THE EUCO$_2$ PROJECT
STAGE 2
TURIN / TORINO

TRAMWAY ON A
BRIDGE OVER RIVER PO
© C.

BRUSSELS FRANKFURT GLASGOW HAMBURG HELSINKI MADRID NAPLES OSLO PARIS PORTO ROTTERDAM STOCKHOLM STUTTGART **TURIN**

PROVINCIA
DI TORINO

Introduction to the Province of Turin

Turin is the capital of the Piedmont region and is located in the north west of Italy on the bank of the Po River. It is surrounded to the north and west by the Alps. The province of Turin is one of 8 provinces of Piedmont; includes 315 municipalities and covers an area of 6830km^2, with a landscape that incorporates mountains, hills and plains.

The province was home to 2.24 million inhabitants in 2005, an increase from 2001 as a result of migration from southern Italy and immigration from abroad. Over half of the provincial population lives in the city of Turin and the surrounding urban area. On average there were 2.2 people per household in the province. There were 328 inhabitants per km^2 in 2005, higher than the national average. The population of the province is ageing due to an increasing life expectancy and a declining birth rate. In 2005 approximately 18% of the population was under 18 and 22% over 65.

The Province of Turin is a major industrial centre that specialises in the development and manufacture of transport vehicles. Turin is known for its aerospace industry, and has emerging information technology, biotechnology and renewable energy sectors. Italy's largest bank, Intesa Sanpaolo, was founded in the province. The Province of Turin is also a popular tourist destination. Turin is home to the University of Turin and the Polytechnic University of Turin. In recent years, unemployment in the region has fluctuated around the 6% mark.

Turin can be accessed via toll motorways from France, Switzerland and other parts of Italy, and there are regular trains that connect Turin with other large Italian cities. The province's metro system, the Metropolitana di Torino, connects Turin city centre with the city of Collegno, with planned expansions to the network that will

TURIN SKYLINE
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link the city's south-western suburbs to the northern district of Barriera di Milano. Suburban commuter railways further connect surrounding towns to the city of Turin. The Turin-Caselle Airport is an international airport located to the north of Turin, which carried 3.5 million passengers in 2010[1].

Italy has been introducing policies and regulations to reduce greenhouse gas emissions. For example there is an obligation for electricity generating companies to produce a proportion of their total electricity output through renewables. A feed-in tariff has also been introduced for photovoltaic panels, with a fixed tariff, guaranteed for 20 years and adjusted annually for inflation. Subsidies are available for cogeneration units fuelled by natural gas and bioenergy, with larger subsidies available for the latter. There are tax incentives available for investments in solar thermal systems and technologies that promote energy efficiency.

Emissions per capita in Turin are about the same as the Italian average, albeit with more emissions from industry than many other Italian cities.

CASTELLO DEL VALENTINO
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1 Turin Airport: The Company, http://www.aeroportoditorino.it/en/aeroporto_en/azienda_en.html , accessed 8th February 2011

Emissions Inventory and Energy Baseline

Total emissions from the City in 2005 were 22186kt CO_2e. This comprised of 81% from the Energy sector, 11% from Industrial Processes, 7% from Agriculture and 1% from Waste. These figures can be viewed in the table below and a more thorough presentation can be found at getagriponemissions.com.

The energy sector is the main focus of this study with emissions from four types of processes considered: combustion, distribution, transformation and extraction. Each process produces GhG emissions: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The level of emissions varies depending on the manner and state (gas, solid, liquid) of energy that is combusted/distributed/transformed/extracted within the region, as well as how the electricity the province consumes is produced. CO_2 is the dominant greenhouse gas in this sector and consequently is the focus of this study.

Turin Chart 1, right, displays the CO_2 emissions from the energy sector in 2005; a total of 17477 kt CO_2 assoicated with an end user energy demand of 68533 GWh. The figures show that in 2005 the emissions from the residential sector accounted for 23% of energy emissions, the service sector 16%, the industrial sector 36% and the transport sector 22%; the transport sector emissions comprising 96%, 2%, <1% and 2% from road, rail, marine and domestic aviation respectively. The energy industry accounted for 0% of emissions and fugitive emissions 3%. GRIP level 1, 2 & 3 methodologies were used to estimate 100%, 0% and 25% of the emissions respectively.

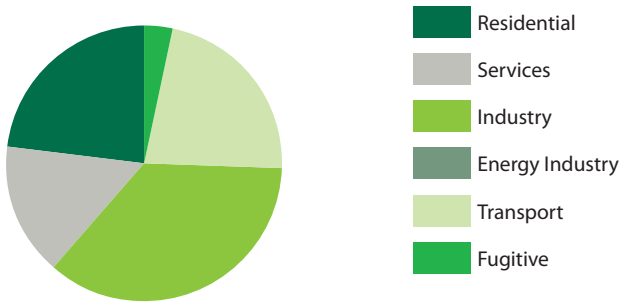
Turin Chart 2 below shows how electricity was generated in Italy in 2005.

In 2005, 30% and 0% respectively of electricity generated in Italy and the province was from coal generation, 49% and 100% was from combined cycle gas turbines, 0% was from nuclear power, 1% and 0% was from wind power, and 20%and 0% was largely from other forms of renewables. The country imported approximately 16% of its electricity in 2005.

