which are small hydroelectric plants. The

once more the “basic level” at which ERP systems are understood and implemented.

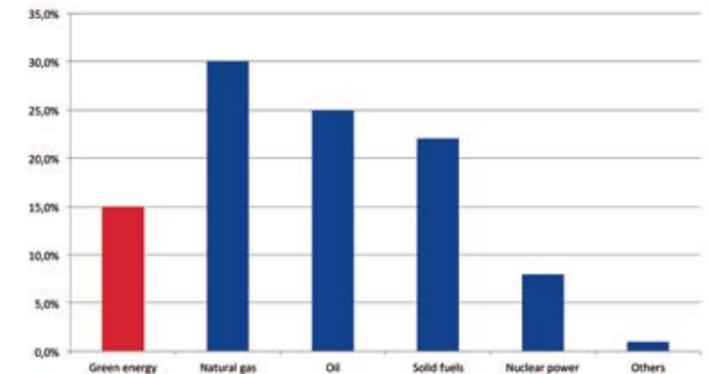


Figure 16: Romania's Energy Consumption (source: ec.europa.eu)

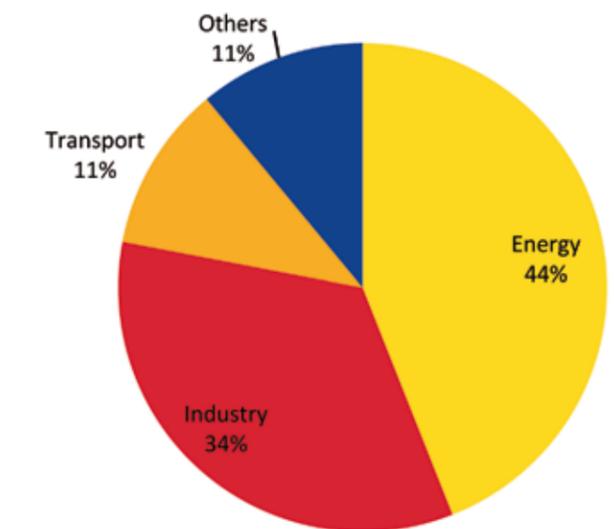


Figure 17: CO<sub>2</sub> Emission by Sector (source: ec.europa.eu)

small hydroelectric plants in Romania have a total capacity of 1,125 MW.

Romania's wind resources are well-documented, and there are a broad range of existing applications from small autonomous units for rural areas to large energy plants. Forecasts regarding Romania's wind energy production estimate the wind energy generation growth from 800 MWh in 2010 up to 2800 MWh in 2020.

The potential market for solar applications is very large, but some specific investments will be needed in order to harvest this green source of energy. The average solar radiation in Romania ranges from 1.100 to 1.300 kWh/m<sup>2</sup> per year, for more than half of the country's surface. If the solar resource in Romania was used only for solar ther-

mal applications, the country would have a potential of 60 PJ per year. Romania's solar electricity potential is approximately 1,200 GWh. Forecasts regarding Romania's solar energy production estimate the wind energy generation growth from almost 0 in 2010 up to 140 MWh in 2020. Romania has a total geothermal installed capacity of about 145.1 MW, producing 2,841 TJ/year. This energy is produced from 96 wells with hot water, ranging between 55-115°C. 37 of these wells are used exclusively for health and recreational purposes. Drilling for new wells is a very high-cost process - around 30% of the total investment for a geothermal electricity plant, while for a heating plant it is even higher, around 50-70%.

## EFFICIENT USE OF ENERGY

In the last 20 years the average efficiency of the power sector increased noticeably, from 23% to 38%. The efficiency improvement is due to the rising share of hydropower in the electricity mix and to the modernization of the thermal power plants. Old power plants have been replaced by gas fired-facilities, having a higher level of efficiency. Still, Romania's average rate of transport and distribution losses is twice as high as the EU average, at 14 percent in 2009, and has been increasing since 1990, when they averaged 9%.

