Proposed Harmonised Guidelines

Valuing Damages to the Environment

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Valuation of Damages to the Environment

Categories covered with monetary values:

- Air pollution (health, agricultural crops, man-made material)
- Noise (health, annoyance)
- Climate change (greenhouse gases: CO_2, nitrous oxide (N_2O), methane (CH_4), …)

Other effects (beyond the scope of HEATCO):

a) Very site specific (e.g. vibration, visual intrusion, loss of important sites, impairment of landscape): include monetary values as far as possible following the general recommendations.

b) No monetary value available – yet (e.g. biodiversity losses): consider beside the CBA

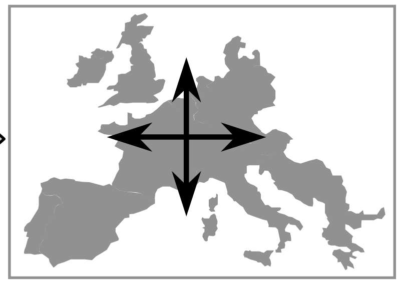
General Approach

- Value impacts, not pressures
- Monetise as far as possible

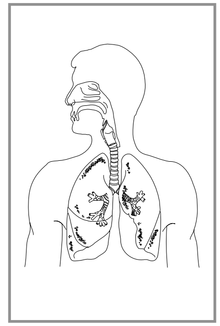
Impact Pathway Approach

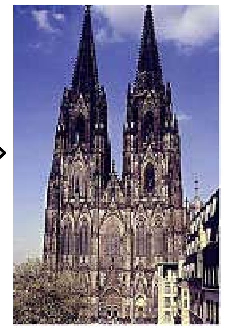
Pollutant Emission

Transport and Chemical Transformation



Physical Impacts





Monetary Valuation

General Approach

- Value impacts, not pressures
- Monetise as far as possible
- Use WTP as far as possible
- Use national values if they are “state-of-the-art”
- Provision of “fall-back” values for each country
- Report costs <u>and</u> physical impacts
- Increase of values with time: income elasticity of 1.0
  - ➢ Importance of good modelling of future emissions!

Air Pollution - Impacts Considered

- Basis: ExternE methodology – Europe-wide exposure

Impact category	Pollutant	Effects included
Public health – **mortality**	$PM_{2.5}$, PM_{10} [1)] O_3	Reduction in life expectancy due to acute and chronic effects Reduction in life expectancy due to acute effects
Public health – **morbidity**	$PM_{2.5}$, PM_{10} [1)], O_3 $PM_{2.5}$, PM_{10} [1)] only O_3 only	Respiratory hospital admissions Restricted activity days Cases of bronchodilator usage Lower respiratory symptoms New cases of chronic bronchitis Cardiac hospital admissions Symptom days Cough days
Material damage	SO_2, acid deposition	Ageing of galvanised steel, limestone, natural stone, mortar, sandstone, paint, rendering, zinc
Crops	SO_2 O_3 Acid deposition N	Yield change for wheat, barley, rye, oats, potato, sugar beet Yield loss for wheat, potato, rice, rye, oats, tobacco, barley Increased need for liming Fertiliser effects

[1)] including secondary particles (sulphate and nitrate aerosols).

Air Pollution - Costs

Cost components:

- Disutility (WTP to avoid health impact)
- Direct costs (resource costs: medical costs, yield loss)
- Opportunity costs (productivity losses)

Parameters to be considered for population exposure:

- Height of emission source
- Local environment
  - Urban
  - Outside built-up areas
- Location within Europe

Calculation Procedure Air Pollution

a. Quantify changes in pollutant emissions (NO_x, SO_2, NMVOC, $PM_{2.5}$/PM_{10}) due to a project in tonnes, using state-of-the-art national or European emission factors.
   - ➢ Take into account future development of emissions

b. Classify emissions according to emission height (ground-level – high stack) and local environment (urban – outside-built-up areas).

c. Calculate impacts (years of life lost - YOLL) and costs per pollutant.

d. Report impacts (YOLL) and costs.

Impact Indicators for Air pollution (YOLL/1000 t emitted)