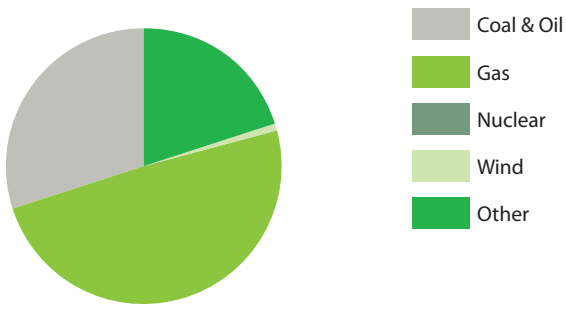
Turin GhG Inventory 2005

Sector	CO_2 (kt)	CO_{2eqv} (kt)
Residential	3986	4,011
Services	2719	2,743
Industry	6281	6,321
Energy Industry	0	0
Transport	3894	4,040
Fugitive	596	812
Total Energy	17477	17,928
Industrial Processes	1443	2508
Waste	0	284
Agriculture	0	1466
Total	18920	22186

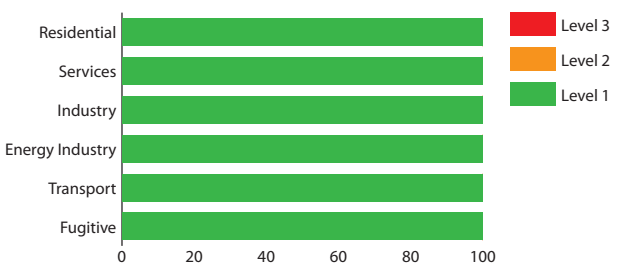
Turin Chart 1: Energy Sector



Turin Chart 2: National Electricity Generation



Turin Chart 3: GRIP Methodologies Used



Scenario Overview

INTRODUCTION

There were four scenario sessions conducted in the Province of Turin. Three scenarios focused on reducing CO_2 emissions by 80% by 2050. The remaining session looked at what level of CO_2 reduction could be achieved by 2025 and what actions could be pursued in the short-term.

To ensure that the scenarios were developed independently, the participants in the sessions were not informed how previous groups, either in the province, or outside had acted. This section provides a comparison between the first three scenarios.

The emissions decrease by 39%, 63% and 54% and energy demand decreases by 17%, 41% and 34% in Scenarios 1, 2 & 3 respectively.

ECONOMY AND POPULATION

The population grows by 11%, 3% and 14% in Scenarios 1, 2 & 3 respectively. This is driven by increases in life expectancy in all scenarios, migration to Turin from abroad in Scenario 2, and migration from other areas of Italy in Scenario 3. Average household size decreases in all scenarios because there are more elderly people, in Scenario 2 because more students live alone, and in Scenario 1 because of a higher divorce rate.

The economy grows by 2-3% per annum. The industrial sector reduces its share of the economy whilst the commercial sector increases its share. In Scenarios 1 & 2, heavy industry is partially replaced by knowledge intensive industry. In Scenarios 2 & 3, public administration's share of the economy decreases due to budgetary cuts. The agricultural sector grows in Scenarios 2 & 3 due to a combination of increased food prices and demand for local produce.

RESIDENTIAL SECTOR

Emissions decrease by 35%, 72% and 62% in Scenarios 1, 2 and 3 respectively. In Scenario 2, electricity demand reduces by 50%, partly as a result of behavioural change induced by education programmes, along with improvements in the efficiency of appliances, air conditioning systems and lighting. Natural gas was used to fuel over half of the heat demand in each scenario and solar thermal panels and heat pumps produce between 15%-25% of the heat demand. In Scenario 2, onsite renewable electricity generation meets 40% of electricity demand, compared to 10% in Scenario 1 and 7% in Scenario 3.

SERVICE SECTOR

Emissions decrease by 49%, 76% and 60% in Scenarios 1, 2 & 3 respectively. In each scenario, the province is dependent on natural gas to meet heat demand. The amount of heat demand met by district heat networks increases in each scenario and is partly fuelled by bioenergy. In Scenario 3, district heat networks utilise geothermal energy to produce 10% of the outputted heat. In each scenario onsite generation meets 10-20% of electricity demand and 7-10% of heat energy.

INDUSTRIAL SECTOR

Emissions decrease by 41%, 46% and 50% in Scenarios 1, 2 & 3 respectively. There is a decline in heat demand in each scenario and an increase in electricity demand due in part to a transition towards knowledge based industries. In each scenario the sector remains reliant on natural gas to meet heat demand. CHP plants generate 21%, 54% and 19% of the electricity consumed in Scenarios 1, 2 & 3 respectively, and they are fuelled by fossil fuels, making the electricity generated in CHP plants more carbon intensive than electricity from the national grid. On-site electricity generation meets 10-20% of electricity demand.

TRANSPORT

Road transport emissions decrease by 31%, 74% and 48% in Scenarios 1, 2 & 3 respectively. Road vehicle kilometers decrease in each scenario. In Scenario 3 there is an increase in vehicle efficiency and a transition towards electric vehicles. In Scenario 1 there are smaller improvements to vehicle efficiency than Scenario 3, and petroleum provides half the energy used to propel road vehicles. In each scenario policies and regulations are introduced to encourage modal shift from road to rail, resulting in an increase in the kilometers travelled by rail vehicles. Rail transport continues to be powered by electricity, with emission reductions as electricity becomes less carbon intensive.

ELECTRICITY GENERATION

In Scenarios 2 & 3, the province generates 5% of Italy's electricity. More than half of electricity generation is from natural gas without CCS. Renewables provide more than a third of electricity generated in the region. In all scenarios Italy continues to have a national grid and imports some electricity from France. CCS is not used in Scenarios 1 & 2 but is used in Scenario 3. In Scenario 1, fossil fuels continue to generate 50% of Italy's electricity, compared to 27% in Scenario 3 and 31% in Scenario 2. In all scenarios renewables produce more than a sixth of electricity generation.

