Projects, Plans and Strategies

Update from Ireland

EnvEcon

Decision Support

Andrew Kelly

April 2019

Berlin

EnvEcon
Decision Support

Structure of Presentation

CONAIR PROJECT

NAP CONTROL PLAN

CA STRATEGY

CON+AIR Project

- Conflicts of Climate & Air Pollution
- EPA funded research project in Ireland
- Led by EnvEcon with Nilu as a partner
- and a couple of our own on the steering group - Helen & Martin

- Ambition to define a **plausible** (if unlikely) problematic pathway for air pollution to **put scale on the impact of various scenario assumptions on emission outcomes**.
- We developed an **alternative 'solution' pathway** to ascertain the impact on emissions.
- Nilu ran **Episode** and **EMEP** to generate concentration outcomes for all of our spatial emission maps.

EnvEcon Decision Support

NILU Norsk Institutt for luftforskning Norwegian Institute for Air Research

epa Environmental Protection Agency

EnvEcon Decision Support

The Problematic & Solution Pathway Scenarios

Drivers of growth in energy demand in Problematic Pathway

Fundamentals to 2030

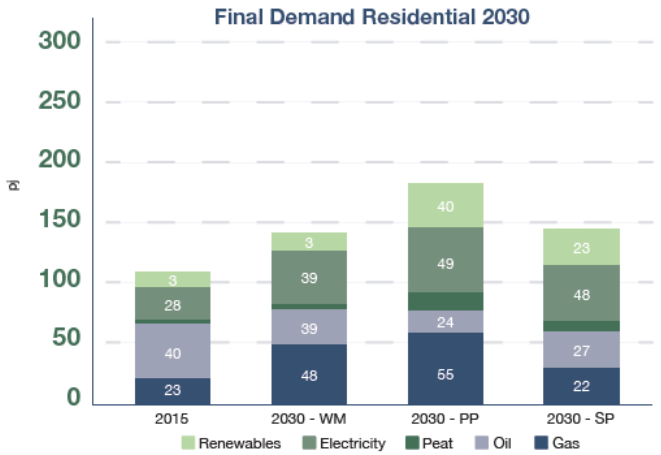
- Population growth according to CSO M1F1 scenario to 5.5 million.
- Year on year economic growth at 3.74%

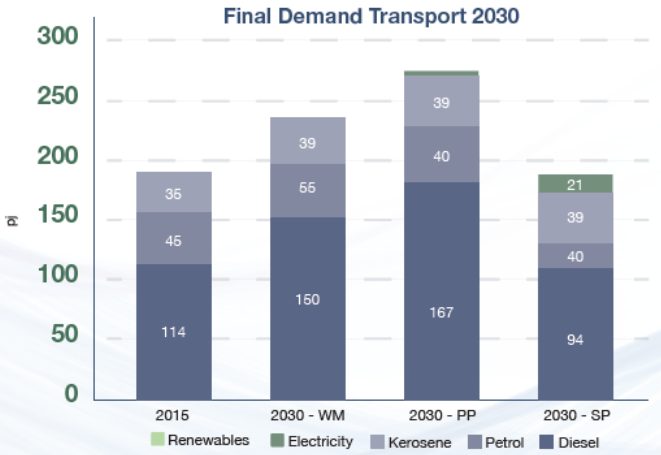
Residential Sector

- 350,000 new biomass boilers from fuel switching from oil.
- 150,000 new biomass boilers in new builds.
- 300,000 new wood-stoves.
- Indoor temperatures increase by 1°C.

Transport Sector

- Per capita car ownership increases from 500 to 550 per 1000.
- No reduction in number diesel vehicles on road.
- Slow take up of electric cars.
- Continued construction of housing in urban sprawl.
- Climate change discouraging cycling and walking.