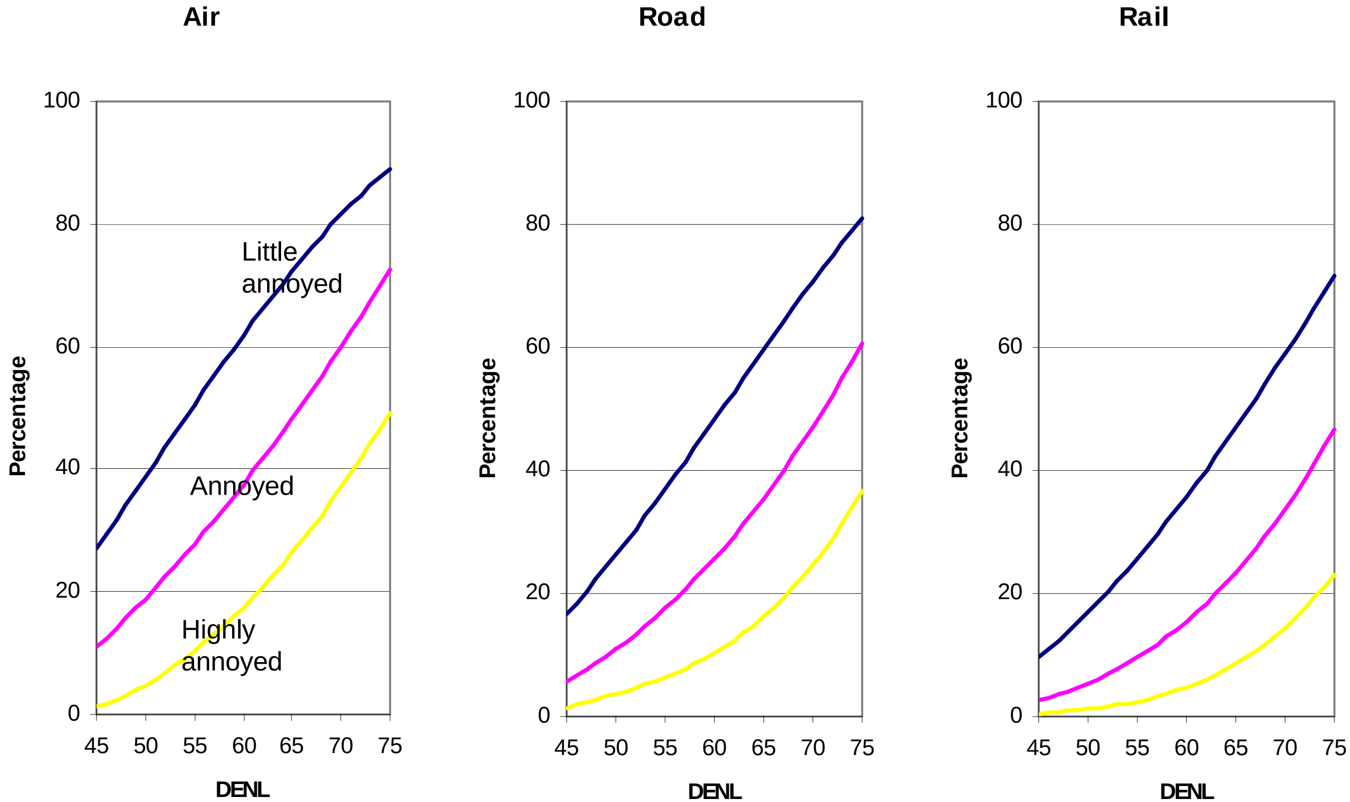
Pollutant emitted	**NO_x**	**NMVOC**	**SO_2**	**$PM_{2.5}$**	**$PM_{2.5}$**
Effective pollutant	O_3, Nitrates	O_3	Sulfates	$PM_{2.5}$	$PM_{2.5}$
Local environment				urban	outside built-up areas
Austria	61	0.6	58	5,800	1,080
Belgium	57	1.3	81	6,200	1,470
Cyprus**	8	0.5	8	5,100	400
Czech Republic	50	1.0	58	5,900	1,180
Denmark	29	0.9	28	5,400	680
Estonia	18	1.5	17	5,300	590
Finland	11	0.2	9	5,100	450
France	65	0.8	65	6,000	1,280
Germany	53	1.2	65	5,900	1,220
Greece	20	0.2	20	5,400	670
Hungary	63	0.6	58	5,800	1,080
Ireland	30	0.7	25	5,300	640
Italy	50	0.8	54	5,800	1,120
Latvia	22	0.9	21	5,300	590
Lithouania	29	0.9	26	5,400	690
Luxemburg	70	1.5	73	6,000	1,330
Malta	8	0.5	8	5,100	400
Netherlands	56	1.1	74	6,000	1,320
Poland	46	0.8	49	5,800	1,070
Portugal	31	0.5	30	5,400	720
Slovakia	57	1.0	55	5,700	1,020
Slovenia	63	0.5	59	5,700	1,020
Spain	34	0.4	33	5,400	720
Sweden	15	0.4	15	5,200	530
Switzerland	68	0.7	59	5,800	1,120
United Kingdom	35	1.0	44	5,700	980

Fall-back Values for Air pollution (€$_{2002}$/tonne, factor price)