THE BELL TOWER
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Scenario 1: Province of Turin

Scenario Characteristics

IN THIS MEDIUM GROWTH SCENARIO CO_2 EMISSIONS REDUCE BY 39% AND PER CAPITA EMISSIONS CONTRACT TO 4.4T. END USER ENERGY CONSUMPTION REDUCES BY NEARLY A FIFTH. THE POPULATION OF THE PROVINCE INCREASES DUE TO A HIGH BIRTH RATE AND INCREASED LIFE EXPECTANCY. HEAT DEMAND IN THE RESIDENTIAL SECTOR REDUCES, DRIVEN BY BEHAVIOURAL CHANGE. DUE TO ELECTRIFICATION FOSSIL FUEL COMBUSTION IN THE INDUSTRIAL SECTOR DECREASES. PRIVATE VEHICLE USE INCREASES ALTHOUGH THERE IS LESS TRAFFIC IN THE CITY - WHICH HAS BEEN DISPLACED ONTO THE PUBLIC TRANSPORT NETWORKS. THE PROVINCE RECEIVES ITS ELECTRICITY FROM A CARBON INTENSIVE ITALIAN GRID.

ECONOMY AND POPULATION

The population of the province has grown to 2.5 million people as life expectancy and birth rate have increased. The regional population remains at 4% of the national population. More people choose to live alone and the divorce rate has increased, leading to a decrease in household size.

"The heavy industry as conceived 30 years ago no longer exists but there is another industry."

The economy of the province has grown by an average of 2% per year as improved rail links and communication technologies have supported economic growth. The industrial sector's share of the economy has decreased partly because heavy industry is no longer present in Turin. Agriculture has retained its share of the economy whilst the commercial sector's share has increased to 50%. Initially budget cuts and privatisation of transport caused public administration's share of the economy to decrease, but the aging population requires more services and public administration now forms 25% of the economy.

RESIDENTIAL SECTOR

Emissions have reduced by 35% since 2005. There are more homes and more appliances in each home but these appliances are more efficient, people are more aware of their energy demand and smart grids have been developed which has helped reduce demand. Onsite solar PV meets 10% of electricity demand.

"I believe that electricity efficiency should not be underestimated. Bulbs can reduce electrical consumption by an ¼ in one shop."

There has been a 20% reduction in heat demand because of technological and behavioural change. The majority of heat demand is met by natural gas; two thirds of which is used in CHP plants. Bioenergy provides 9% of heat demand. A district heat network enables distribution of heat from CHP plants. Increase use of solar thermal panels provides 15% of heat demand.

SERVICE SECTOR

Emissions have reduced by 49%. Electricity demand has reduced by 10% and heat demand has reduced by 20%; the same as the residential sector. The majority of heat demand is provided by natural gas. Solar thermal panels meet 10% of heat demand and solar photovoltaic panels meet 10% of electricity demand. Emission reductions have been delivered due to the low-carbon content of electricity.

INDUSTRIAL SECTOR

Emissions have reduced by 41%. The sector has evolved to become more electricity intensive than heat intensive. Heat demand has reduced by 20%. The sector remains reliant on natural gas used in buildings and CHP plants to meet 93% of heat demand. Onsite renewable technologies are not used for heating but provide 20% of electricity demand.

"As the economy grows I cannot avoid thinking about a growth in consumption (in the industrial sector). I cannot think of saving one 5th of the energy when economic growth is at 2% every year."

TRANSPORT

"We'll probably have run out of oil by 2050 so we decrease oil first of all."

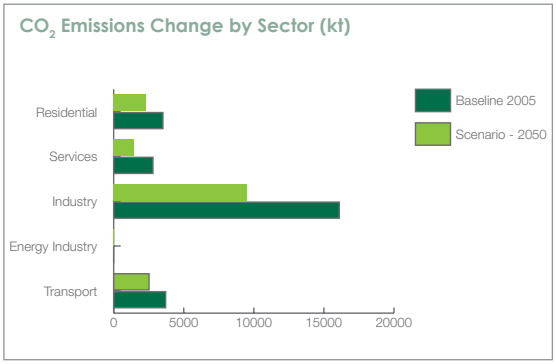
Emissions have reduced by 31%. Road vehicle kilometres have decreased and there has been a modal shift from road to rail transport; regional policies promote sustainable travel by excluding cars from the city centre during peak times and promoting the use of public transport. Road and rail vehicles are more efficient. Petrol powers 50% of road vehicles, with natural gas, electricity, liquid petroleum gas and hydrogen 'fuelling' the rest. Rail transport is almost entirely electrified.

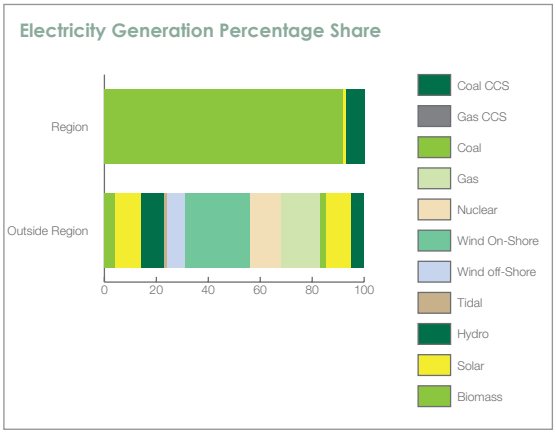
"I believe that there are two sources of fuel that really should be increased (for road transport), electricity and hydrogen, taking into account that we have storage issue for hydrogen and disposal of the batteries."