Romania's National Energy Efficiency Action Plan sets an energy savings target of 2.8 Mtoe by 2016. It aims to improve industrial energy efficiency and includes voluntary agreements, financial instruments and regulations. Thus, the industry is stimulated to adopt energy savings measures (modernization of technological processes or efficient use of energy). The Romanian Fund

## HEALTH SUPPORT, MONITORING, DIAGNOSTICS AND LIVING ASSISTANCE

Romania spends around 5% of its GDP on health. In 2010, Romania spent only 275 euros per person, which is among the lowest rates in the EU and 10 times less than what the Western European countries spend for their health support system. Austria spends 2,186 euros per person per year, Luxembourg spends 3,526 euros, Switzerland and Norway roughly around 2,820 euros.

In 2005 there were 1.9 doctors and 7.7 beds for 1000 people. In October 2009, Romania had around 50,000 doctors and in August 2010 it had only 425 hospitals. Even so, in May 2010, after meeting with IMF representatives, the Romanian Government decided to close around 200 hospitals and to redistribute the medical personal. From April 2011, 67 hospitals have been closed.

Estimated at 88,000 GWh per year, Romania's biomass sources have a great potential. About 66% of the firewood and wood waste is located in the Carpathians and Sub-Carpathians, and about 58% of agricultural waste is located in the South Plain, West Plain, and Moldavia. The estimated energy production by using the biomass shows a growth from almost 0 in 2010 up to 350 MWh in 2020.

The Romanian Energy Strategy 2007-2020 establishes targets for renewable electricity in power production: 35% in 2015 and 38% in 2020.

for Energy Efficiency offers investment subsidies to industrial companies that propose the implementation of energy efficiency and renewable projects.

Under the National Strategy for Energy Efficiency for 2004-2015, a 40% energy consumption reduction was set to be achieved by 2015: 41% decrease should be achieved in buildings, 29% in the energy generation sector, 16% in industry and 14% in transport.

In the last two decades, energy consumption in the industry sector fell drastically (65%). Due to the global crises, in 2009 alone, the energy consumption decreased by 24%. Energy-intensive branches accounts for 64% of industrial energy consumption. The shares of chemical industry are 32% of the industrial energy consumption, followed by steel (23%), non-metallic minerals and paper industries with only 7% and 2%, respectively.

In Romania, the most frequent causes of death are cancer and heart diseases. Diseases like HIV/AIDS, tuberculosis, syphilis or viral hepatitis are more frequent than in the rest of European countries.

The main reason for the system's collapse is that only 4.1 million people pay for medical insurance and around 11.6 million benefit from it. Private medical insurance policies develop slowly and 36% of the costs of medical system, on average are currently supported by the population, apart from their medical insurance costs. The medical insurance represents 10.7% of the income.

The Romanian health support system is financed through The National Health Insurance Fund, which has accumulated a debt of over 100 million euros (in May 2010).

## HOME APPLIANCES

In 2010, large home appliances sales decreased by 15%. Small home appliances market by 20%. (Figure 18)

The vast majority of Romanian urban households have modern home appliances. The rural households or those situated in towns with less than 50,000 inhabitants have less home appliances. The difference consists of appliances that are not strictly necessary: laptops, printers, mp3 players, air conditioning, home cinema, etc.

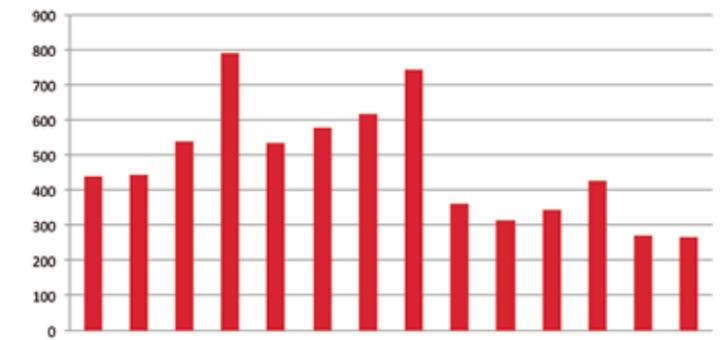


Figure 18: Evolution of Home Appliances Market in 2007-2010 (source: GfK Romania)

## SMART HOUSES

Increasing awareness of global warming forces policy makers and industries to face two challenges: reducing greenhouse gas emissions and securing stable energy supply against ever increasing world energy consumption, which is projected to increase by 71% from 2003 to 2030. In addressing these two issues simultaneously, renewable energies prove themselves attractive, as they are independent from the fossil fuel supply and do not contribute to greenhouse gas emissions.