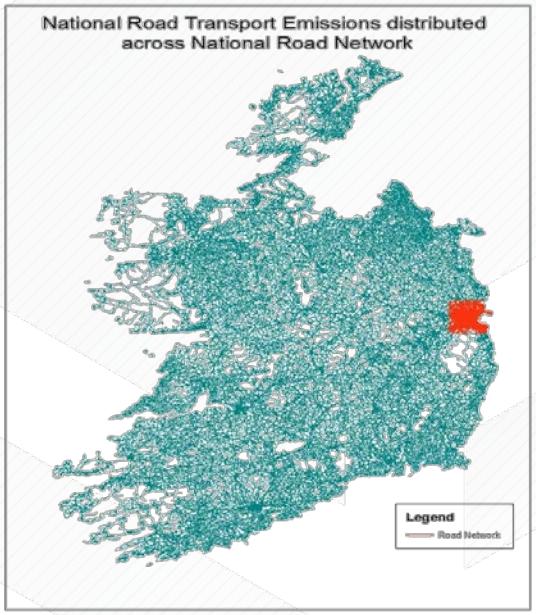


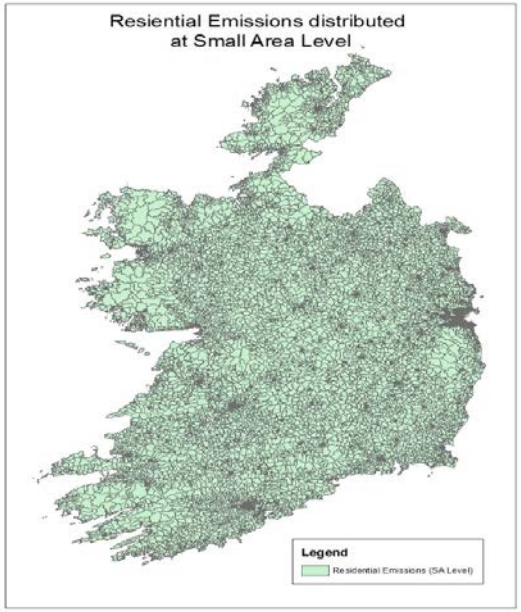
Residential and Transport sector energy demand in 2015 (measured) and in WM, PP and SP scenarios in 2030.

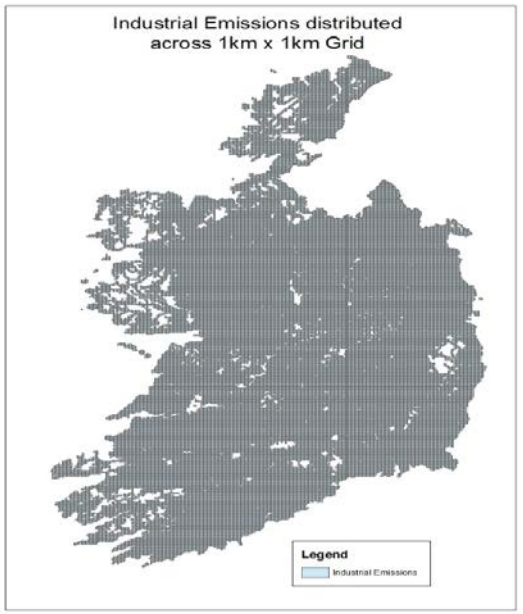
Graph notes:

- Order of magnitude increase in renewables (mostly biomass) use in residential sector in both PP and SP as compared to WM scenario
- Large decrease in use of diesel in SP as compared to PP.

Spatial Distribution of National Emissions







- Emissions from **transport** spatially distributed at road network level using annual average daily traffic values (AADTs) and commonly available information from existing geographical data, census data, traffic data and vehicle fleet data.
- **Residential** emissions are distributed at Small Area Level based on both primary and secondary fuel use patterns calculated using census data and CSO Household Budget survey data.
- **Industrial** emissions are spatially distributed using MapEire's prepared normalised 1km x 1km grids, which are based on relevant spatial data sets and statistics, and include the share of emissions to be allocated to each grid cell.