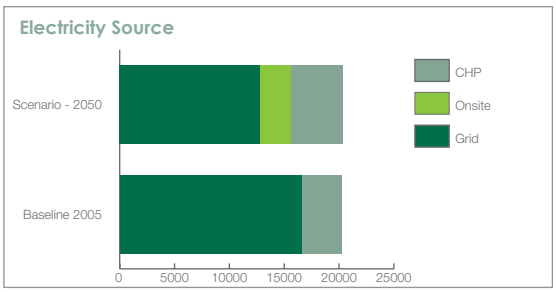
ELECTRICITY GENERATION

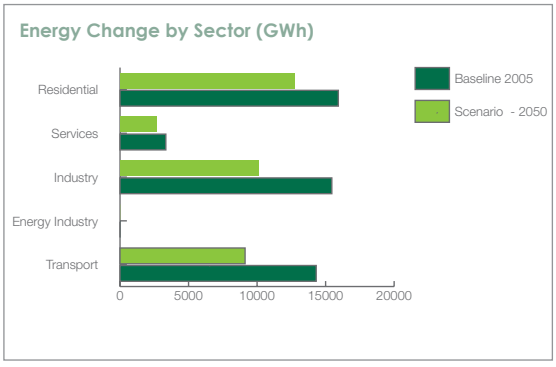
The region's electricity generation presents a similar generation mix to 2005. Almost two thirds is from combined cycle gas turbines and 28% is from hydro-electric plants. Half of the electricity generated nationally is from fossil fuels, predominantly natural gas. Onshore wind and solar PV supply the reminder of nationally generated electricity. Italy continues to import approximately 15% of its electricity from French nuclear power stations. There are no power plants in Italy with CCS technology and no nuclear power stations.

"Nuclear power will increase but we do not know if it will be in the Italian territory. One proposal is that nuclear power stations will be in Algeria."









Emissions Change	-39%
Energy Change	-17%
Emissions per Capita	4.4t

Scenario 2: Province of Turin

Scenario Characteristics

IN THIS HIGH GROWTH SCENARIO CO_2 EMISSIONS REDUCE BY 63% AND PER CAPITA EMISSIONS CONTRACT TO 2.9T. END USER ENERGY CONSUMPTION REDUCES BY MORE THAN A THIRD. THE POPULATION OF THE PROVINCE INCREASES DUE TO IMMIGRATION. NEW HOMES BUILT TO PASIVHAUS STANDARDS HELP REDUCE ENERGY CONSUMPTION IN THE RESIDENTIAL SECTOR. A REDUCTION IN HEAT DEMAND IN THE INDUSTRIAL SECTOR IS CAUSED BY THE CLOSING OF HEAVY INDUSTRY. PRIVATE VEHICLE USE DECREASES DUE TO BEHAVIOURAL CHANGE WHICH TOGETHER WITH A TRANSITION TO LOW-CARBON FUELS DELIVERS A REDUCTION IN EMISSIONS. THE PROVINCE LARGELY RECEIVES ITS ELECTRICITY FROM A LOW-CARBON ITALIAN GRID WITH IMPORTS FROM FRANCE AND BRITAIN.

ECONOMY AND POPULATION

The population of the region has increased by 3% to 2.3 million since 2005 despite a low birth rate, due to immigration. However, the number of households has increased by 7% as average household size has decreased. Average life expectancy has increased so there are more elderly people. There are many students in the region. These demographics are not national trends; there is a higher birth rate in the south of Italy and the average household size is larger.

The regional economy has grown by on average 3% per year. Economic growth in the region has been faster than national economic growth and the region now has a 5% share of the Italian economy. Increasingly, production occurs outside the province, but there are more jobs in research and development in the region hence the industrial sector has contracted and the commercial sector has grown. As food has become more expensive, local production has been favoured and agriculture has increased its share of the regional economy to 2%. Public administration has a reduced share of the economy.

"The lack of food is something that cannot be taken for granted. Food will become more expensive and people will go back to growing their own food."

RESIDENTIAL SECTOR

Emissions have reduced by 72% since 2005. Electricity and heat demand have halved due to education, cultural changes and improvements to the efficiency of technologies, air conditioning and lighting. New homes have been built to PassivHaus standards. Renewable technologies, particularly solar PV panels on new buildings, meet 40% of electricity demand. A district heating network has been developed and supplies 40% of the heat demand and 50% of electricity demand. CHP plants feed heat networks and are fuelled largely by natural gas. The remainder of heat demand is met largely by fossil fuels and a quarter is met by solar thermal panels.

"I think that environmental energy certification is growing a lot... New air-conditioning units could cut down consumption by 50%."

SERVICES SECTOR

Emissions have reduced by 76% since 2005. Electricity and heat demand have both reduced by 40%; a higher reduction may have been achieved but it was limited by less than incentivised building occupiers that do not pay the energy bills. CHP plants with the same energy mix as in the residential sector meet 40% of electricity and heat demand. Onsite renewable technologies generate 20% of electricity demand, whilst solar thermal panels and ground-source heat pumps generate 7% of heat demand.

"Well, maybe the reduction in consumption (of energy in the service sector) is a little less because when people are at work they do not behave so well – when the money is not theirs."

INDUSTRIAL SECTOR

Emissions have reduced by 46%. Heavy industry has closed, particularly that which was inefficient and unable to compete with industry abroad. More efficient industrial processes, for example, highly insulated ovens, have reduced heat demand and industry has become more electricity intensive, heat demand has reduced by 30%, where as electricity demand has decreased by 20%. New industrial districts have installed smart grids and connected to district heating networks supplied with heat by natural gas fuelled CHP plants. CHP plants meet 60% of heat demand and 54% of electricity demand. Overall, natural gas meets 90% of heat demand. Onsite technologies such as solar PV, solar thermal and ground-source heat pumps generate 10% of electricity demand and 8% of heat demand.

TRANSPORT

"We're still not very aware about disposal costs for these batteries (for electric cars). In heavier vehicles like large lorries it can be helpful to have an electric component, not necessarily all of it... saying that one vehicle out of three will be electric is optimistic."

Emissions have reduced by 70%. Road transport emissions have reduced by 74%. Rising costs and cultural changes have reduced the use of private vehicles, for example, more people work from home and use teleconferencing. There has been a 30% decrease in the

distance travelled by road vehicles and a 60% decrease in energy use because vehicles are more efficient. Electricity propels half of road vehicles. The development of hydrogen vehicles has been restricted by difficulties associated with supplying hydrogen.

"Can we leave room for hydrogen development in rail transport? The principle is the same as in road transport. Why can we not think of an increase in the use of hydrogen as an energy source?"