Therefore, providing heating and cooling by utilizing renewable energy such as solar energy is a key solution to the energy and environmental issues. Romania has an important solar energy potential because of its geographic position and of its favourable climatic conditions.

## NOMADIC ENVIRONMENTS

Romania's mobile communications market is served by five mobile network operators utilising a mixture of GSM, CDMA and WCDMA technologies. Current penetration levels indicate saturation although multiple SIM-card ownership is evident. Mobile broadband is widely available following the launch of competing 3G networks, with competition making services increasingly affordable.

### Mobile Internet

Zapp offers a wireless broadband service based on CDMA 1X and 1xEV-DO technology, with speeds of up to 2.4 Mbit/s downstream / 153 kbit/s upstream. Recently, the network added EV-DO Rev. A capabilities, with 3.1 Mbit/s downstream / 1.8 Mbit/s upstream. Subscriptions offer unlimited data transfers, with speed limitations after a certain amount is transferred. An UMTS 3G+ network is being deployed, with speeds up to 7.2 Mbit/s.

Orange Romania offers a 3G/3G+ service up to 7.2 Mbit/s in selected areas. An unlimited time, 8 GB/month traffic limit. Lower priced plans, with less included traffic are also available. Additionally, where 3G/3G+ is unavailable, there is nationwide coverage of the GPRS / EDGE /

The legislation supporting the development in this field has been build up. The introduction of "Green Certificates" encourages the industrial development of solar energy and gives a new opportunity for national and international machines and plant builders. Six "Green Certificates", as much as for no other energy project, are given for each MWh installed. A first foreign investor has recently begun the production of photovoltaic modules in Romania.

Also private households are attracted to use solar energy in order to cover their energy consumption. The "Casa Verde (Green House)" Program including solar energy, biomass and geothermal energy is a great success in Romania.

The first stage of the national program called "Green House" has better results than expected, the applications surpassing the global value of the program.

UMTS network (where available) providing speeds of between 220-384 kbit/s downstream.

Vodafone Romania also uses 3G/3G+ technologies, with speeds of up to 7.2 Mbit/s. The HSDPA coverage is mainly targeted towards Bucharest and several other major cities and destinations.

### Smart phones

The mobile market in Romania is beginning to evolve. The emergence of smart phones worldwide has changed the way people think about their mobile phone, and Romania will be no different.

Researches show a small penetration of IOS, Android and BlackBerry (less than 15% of total smart phone), Symbian dominates as Nokia has a major market share in Romania. Romania is closer to India and S-E Asia countries where Symbian is the main OS among smart phones, unlike US.

The small number of smart phones is an issue for a Romanian applications developer. This is why there are not too many local applications and when an applica-

tion reaches 10.000 downloads is considered a success. However applications like Ovi Maps, Google Maps, Facebook application are quite popular for Romanian smart phone users.

The Romanian market is very small, and therefore neither advertising nor premium application can generate enough money from applications.

### Information technology

After several quarters of delayed acquisition of desk computers, monitors or peripherals, the Romanians in-

## PUBLIC TRANSPORT

Having an efficient urban transport system is essential for the well-functioning of daily activities and has a significant impact on economic growth.

Bucharest is known to be the only city in Romania which starting with 2009 has an underground railway system, comprising both the Bucharest Metro and the light rail system Regia Autonomă de Transport București.

Now it is one of the most accessed systems of the Bucharest public transport network with an average of 800,000 passengers during the work week. In total, the network is 67 km long and has 49 stations.

Some proposals have been made about building metro networks in some of the other largest cities in the country, such Cluj-Napoca.

Romania's biggest cities should have a transport authority based on the model of the existing transport authorities in Berlin or Paris, which serve millions of passengers and manage to bring added-value to the level of quality provided.