EnvEcon
Decision Support

Drivers of change in the Solution Pathway

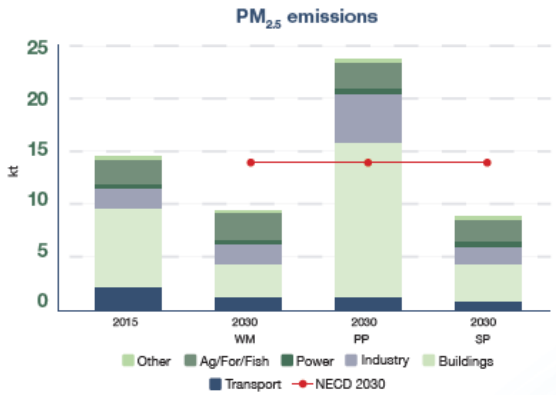
Fundamentals remain the same

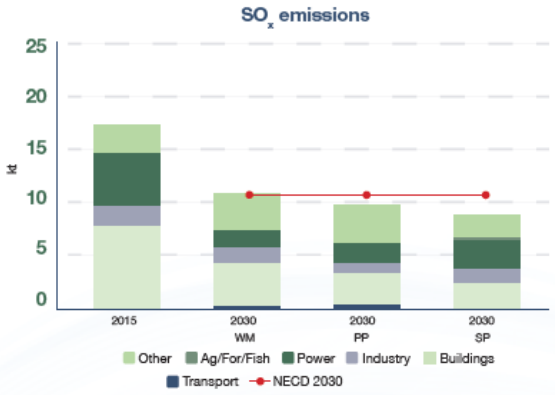
Residential Sector

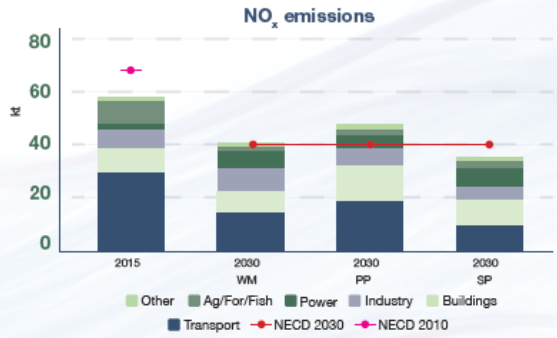
- Fabric first improvements in energy efficiency prioritized.
- 200,000 new heat pumps from fuel switching from oil.
- More efficient boilers and stoves.
- More sealing of chimneys.
- Mandatory wood fuel quality standard established.
- Installation of boilers and stoves certified.
- Chimney Sweep Mandatory.

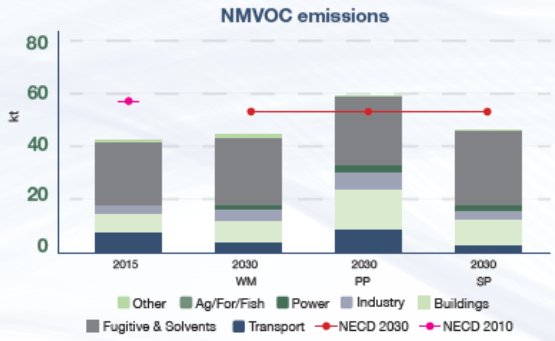
Transport Sector

- One million electric vehicles by 2030.
- No increase in current levels of vehicles per capita.
- Reduced need for automobile travel through the roll-out of the bus connects scheme in Dublin, an expansion of tram and suburban rail lines and bicycle lanes in major cities, planning which increases urban living and an encouragement of benefits of working from home.
- Modify emissions test in NCT.
- New information campaign on benefits of eco mobility.