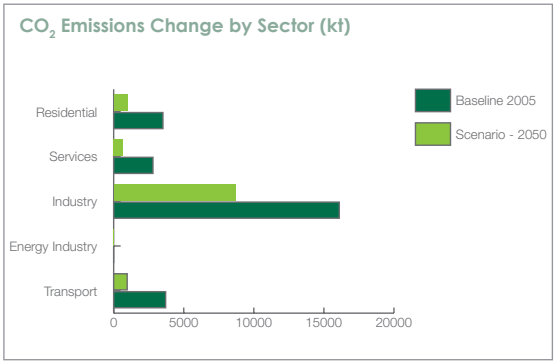
Rail vehicle kilometres have increased by 50% and energy use by 25%. As more railway lines have been introduced and the frequency of trains has increased energy use has increased by 25%.

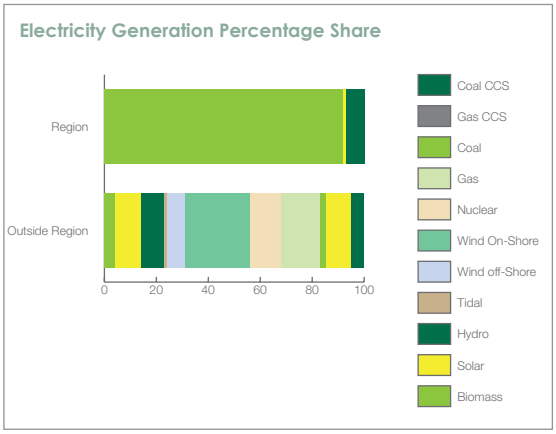
ELECTRICITY GENERATION

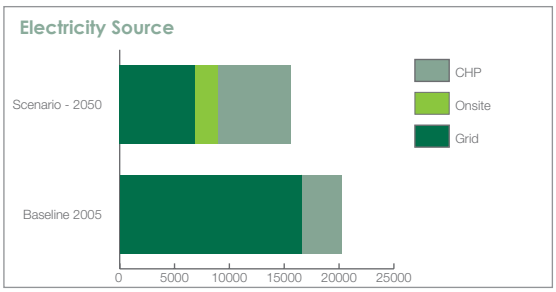
"The problem with wind is that turbines require 200 days of constant wind per year, which is not the case in Turin. Also, they destroy the territory and the land."

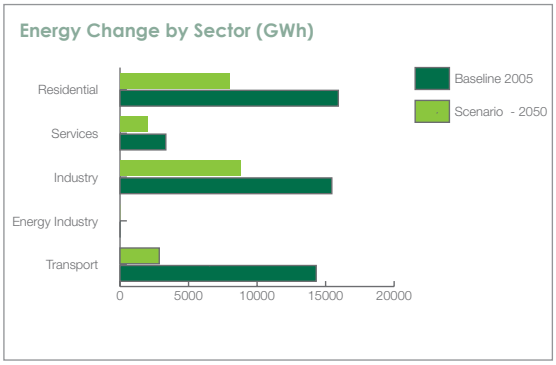
The province continues to generate 5% of Italy's electricity. Over half of the province's electricity is generated by combined cycle gas turbines. Natural gas has a decreased share of the energy mix. Less carbon intensive sources form the remainder of the energy mix; 5% solar PV, 30% hydroelectric, 10% bioenergy and 2% onshore wind. New hydroelectric plants are mostly small-scale. In the national grid there has been a move away from fossil fuels, especially coal which now generates 5% of Italy's electricity and an increase in onshore and offshore wind, hydroelectric power and nuclear power. Italy imports electricity from France and Britain where political will has supported the development of nuclear power. Incentives for solar PV plants mean they now generate 7% of Italy's electricity. There are no CCS plants in the country.

"We cannot produce electricity using tidal power, or onshore and offshore wind. Hydroelectric - I would say not much, so it's micro hydroelectric. Some solar energy – yes we could have more, but not much... the province of Turin is not the best for solar energy."









Emissions Change	-63%
Energy Change	-41%
Emissions per Capita	2.9t

Scenario 3: Province of Turin

Scenario Characteristics

IN THIS MEDIUM GROWTH SCENARIO CO_2 EMISSIONS REDUCE BY 54% AND PER CAPITA EMISSIONS CONTRACT TO 3.3T. END USER ENERGY CONSUMPTION REDUCES BY MORE THAN A THIRD. THE POPULATION OF THE PROVINCE INCREASES DUE TO ECONOMIC GROWTH ATTRACTING PEOPLE TO THE PROVINCE. POLICIES REQUIRING THE RETROFITTING OF EXISTING HOMES AND FOR NEW HOMES TO MEET PASIVHAUS STANDARDS HELP REDUCE ENERGY CONSUMPTION IN THE RESIDENTIAL SECTOR. LOCAL BYE LAWS ENSURE ONLY EFFICIENT APPLIANCES ARE PURCHASED FOR USE IN THE SERVICE SECTOR. A REDUCTION IN HEAT DEMAND IN THE INDUSTRIAL SECTOR IS DRIVEN BY COST SAVINGS. PRIVATE VEHICLE USE DECREASES DUE TO SUCCESSFUL PLANNING POLICY THAT HAS INCREASED THE USE OF PUBLIC TRANSPORT. THE PROVINCE LARGELY RECEIVES ITS ELECTRICITY FROM A LOW-CARBON ITALIAN GRID.

ECONOMY AND POPULATION

The population of the region has grown to 2.6 million driven by economic growth and inward investment. The aging population, immigration and development of transport connections have changed the population distribution within the province. This has led to a greater population in the periphery of the province. Household size has reduced.

"If environmental comfort is enhanced then people may choose to come here because it is more attractive".

The region's economy has grown by 2% per annum; a faster rate than the national economy. Public administration has a decreased share of the region's economy due to cost cutting and increases in efficiency of service provision. The agricultural sector has grown to 2% of the provincial economy, and the commercial sector has grown to 50%.