If the authorities allocate funds to the transport companies, therefore encouraging new projects, and lead campaigns to promote the use of public transport, then the situation changes radically: activities are improved, the quality of life increases and citizens can benefit from efficient, safe, fast and comfortable public transport services. In this context, every city, like many other European cities, needs to have a public transport authority in order to ensure the quality of this type of transport. Romania total road network is estimated to be 198,817 km long, out of which 60,043 km are paved and 138,774 km (2004) are unpaved. The World Bank estimates that the road network that is outside of cities and communes (i.e. excluding streets and village roads) is about 78,000 km long.

According to europaworld.com, in 2004 in Romania there were:

- 3,225,000 automobiles
- 43,000 buses and coaches
- 482,000 lorries and vans
- 235,000 motorcycles and mopeds

crease the acquisition of all these categories, not only mobile computers. As a result, sales in the sector increased in 2011 by 27.5% compared to the same quarter of 2010.

The consumer's need, both private and commercial, to have access to the internet for learning, socializing, shopping, entertainment continues to grow, and leads the consumer to regard IT products as must have items. Desktop computers were also in the green zone; however, the growth rate was almost four times below laptops' result.

In 2010, an estimated 4 million cars existed in Romania.

As a relatively new member state of the EU, Romania makes significant investments into meeting European standards in several areas. Public transport issues are coming increasingly to the fore in today's society. The Romanian Association of Public Transport (URTP) is a major driving force in this field, representing most of Romania's public transport operators. As part of its efforts to establish high standards for all its members and to help them with the operation of their services, URTP publishes a statistical yearbook which provides a foundation for decision making for both large and small operators.

URTP is the main representative of Romanian public transport with 52 members, 36 of whom are operators. It is a member of several public transport organisations and regularly takes part in projects and expert conferences across Europe.

### Romanian railway transportation system

Following the opening of the former eastern block at the beginning of the 1990's, a series of Pan-European Transportation Conferences were held with the purpose of identifying the transportation infrastructure development needs for the Eastern Europe. A series of corridors has been defined. The corridors form a network spanning from the west (Nuremberg) to the east (Nijnyi Novgorod), and from the north (Helsinki) to the south (Thessaloniki).

Concerning the integration of national transportation systems with the European systems must be noted that through Romania are passing the following corridors:

- Corridor IV: Central Europe – South East Europe Berlin/Nuremberg–Praha–Budapest–Arad–Bucharest–Constanta Arad–Timisoara–Craiova–Calafat–Vidin–Istanbul/Thessaloniki;
- Corridor VII: Danube (waterway corridor);
- Corridor IX: North East Europe – South East Europe Helsinki-S.Petersburg-Kiev/Moskva-Odessa-Chisinau-Iasi-Bucharest-Giurgiu-Dimitrovgrad-Alexandroupolis

Regarding the level of integration of Romanian railway systems in the pan-European corridors, can be mentioned the following specific characteristics of the local railway system: in the interoperability context, respectively of the costs related to the provision of the interoperability on the railway network, the Romanian Railways has a few specific elements conferring it net advantages in comparison with other administrations.

A first advantage is represented by the small dispersion of the types of centralization equipment used, fact implying the need of a restraint number of types of interfaces between the existing systems and the ones that will be introduced in the future.

A second advantage is represented by the endowment of all the traffic signals from CFR with equipment for the automatic control of the train speed and the self-stop

## WASTE MANAGEMENT

Waste management is a difficult and complex problem in Romania which is far from being solved according to the environment rules of the European Union. The worsening of the waste problem, especially of the domestic waste is generated by the significant increase of its quantity, as well as by the inappropriate way of solving different stages of waste processing.

On the list of Romania's ecological priorities, waste management is placed on the third place, after water and air pollution.

National policy documents governing waste management comprise two main components: National Waste Management Strategy and National Waste Management Plan, which are basic tools for EU waste policy implementation in Romania. Both documents are currently under revision process to establish updated targets and actions, for reducing the amount of waste disposed by landfilling through effective selective collection, recycling and restoring to economic systems of materials and energy from waste. Based on these documents, regional plans and county waste management were prepared, these being useful in development projects funded by European funds and optimization of investment and operating costs in waste management at district and regional level.