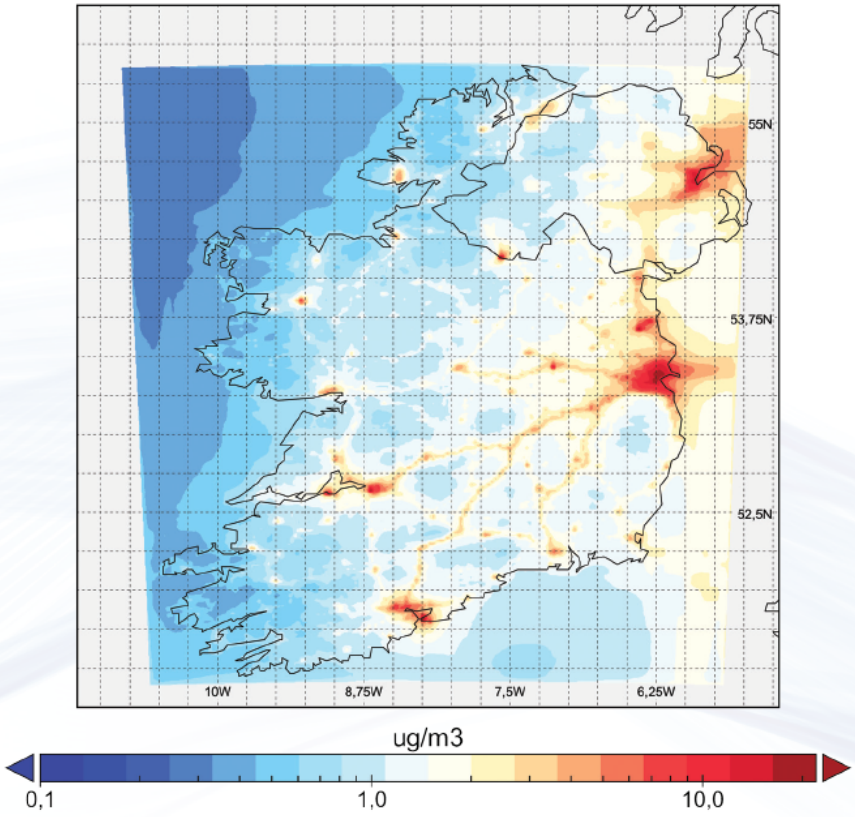


Graph notes:

- $PM_{2.5}$ emissions from the residential sector are nearly three times greater in the PP than in the WM.
- Emissions of NO_x from the transport and buildings sector increase in the PP as compared to the WM.
- Emissions in the SP are lower than the WM and the NECD limit.

Nitrogen dioxide (NO_2) in Ireland – EMEP model results

Surface NO_2, 2015 scenario



Modelled surface annual mean NO_2 concentrations (µg/m³) in 2015

Nitrogen dioxide (NO_2) results from the release of NO_x (=NO_2+NO) and further chemical production from NO. NO_x is the most significant emission from road transport and this sector is especially important as vehicle emissions in urban areas lead to the exposure of large populations to health risks from higher NO_2 concentration levels.

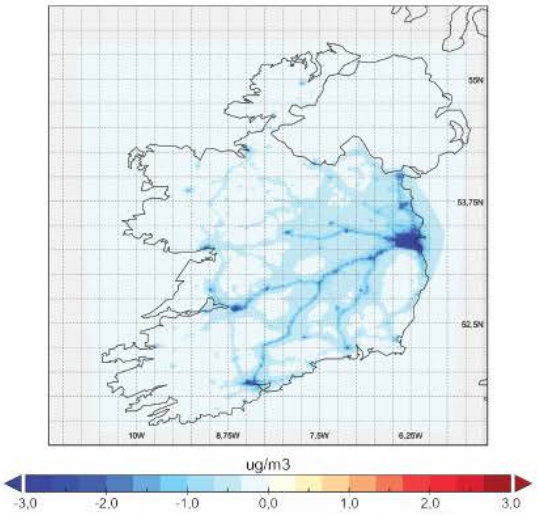
Air Quality measurements from 2007 to 2017 in Ireland show that the NO_2 annual levels are usually lower than the European air-quality directive limit for the annual mean (and World Health Organization guideline) of 40 µg/m³. An exception was in 2009 in Dublin. Local meteorological conditions may entrap pollutants close to the surface leading to very high concentrations.

The map shows the modelled gridded-average NO_2 annual mean concentrations for the year 2015. The model grid has a horizontal resolution of 2x2 km² and the middle of the lowest model layer is 22m. The maximum grid value is 22 µg/m³ (in Dublin).

The highest concentrations are found in urban areas, but the main roads can also be seen as high concentration areas. In larger agglomerations, due to the use of gas in heating, residential emissions of NO_x are notable.

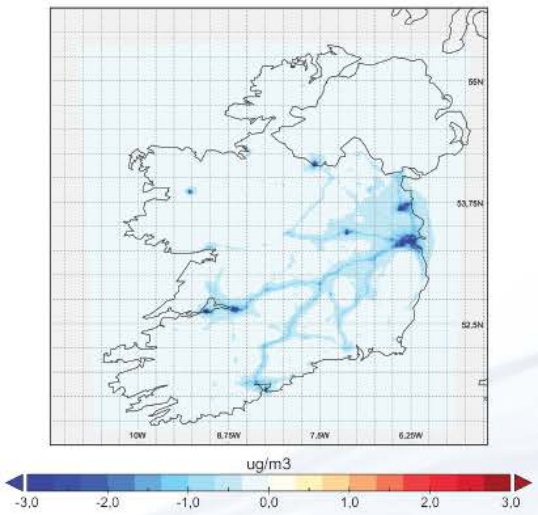
Nitrogen dioxide (NO_2) in Ireland – EMEP model results