"If mobility increases, as has been the recent trend, despite the economic crisis and low GDP, this will continue to be the case."

RESIDENTIAL SECTOR

Emissions have reduced by 62%. Heat demand has halved; policies required new homes be built to PassivHaus standards and existing buildings be retrofitted. Natural gas used directly in homes meets 40% of heat demand. Bioenergy and petroleum, used in Alpine areas of the province, meet 10% and 5% of heat demand respectively. A combination of CHP, heat networks and geothermal energy meet the reminder of demand. Grants and policies focused on these technologies after demand reduction options (e.g. insulation and double glazing) had been exhausted.

Electricity demand has decreased by 15% as appliances have become more efficient, but reductions have been offset by population growth and increased use of air conditioning as the climate changes. Smart grids and smart metering have changed electricity use, spreading out peak demand and allowing a larger proliferation of renewable technologies to feed into the national grid.

Onsite renewable electricity technologies generate 7% of electricity demand.

SERVICE SECTOR

Emissions have reduced by 60%. Electricity demand has decreased by 5% due to local bye laws ensuring only efficient products are purchased. Onsite PV panels meet 15% of demand. Heat demand has decreased by 60%. The public sector set an example in how to reduce demand that was replicated in the private sector.

INDUSTRIAL SECTOR

Emissions have reduced by 50%. Electricity and heat demand have decreased by 25% and 30% respectively. Industry is constantly striving to increase efficiency and reduce production costs, and this has facilitated reductions. Onsite electricity generation technologies such as solar PV and wind turbines have been installed on warehouse roofs and in car parks, meeting 15% of electricity demand. Most of the heat demand is met by natural gas. Onsite solar thermal panels, heat pumps and petroleum meet the remainder of demand.

TRANSPORT

"Having an electric car is not that difficult. The moment there is an efficient battery, then everyone can power it from their house."

"In Stockholm people just use cars at the weekend because public transport meets their demands for work and leisure. Efficient public transport exists here in Turin too."

Emissions have reduced by 48%. Road vehicle kilometres have decreased by 25% due to policies, actions and regulations limiting travel and encouraging a modal shift from private cars to public transport, for example, pricing mechanisms have increased the costs associated with owning and travelling in a car. Increased social networking and home working have also reduced the distance travelled by residents.

"An electric car is much more efficient than a petrol car. If the number of electric cars is increased, then they can be a lot more efficient than petrol cars."

Vehicles are on average 20% more efficient because the vehicle fleet comprises smaller, lighter cars and electric cars, and driving habits have changed. Half of road vehicles are electric, with 30% using petroleum and the remainder 'fuelled' by bioenergy, hydrogen, natural gas and liquid petroleum gas. Hydrogen is used in buses. The distance travelled by rail vehicles has increased by 30% as personal and freight transport has moved to rail. Newer trains are more efficient, so total rail energy use has increased by 20%.

"The two metro lines and the light rail line in Turin will be expanded and this will mean more freight can be moved around."

ELECTRICITY GENERATION

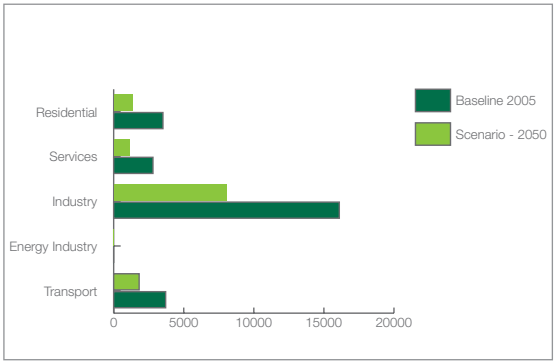
"We should have a map for geothermal power like we do for hydroelectric. It's not sustainable on a large scale because of the environmental effects."

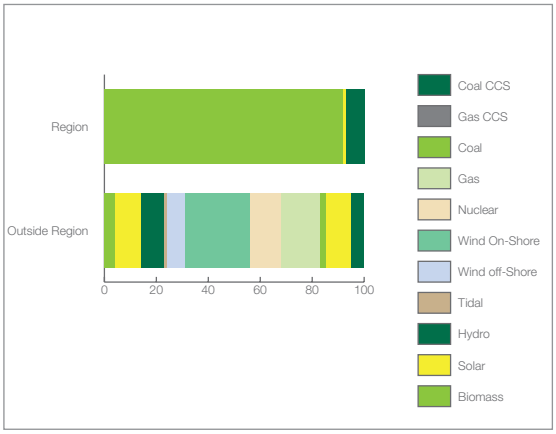
Nationally, 27% of Italy's electricity demand is met by fossil fuel plants, which are partially fitted with CCS. nuclear power, meets 18% of electricity demand; Italy's reliance on imported electricity has been reduced. Renewable sources, offshore wind, onshore wind, solar power, tidal power, hydroelectric power and bioenergy meet the reminder of demand.

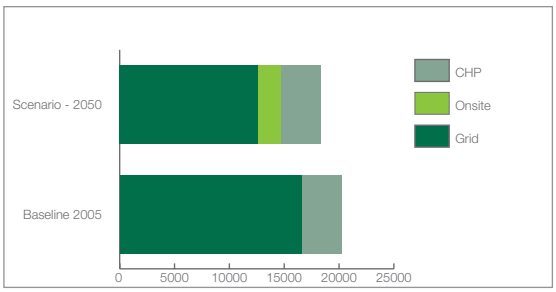
"I think that nuclear will go up and the difference will be that instead of being imported we will be producing it ourselves."

