The EEA waste model
Past, Present & Future

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Copenhagen Resource Institute
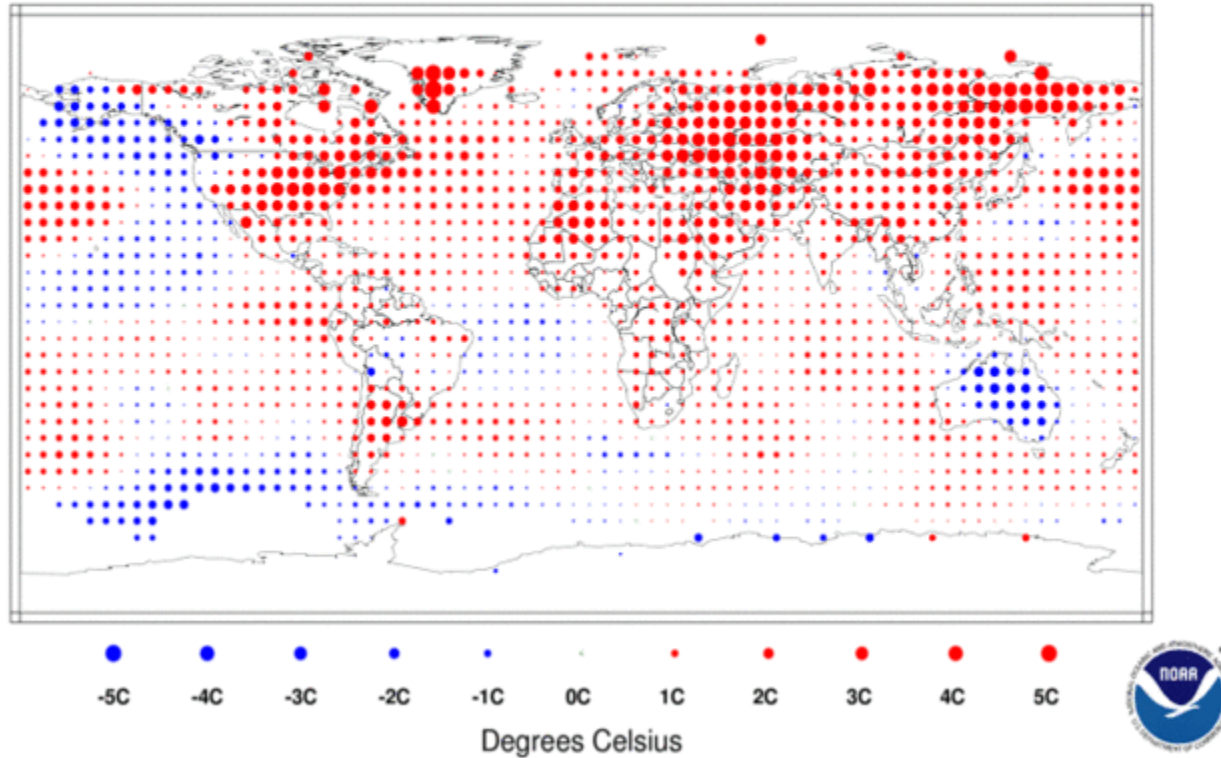
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Christian Fischer and Emmanuel Gentil

Temperature Anomalies May 2012

(with respect to a 1971-2000 base period)

National Climatic Data Center/NESDIS/NOAA

Degrees Celsius

Warmest May on record in northern hemisphere

Original scope of the model

- EU-wide (EU 27+ NO+ CH)

- Are waste quantities increasing?

- Is waste management getting better?

- What is the potential for climate pollution reduction?