Surface NO_2, (WM - reference) scenario



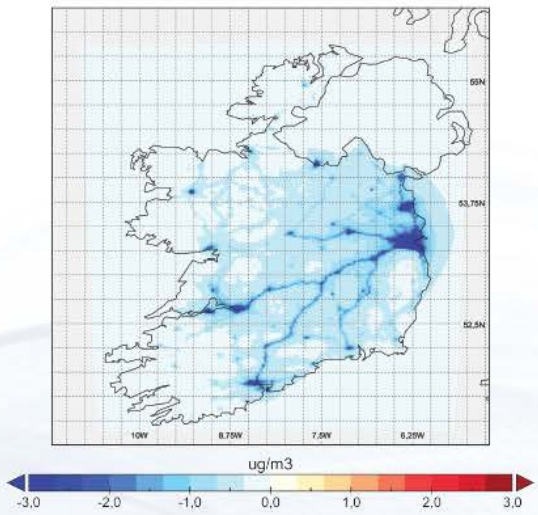
Change in NO_2 annual mean concentrations in scenario "With Measures" relative to the 2015 reference.

Surface NO_2, (WM - reference) scenario



Change in NO_2 annual mean concentrations in scenario "Problematic Pathway" relative to the 2015 reference.

Surface NO_2, (WM - reference) scenario

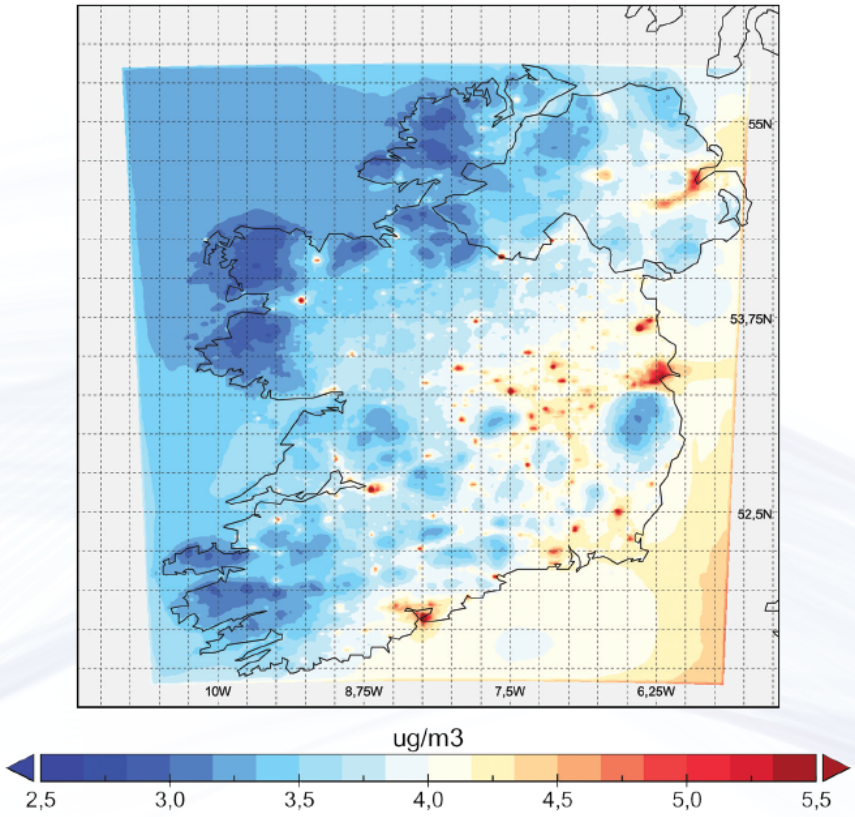


Change in NO_2 annual mean concentrations in scenario "Solution Pathway" relative to the 2015 reference.

In all emission scenarios modelled, a decrease in NO_2 concentration levels can be observed. This is mainly a result of the different projections to 2030 of the emissions from traffic: total annual NO_x emissions in Ireland decrease roughly 3 times, 2 times, and 4 times relative to 2015 levels in the WM, PP, and SP, respectively. These reductions are facilitated by replacement in the diesel car fleet of older EURO4, EURO5 and EURO6 emissions rated vehicles with compliant EURO6 vehicles.

Particulate Fine Matter ($PM_{2.5}$) in Ireland– EMEP model results

Surface $PM_{2.5}$, 2015 scenario



Modelled surface annual mean $PM_{2.5}$ concentrations (µg/m³) in 2015

Fine particulate matter ($PM_{2.5}$ and PM_{10}) is responsible for adverse health effects and premature deaths, with current estimates suggesting an average life loss of about 8 to 10 months in the most polluted European regions.