Currently, the waste hierarchy shall apply as a priority order, in four steps to according Directive 2006/12/CEE, but by the end of 2010, following the transposition of the new waste directive 2008/98/CEE there will be applied the five-step waste hierarchy: prevention, preparation for reuse, recycling, other recovery and disposal operations. Creating and implementing an integrated waste management system is also supported by economic and legal instruments integrated with other sectoral policies. Financing resources for an integrated waste management system is required by the law through:

- Environment Fund
- In addition to the state budget based on programs in the amounts allocated to this destination
- Local budgets

INDUSI type. This fact simplifies especially the migration process from the existing unique system to ETCS systems. INDUSI also being a system used on extended scale in Europe, here can be appreciated that the SMT (Specific Transmission Module) issue for INDUSI (necessary in ETCS, level 1) is mainly solved, fact that diminishes the designing costs.

Practically, the Romania has in a large percentage various types of centralization, based on relays, but in the same category, and there are also many other of the mechanical type. The Romanian is in full implementation process of the electronic centralization. Other railway administrations have many other systems, came from various producers, meaning that they will have issues first of all related to the interfaces, because they cost, for designing, as well as for the achievement".

- Public-Private Partnership
- Structural Funds
- Banks
- Private investors
- Sectoral research and development programs
- ISPA, PHARE

In Romania, the Environment Fund Administration is the economic-financial tool for supporting and achieving priority environmental projects in accordance with rules and standards in force.

Various research programmes run by the Ministry of Education Research, Youth and Sport aim developing of new environmental friendly technologies as well as new technologies on waste recovery.

In order to improve the existing situation and to respect the EU legislation, Romania asked for a period of transition for the Chapter 22 – Environment. The main important aspects are presented below.

### Landfill:

- 2013 – closure of 238 existing municipal landfills which are not in compliance with EU regulations;
- Construction of 65 municipal landfills which are in compliance with EU regulations (min. capacity of 100,000 t/year – regional) – transfer stations;
- 2016 – reduction of the quantity of solid waste disposed in 101 municipal non-hazardous waste which are not in compliance with EU regulations;
- 2013 – reduction of the quantity of liquid waste disposed in 23 plants which are not in compliance with EU regulations;
- 2006 – 2011 – reduction of the quantity of liquid waste disposed in five sedimentation ponds which are not in compliance with EU regulations.

**Biodegradable waste management:**

The Strategy provides to reduce the removal by landfills of biodegradable waste:

- by 25% up to 2011;
- by 50% up to 2015;
- by 65% up to 2016, compared with the quantities generated in 1995.

**Packaging and packaging waste:**

- 2013 – recycling target level - 55%
- 2013 – revaluation target level – 62%

**EMBEDDED SYSTEMS IN AGRICULTURE**

Romania has an agricultural capacity of approximately 14,7 million hectares, of which only 10 million are used as arable land. In November 2008, an evaluation revealed that 6.8 million hectares are not used.

Agriculture summed up about 6% of GDP in 2007, down from 12.6% in 2004. As of August 2009, approximately 3 million Romanians (close to 30% of the country's workforce) are employed in agriculture, compared to 4-5% in other Western countries. Mechanization is comparatively poor, with one tractor available for every 54 hectares, while the EU average is one tractor for every 13 hectares. Approximately 170,000 tractors exist in Romania, of which about 80% are aging or obsolete. Unlike Western Europe, where tractors are replaced after 3,000-4,000 hours of use, in Romania they sometimes last up to 12,000 hours.

The Romanian government is implementing a Land Parcel Information System/Integrated Administration and Control System (LPIS/IACS) based on ArcGIS Server software from ESRI. The implementation is expected to meet stringent European Union (EU) agricultural land regulations, which is essential for the country's admission to the EU.

ESRI's ArcGIS Server and GAF AG's LaFIS, an agricultural information and decision support system, will be installed in the country's agency of payments and interventions in agriculture (APIA), including its 210 local offices.

Technologization – the ministry supports the development of services for agriculture through investments programmes for farmers, aiming to improve the endowments in order to increase the performance of the sector. The national "Farmer" Programme and other laws provide for granting of subventions to procure new equipments is financed from the national budget.

Irrigations - regarding the land Reclamation in Romania due to climacteric and soil condition the development of the irrigation and the drainage system covers almost 30% of the arable land. But the effective irrigated area represents 14,4% of total area resulting of the lack of equipment these being old and in many cases implying high running costs and in other cases many of the components have been destroyed by the physical depreciation. The Ministry of Agriculture has promoted in the last years the financial support through governmental credits for modernisation of the irrigation system granted to farmers and associations.