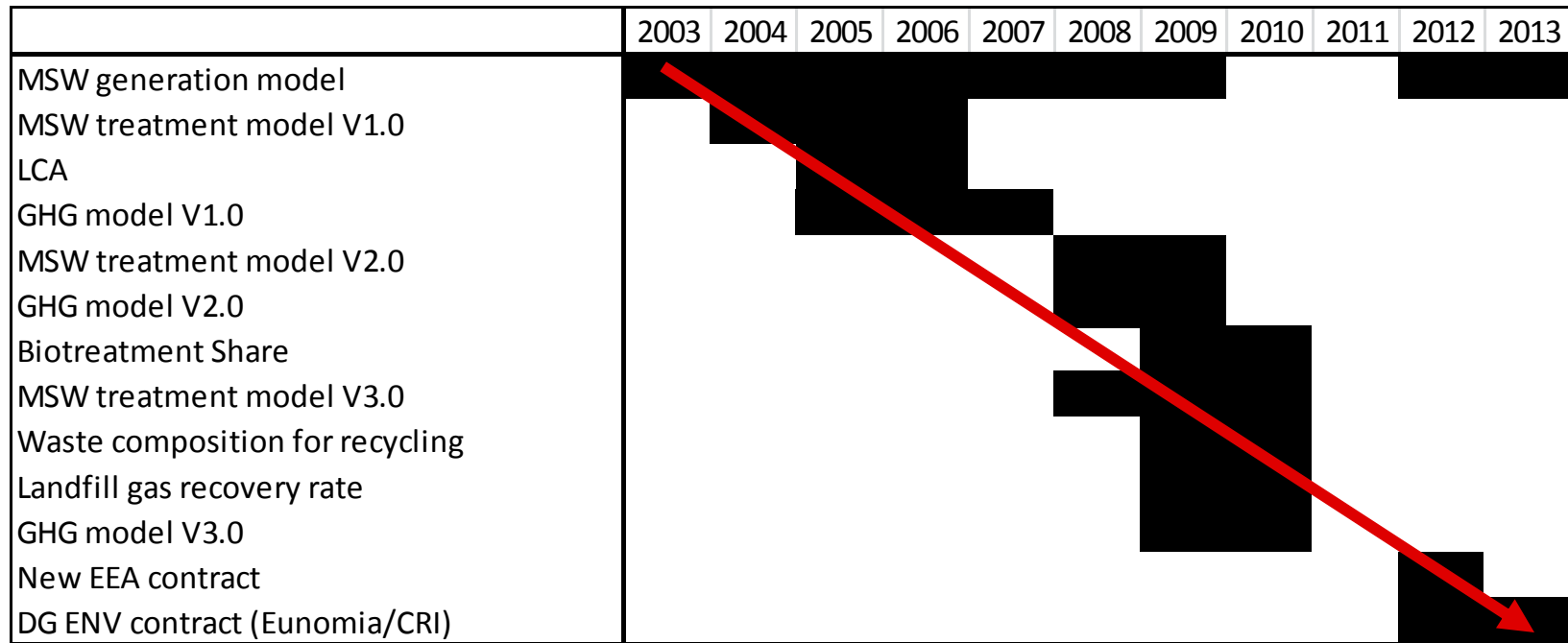**COPENHAGEN RESOURCE INSTITUTE**
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Model Backbone

- Time series 1950-2008
- MSW generation per year
- Waste management share per year
- Composition (fraction level)
- GHG modelling

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A long story started in 2003

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
MSW generation model											
MSW treatment model V1.0											
LCA											
GHG model V1.0											
MSW treatment model V2.0											
GHG model V2.0											
Biotreatment Share											
MSW treatment model V3.0											
Waste composition for recycling											
Landfill gas recovery rate											
GHG model V3.0											
New EEA contract											
DG ENV contract (Eunomia/CRI)											