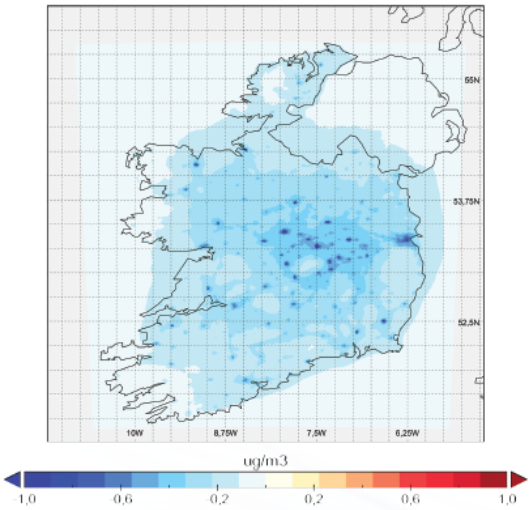
Air Quality measurements in Ireland show that the $PM_{2.5}$ annual levels are lower than the European air-quality directive limit for the annual mean of 25 µg/m³, however they are close to the World Health Organization guideline of 10 µg/m³.

The chemistry transport model results show the distribution of the gridded-average $PM_{2.5}$ annual mean concentrations for the year 2015. The maximum grid value is 10 µg/m³ and the national mean is 4 µg/m³.

The highest concentrations are found close to the main sources of the pollutants. That is roads, residential areas and industrial facilities. The secondary production of $PM_{2.5}$ is estimated as negligible compared with direct emission sources.

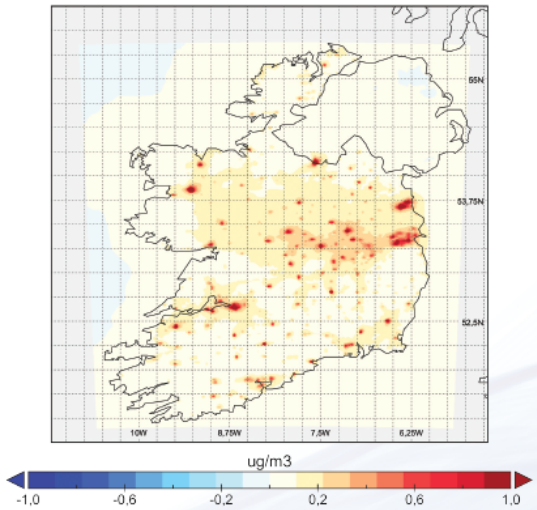
Particulate Fine Matter ($PM_{2.5}$) in Ireland – EMEP model results

Surface $PM_{2.5}$, (WM - reference) scenario



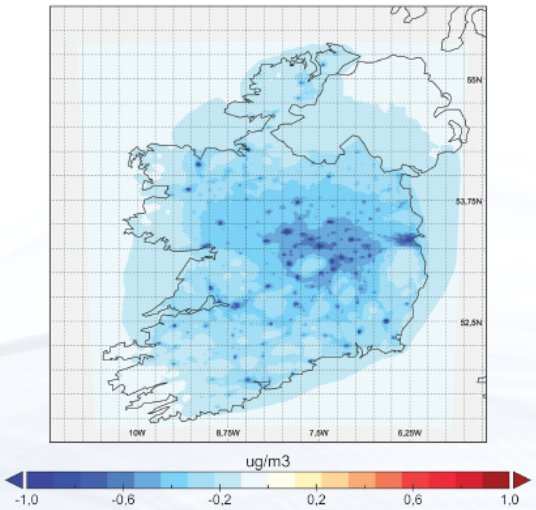
Change in $PM_{2.5}$ annual concentrations in scenario "With Measures" relative to the 2015 reference.

Surface $PM_{2.5}$, (PP - reference) scenario



Change in $PM_{2.5}$ annual concentrations in scenario "Problematic Pathway" relative to the 2015 reference.

Surface $PM_{2.5}$, (SP - reference) scenario



Change in $PM_{2.5}$ annual concentrations in scenario "Solution Pathway" relative to the 2015 reference.