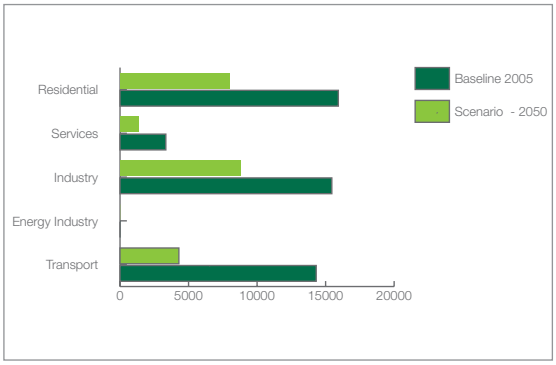
Peak demand is met by natural gas and hydroelectric power plants. The province of Turin generates 5% of Italy's electricity through combined cycle gas turbines (60%), hydroelectric power plants (30%), solar power plants (5%) and biomass power plants (5%).

"There are no projects related to wind at the moment. We believe the landscape is not compatible with wind."









Emissions Change	-54%
Energy Change	-34%
Emissions per Capita	3.3t

2025 Synthesis Scenario: Province of Turin

Scenario Characteristics

IN THIS MEDIUM GROWTH SCENARIO CO_2 EMISSIONS REDUCE BY 38%. THE POPULATION OF THE PROVINCE INCREASES. PUBLIC ADMINISTRATION HAS BEEN KEY TO REDUCING ENERGY CONSUMPTION AND LEADING THE WAY IN EMISSIONS REDUCTION THROUGH RENEWABLE ENERGY UPTAKE. A REDUCTION IN HEAT DEMAND IN THE INDUSTRIAL SECTOR IS CAUSED BY THE CLOSING OF INDUSTRY. PRIVATE VEHICLE USE DECREASES DUE TO AN INCREASE IN HOME WORKING WHICH TOGETHER WITH EFFICIENCY IMPROVEMENTS DELIVERS DEMAND REDUCTION. THE PROVINCE LARGELY RECEIVES ITS ELECTRICITY FROM A LOWER CARBON ITALIAN GRID.

"Unfortunately it is not us who will decide what needs to be done... the change in mindset must occur in the policy makers and decision makers as they are the ones we have to interact with."

"Biofuel? In cars in the province of Turin? I don't think so. This will go against our culture; it competes for land with food production."

INTRODUCTION

The purpose of the final scenario session was to identify, based on the outcomes of the 2050 scenario sessions, what emissions reductions might be achieved in the region by 2025. This session included stakeholders that took part in each of the 2050 scenario sessions. A full scenario was completed which led to an emission reduction of 38% by 2025.

ECONOMY AND POPULATION

The provincial economy has grown by an average of 2% per annum. The population has increased by 2%. There has been a larger increase in the number of residential buildings which has led to a reduction in household size.

RESIDENTIAL AND SERVICE SECTOR

"There is another problem about incentives – you don't know how you can get them. You have to consult experts to know how to do these things without wasting your time."

Heat demand and electricity consumption have decreased in both the service and residential sectors. Local authorities have been key to successfully reducing demand and increasing micro generation. Furthermore, energy prices have risen, which has helped to reduce energy use. A district heating network has been set up in the densely populated areas of the city of Turin, providing 50% of residential and service heat energy. A further 15% and 20% of residential and service sector heat demand is met by onsite heat renewable technologies.

"100 years ago we did not heat homes up. Nowadays we cannot stand to be in the cold... We want comfort at any cost."

"Of course for any new building there are regulations that encourage buildings to be energy independent. Schools are encouraged to be independent."

INDUSTRIAL SECTOR

Emissions have reduced by 10%. Industry has partially relocated to eastern European countries. This has led to a reduction in provincial energy use.

TRANSPORT

"In 2025 oil will be a lot more expensive and this will greatly affect consumption. It will be the biggest motivator in this case."

Road vehicle kilometres have reduced because more people are working from home, and there has been an increase in light and high speed rail lines, so more residents use public transport. This has been facilitated by an increase in population density. The new rail lines have led to an increase in freight transported by rail.

"But now we use bigger cars than we used to, cars now have air conditioning, they have all these facilities, so even if the engines are more efficient there is not that much reduction in fuel use."

EU legislation regarding road vehicles CO_2 emissions has led to an increase in vehicle efficiency. As the average car is replaced within ten years, the majority of cars on the road have been manufactured since 2015. A combination of reduction in road travel and increased vehicle efficiency has led to a reduction in energy use in road vehicles of 45% by 2025.

ELECTRICITY GENERATION

"I know there were proposals for an offshore wind plant in the Adriatic Sea, but the population opposed it because of the environmental impact and I don't know whether there are any more proposals."

The carbon intensity of electricity generation in Italy has reduced. Solar generation, particularly in the south of Italy, meets 15% of Italy's electricity demand. A further 10% of Italy's electricity demand is met by wind turbines. Within Turin, one stakeholder noted that three incinerators have been approved; increasing the potential generation of electricity and heat from waste. A further 1% of the electricity generated in the province could be generated using large scale solar plants.

"The cost of fossil fuels is the main driver (for renewable energy), then energy security, then climate change... Because there are unfortunately too many people showing the opposite, that climate change is not happening."

Action	Individual	Organisation	Province	Region	State	Nation	EU	Global	Other
Promotion of retrofitting rather than new build.									
A provincial institute to manage the process of reducing emissions from the residential and service sectors.									

MOLE ANTONELLIANA IN TURIN
© SKYFISH

THE EUCO$_2$ 80/50 PROJECT
STAGE 2
SUMMARY, CONCLUSIONS AND NEXT STEPS

BRUSSELS FRANKFURT GLASGOW HAMBURG HELSINKI MADRID NAPLES OSLO PARIS PORTO ROTTERDAM STOCKHOLM STUTTGART TURIN

METREX
The network of European Metropolitan Regions and Areas

metropolregion hamburg

The Greenhouse Gas Regional Inventory Project
grip

Covenant of Mayors
Committed to local sustainable energy

Partner

Next Steps: Turin

INTRODUCTION

This section identifies how the Province of Turin might work toward meeting at least an 80% reduction in CO_2 emissions by 2050. It has been informed by discussions in the scenario sessions, information provided by the province, and the knowledge of the research team.