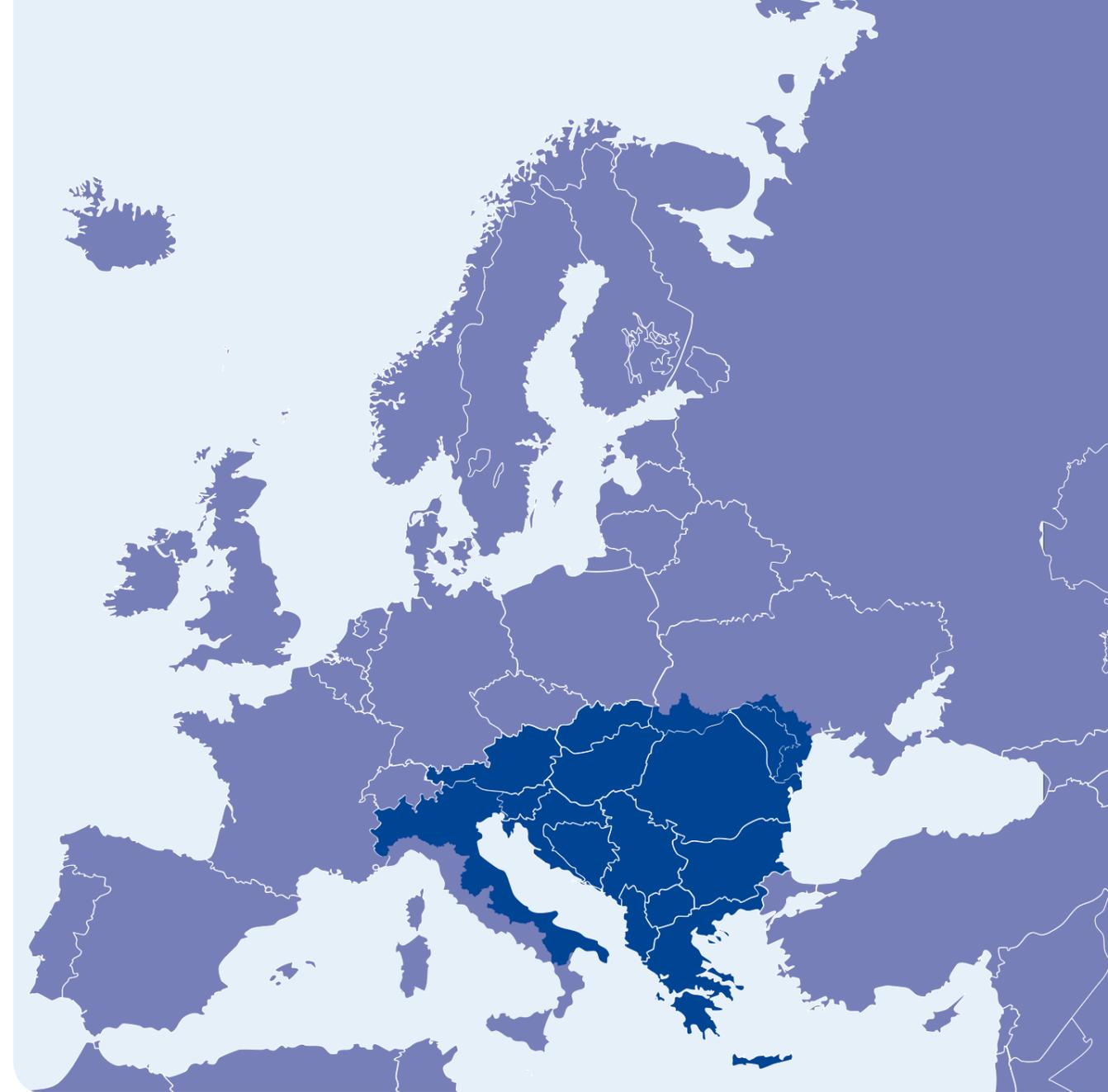


Figure 19: Members of the I3E Consortium, South East Europe



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