The 2030 "With Measures" emission scenario presents an approximate halving of emissions compared to the 2015 inventory for the transport and residential sectors and a 10% increase in industrial emissions. The resulting change in concentrations is a national decrease that can reach 1µg/m³ in agglomerations (left-side map). In the "Solution Pathway" further decreases in the residential sector and a return to the lower 2015 industrial emission levels, leads to further concentration decreases as shown on the right-side map.

The map in the middle is showing the effects of the increase of biomass fuel consumption in the residential and industrial sectors in the "Problematic Pathway". The annual average increase for all Ireland is 0.07 µg/m³, but for the hotspots the modelled increase is around 7 µg/m³.

Nitrogen dioxide (NO_2) in Dublin – EPISODE model results

Modelled surface annual mean NO_2 concentrations (µg/m³) in 2015.

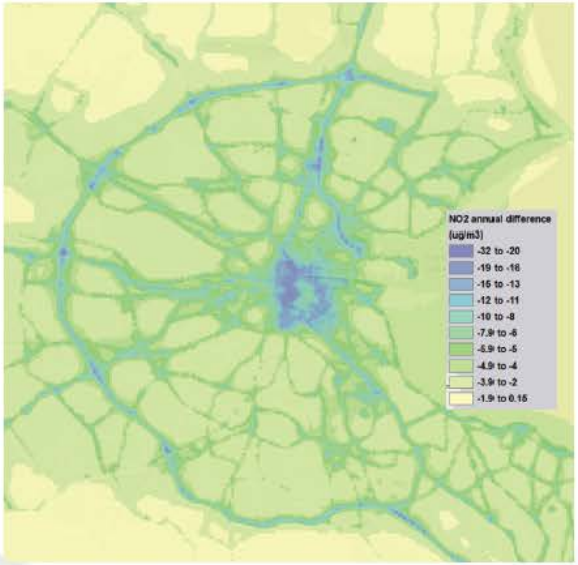
The most obvious pattern in the annual mean NO_2 concentrations map of the Greater Dublin Region for 2015 are the roads with higher emissions. Emissions from traffic represent half of the total emissions in the figure domain. Other relatively high contribution sources are shipping emissions at the harbour and residential heating emissions, especially in the city centre and to its Northeast.

The comparison of the EPISODE results with air quality stations measurements lead to the conclusion that there is an overall underestimation in the model of 25% relative to background and suburban stations. The areas in the map shaded dark orange are very close to the European air-quality directive limit for annual mean and World Health Organization guideline of 40 µg/m³. This means that areas in the city centre and important nodes on main roads may have experience health risking NO_2 levels more frequently than the measurement stations report.

Annual mean concentrations indicate the health risk from long-term exposure.

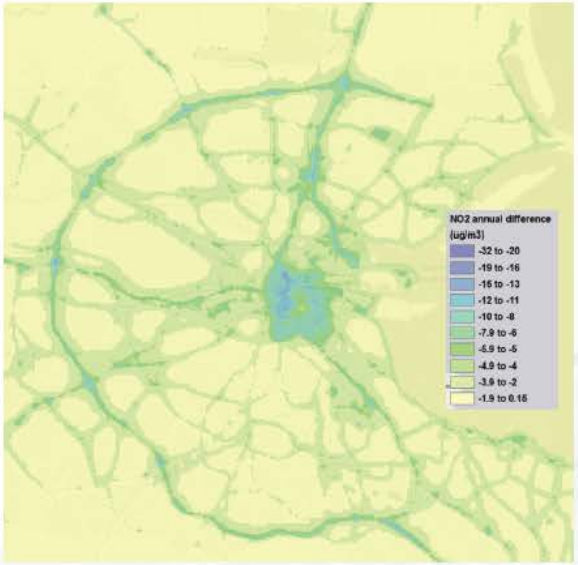
Ambient Air Quality in Dublin – NO_2 – EPISODE model output

Surface NO_2, (WM – reference) scenario



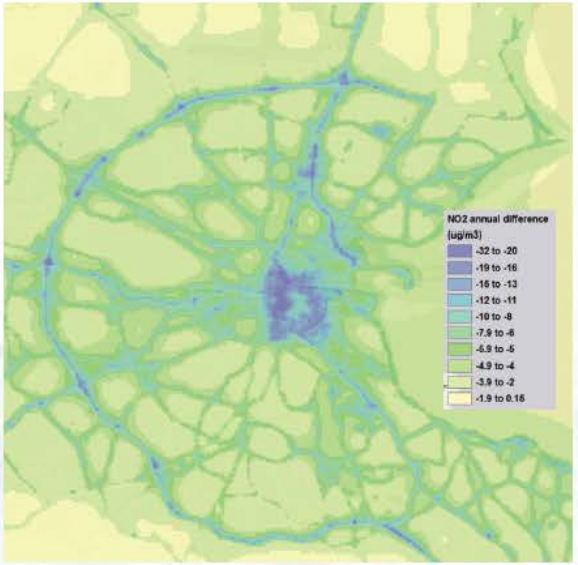
Change in NO_2 annual concentrations in scenario "With Measures" relative to the 2015 reference