Pollutant emitted Effective pollutant	**NO_x** O_3, Nitrates, Crops	**NMVOC** O_3	**SO_2** Sulfates, Acid deposition, Crops	**$PM_{2.5}$** $PM_{2.5}$	**$PM_{2.5}$** $PM_{2.5}$
Local environment				urban	outside built-up areas
Austria	4,300	600	3,900	430,000	72,000
Belgium	2,700	1,100	5,400	440,000	95,000
Cyprus**	500	1,100	500	260,000	22,000
Czech Republic	3,200	1,100	4,100	270,000	67,000
Denmark	1,800	800	1,900	400,000	47,000
Estonia	1,400	500	1,200	160,000	27,000
Finland	900	200	600	360,000	30,000
France	4,600	800	4,300	410,000	82,000
Germany	3,100	1,100	4,500	400,000	78,000
Greece	2,200	600	1,400	270,000	38,000
Hungary	5,000	800	4,100	230,000	59,000
Ireland	2,000	400	1,600	440,000	46,000
Italy	3,200	1,600	3,500	390,000	71,000
Latvia	1,800	500	1,400	140,000	26,000
Lithouania	2,600	500	1,800	160,000	32,000
Luxemburg	4,800	1,400	4,900	730,000	104,000
Malta	500	1,100	500	240,000	20,000
Netherlands	2,600	1,000	5,000	440,000	86,000
Poland	3,000	800	3,500	190,000	57,000
Portugal	2,800	1,000	1,900	270,000	40,000
Slovakia	4,600	1,100	3,800	200,000	54,000
Slovenia	4,400	700	4,000	280,000	58,000
Spain	2,700	500	2,100	320,000	44,000
Sweden	1,300	300	1,000	370,000	36,000
Switzerland	4,500	600	3,900	460,000	76,000
United Kingdom	1,600	700	2,900	410,000	64,000

Noise - Impacts Considered

- Health effects: hypertension and ischaemic heart disease
- Annoyance



Source: Miedema and Oudshoorn, 2001

Calculation Procedure Noise

a. Quantify number of persons exposed to certain noise levels (assumed to be available from noise calculations) for the reference case and the project case.
b. Calculate costs (and percentage of highly annoyed persons) for both cases.
c. Subtract project case total from reference case total.
d. Report impacts (number of people highly annoyed) and costs.

Impact Indicator for Noise: number of persons highly annoyed

L_{den}	Road	Rail	Aircraft
(dB(A))	%	%	%
> 40	0.2	0.1	0.1
> 45	2.0	0.7	2.2
> 50	3.9	1.4	5.9
> 55	6.5	2.7	10.9
> 60	10.4	5.1	17.4
> 65	16.1	9.0	25.2
> 70	24.2	14.7	34.3
> 75	35.4	22.8	44.7

Own calculations based on Miedema and Oudshoorn, 2001

Fall-back Values Noise (€$_{2002}$ per pers. exposed, factor price)

Belgium	Central values			Sensitivity: low			Sensitivity: high		
Lden (dB(A))	Road	Rail	Aircraft	Road	Rail	Aircraft	Road	Rail	Aircraft
> 40	0	0	0	5	2	9	0	0	0
> 45	0	0	0	9	4	14	0	0	0
> 50	24	0	36	14	7	21	54	0	54
> 55	71	24	109	19	11	27	161	54	161
> 60	118	71	182	26	15	34	269	161	269
> 65	165	118	255	33	20	41	376	269	376
> 70	273	226	390	102	87	109	545	438	545
> 75	352	305	495	142	125	147	685	577	685
Cyprus	Central values			Sensitivity: low			Sensitivity: high		
Lden (dB(A))	Road	Rail	Aircraft	Road	Rail	Aircraft	Road	Rail	Aircraft
> 40	0	0	0	3	2	6	0	0	0
> 45	0	0	0	6	3	10	0	0	0
> 50	17	0	26	10	5	15	38	0	38
> 55	50	17	78	14	8	19	114	38	114
> 60	83	50	129	18	11	24	191	114	191
> 65	117	83	181	23	14	29	267	191	267
> 70	194	161	277	72	62	77	387	311	387
> 75	250	216	351	100	88	104	486	409	486

- Central values: health + direct WTP for reducing annoyance based on SP-studies
- Sensitivity low: health + annoyance based on ERF + HEATCO SP-survey
- Sensitivity high: health + WTP for reducing annoyance based on HP-studies

Global Warming

- Base estimates on damage costs as far as possible
- No country-specific values due to global character of damages
- Emissions in future years will have greater total impacts than emissions today
  - Estimates for future years required
- Due to considerable uncertainties sensitivity analysis recommended

- Inclusion of other greenhouse gases than CO_2 via global warming potential (CO_2 = 1, CH_4 = 23, N_2O = 296)
  - Calculation of CO_2-equivalents

Shadow Prices for Global Warming (€$_{2002}$/tonne CO_2-equiv., factor price; based on Watkiss et al. 2005)

	Central guidance	For sensitivity analysis	
Year of emission		Lower central estimate	Upper central estimate
2000 – 2009	**22**	14	51
2010 – 2019	**26**	16	63
2020 – 2029	**32**	20	81
2030 – 2039	**40**	26	103
2040 – 2049	**55**	36	131
2050	**83**	51	166

Calculation Procedure Global Warming

- Quantify change in greenhouse gas emissions (CO_2, CH_4, N_2O; others if data available) due to a project.
  - ➢ Take into account future development of emissions.
- Classify emissions according to emission height (ground-level –aircraft cruising height).
- Calculate CO_2 equivalents of ground level emissions; Multiply high altitude aircraft CO_2 emissions with a factor of 2 (to consider warming effects of other species).
- Multiply CO_2 equivalents with cost factors (no country adjustment).
- Report emissions (CO_2 equivalents) and costs.