To facilitate the transition to a low-carbon economy it is important to take a full energy systems perspective. To advance the low-carbon agenda, policy makers have a range of approaches available to them including education and awareness raising, taxation, financial incentives and planning regulations. These approaches will need to work across sectors, areass and countries, and are key components of building a sustainable energy action plan. It should be noted that whilst climate change mitigation was the original focus of the EUCO$_2$ scenarios, discussion in the sessions often focused on other agendas including energy cost control, security of energy supply and energy self-sufficiency. These agendas and others may be mutually beneficial to the mitigation cause, whilst also, potentially, enabling the 'buy in' of climate sceptic stakeholders.

The EUCO$_2$ scenarios focus on achieving an 80% reduction in CO_2 emissions by 2050; in line with the European target. However, this absolute reduction target may not be appropriate for every area. This is because different areas and sectors have different opportunities to reduce their emissions due to the nature of their activities, and the availability of renewable resources. The year 2050 is used as a future trajectory point to project emissions beyond and therefore the likely global warming that will occur. The European target for 2050 can also be considered as a 2 tonnes CO_2e per capita target (including international aviation and shipping). This alternative target has the advantage of providing a common goal for each metropolitan area that is not relative to a baseline, but it doesn't overcome the target setting difficulties associated with varying provincial sectors and differing renewable access.

None of the scenarios produced emissions reduction of at least 80% by 2050. These scenarios could be further publicised to show how different actions may lead to different emissions reductions and to show how much more needs to be done. Further analysis could examine each sector's change in energy consumption and fuel switch to explore different ways in which they may be achieved. In each scenario 15% of heat demand is met by on-site renewable heat technologies. One action could be to assess the current technical maximum potential for solar thermal panels and set policies and actions to maximise take-up.

Interaction with other European cities through Metrex could also provide an opportunity to discuss the challenges that stakeholders in Turin perceived as most difficult, and learn from the experience of other cities.

RESIDENTIAL SECTOR

In 2005, the residential sector generated 23% of the province's CO_2 emissions. Heat demand was met by fossil fuels, mostly natural gas. To reduce emissions the approach should focus on demand reduction and fuel switching. If the carbon-intensity of the grid is reduced, electric heating will be an option. Behavioural change is key to demand reduction, particularly in the short term and can be promoted through education campaigns. Incentives and information can be used to encourage 'carbon literate' decisions when buying household products such as fridges, televisions and light bulbs. The introduction of smart meters can help householders better understand their energy use, and budget to make reductions. The authorities can lead the way with publicly owned housing by retrofitting buildings and subsidising the purchase of efficient household appliances.

Step	Action
1	Use the next step tick sheet at the end of this document to identify which areas of action are within the region's remit, and which need attention at national, European and/or international levels; as well as which areas of action the region would like control of to take effective action.
2	Put in place data collection protocols to monitor emissions using GRIP.
3	Establish renewable energy capacity in the province.

SERVICE SECTOR

Approximately 16% of the province's CO_2 emissions in 2005 were generated by the service sector including commercial activities and public administration. This sector faces similar mitigation challenges to the residential sector in terms of building operations. However, it is arguable that the public authorities should be seen to be taking the 'climate change lead' in their own properties on reducing energy consumption and implementing on-site generation. There may be short term benefits to the commercial sector in terms of setting a positive image by taking actions to reduce emissions. As the sector's building stock turns over more rapidly than the residential sector, changes may be implemented faster. Demand reduction and switching to a low-carbon fuel mix is essential to emissions reductions as is a transition to low-carbon intensive electricity.

It is not just a simple matter of changing the sector's buildings, but also the people that work within them. Training programmes to increase the 'carbon literacy' of staff can help to instil sustainable practices, leading to lower emissions and potentially have a secondary impact on behaviour outside of work. Such activities can also benefit Corporate Social Responsibility (CSR) reporting. Provincial level award schemes can help to motivate businesses to make energy efficiency enhancements and provide opportunities for sharing examples of best practice. Furthermore, where such changes involve international companies, actions may diffuse to sites elsewhere.

Energy Service Companies, often in the private sector, can provide financial structures to firms and residential developments that are seeking to reduce their emissions through improved efficiency and the use of renewable technologies.

OLD RESIDENTIAL PROPERTY TURIN © SAM CORNWELL

INDUSTRIAL SECTOR

The industrial sector accounted for 36% of the province's CO_2 emissions in 2005. Its energy use is primarily for heat demand and this is met by fossil fuels. The province's industry presents mitigation challenges due to the slow rate of capital stock turnover, lack of financial and technical resources, and limitations in the ability of firms to access and incorporate technological information. There may be limitations in the extent to which provincial authorities can influence industry: companies may be bound by the European Union Emissions Trading Scheme (EU-ETS) and/or be part of large transnational organisations.

Industry in the province may be able to take advantage of subsidies and tax credits, which are most likely to be provided nationally. Due to their size, industrial buildings are often well suited to on-site generation, and electricity companies may be interested in renting space for installations that feed into the grid.

TRANSPORT

The transport sector generated 22% of the province's emissions. Road transport, marine transport and aviation are currently entirely dependent on oil and, if allowed to grow, may increase emissions. Provincial policies can aim to reduce the amount of road vehicle kilometres travelled, through encouraging the use of public transport, walking and cycling, and by promoting the transition to lower-carbon fuels. Activities in other policy areas, such as the location of housing, can influence transport demand, and it is therefore important that all planning measures consider the implications for transport provision. The province has relatively low car ownership and therefore further investment in public transport, and walking and cycling schemes will have benefits by lowering social exclusion in addition to mitigation. Providing the additional generating capacity requirements can be met and the