Surface NO_2, (PP – reference) scenario



Change in NO_2 annual concentrations in scenario "Problematic Pathway" relative to the 2015 reference.

Surface NO_2, (SP – reference) scenario



Change in NO_2 annual concentrations in scenario "Solution Pathway" relative to the 2015 reference.

There is a decrease in NO_2 concentrations for all emission scenarios. The darker the shading in the maps the greater the difference (reduction) in NO_2 annual concentration between the reference AQ simulation in 2015 and the three emission scenarios. The pattern clearly shows greater changes along the road network.

As with the national case, in Dublin NO_x emissions decrease in all scenarios for the sectors of road transport and industry and increase in the residential heating sector. The total emission change for each scenario in Dublin is of -3171, -919, and -2893 Ton NO_x/year for scenarios WM, PP, and SP, respectively. There is a high contribution from traffic emission changes in terms of NO_2 annual concentrations. This is due not only to the level of emissions from traffic in Dublin, but also due to the low level of the emission source relative to sources such as industry and even residential heating.

National Air Pollution Control Plan (NAPCP)

- EnvEcon supported Irish Government with development of the 1st NAPCP
- Followed the template from Ricardo
- Challenges with the timing of the NAPCP as Ireland are in the process of new ambitious Climate plan
- Synchronising actions and commitments at the 1st attempt proved problematic
- Challenges principally envisaged around NH_3 at this stage
- Other air pollutants may also present risks, however …
- New climate plan co-benefits must be formally assessed.

A major lesson remains that WAM scenarios need to be integrated Climate & Air WAM scenarios

Clean Air Strategy

- Irish Clean Air Strategy (CAS) in the process of finalisation
- Many aspects of the CAS relate to ambient air pollution

Residential
- Shifting away from fossil fuels (and solid fuels specifically) for home heating.
- Designing and enforcing standards for fuel qualities and stove installations and operations.
- Low smoke zones potentially.

Transport
- Reducing the number of diesel vehicles throughout the fleet.
- Supporting cleaner fuels and technologies across private, public and commercial fleets generally.
- Significant investments in non-motorised mode infrastructure (cycling/walking) and public transport.

Agriculture
- Increased penetration of low emission spreading technology.
- Restrictions on gorse burning.
- Supports for anaerobic digestion facility development.

Industry and Power
- Challenges to all forms of incineration and calls for tight regulation of the Renewable Heat Incentive.
- Calls for a shift away from coal and peat for power generation and support of cleaner fuels.

Contact

Andrew.Kelly@EnvEcon.eu

www.EnvEcon.eu

Problematic Pathway?

ACTIVITY

- ECONOMIC and POPULATION GROWTH
- FALLOUT from #DIESELGATE
- NATIONAL SMOKY COAL BAN
- RATE of DIFFUSION of ELECTRIC VEHICLES
- LEGISLITIVE APPROACH
- INCREASING CARBON TAXES
- HOUSING CONSTRUCTION BOOM
- URBAN SPRAWL
- INCREASE IN GLOBAL OIL PRICES
- ECONOMIC DOWNTURN GLOBALLY
- CLIMATE CHANGE

DRIVERS OF NO_X and $PM_{2.5}$

- MORE CARS, MORE DRIVING, MORE HEATING
- MORE NON-CONFORMING EURO 6 DIESEL CARS
- MORE BIOMASS COMUBUSTION
- MORE ICE CARS
- MORE UNREGULATED SALES OF WOOD STOVES
- MORE USE OF BIOMASS
- MORE BIOMASS, MORE CARS, MORE HEATING
- MORE DRIVING
- MORE BIOMASS, MORE DIESEL IN CAR FLEET
- MORE USE OF SOLID FUELS, FALL IN OIL PRICE
- MORE BIOMASS, LESS CYCLING AND WALKING