→ 4 reports published

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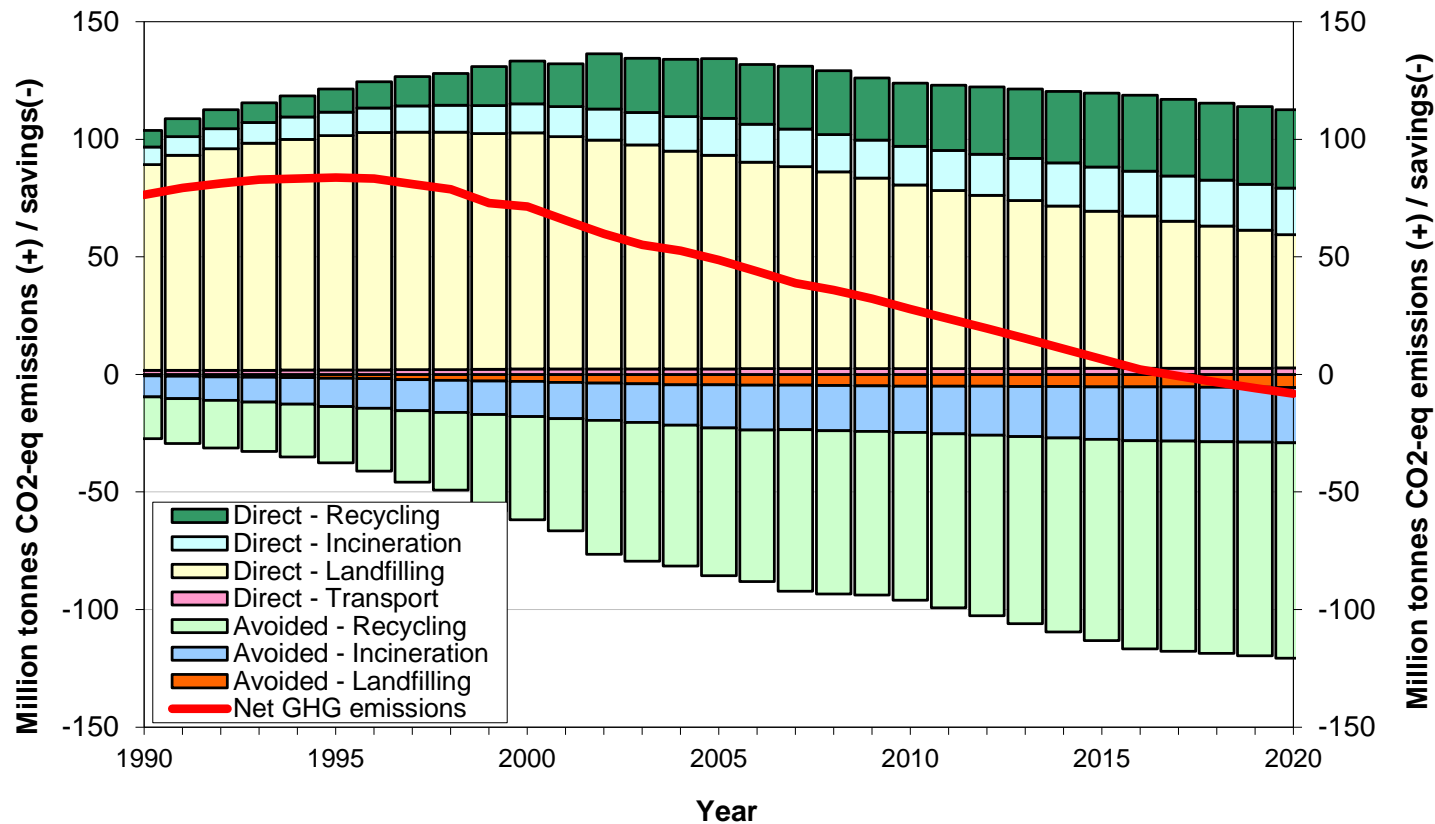# A big model…

- 40 files
- 25 worksheets / file
- 32,400,000 cells (mostly linked)
- A bit tricky to find the information…

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Time series of emissions vs avoided emissions

Boundaries of the model

Life cycle thinking

WRI/WBCSD (Scope 1, 2, 3)

IPCC
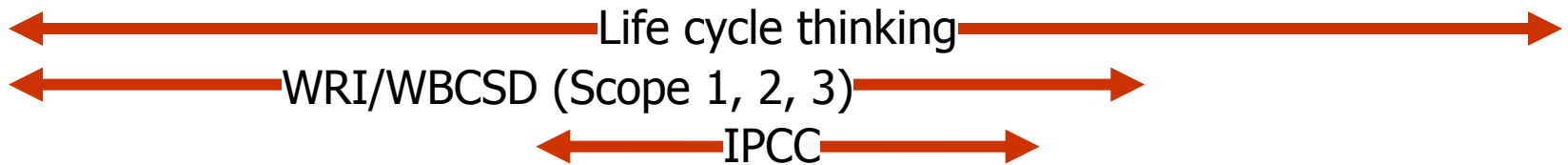
Upstream impacts (electricity use, …)	Direct **Operational** impacts (Landfill emissions, …)	Indirect **Downstream** impacts (Avoided emissions) material & energy recovery (Aluminium recycling)
Excluded WM infrastructure	Limitations Europe wide parameters	Limitations Same EF for Europe
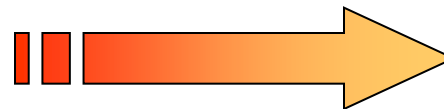
Only municipal waste
Only greenhouse gases

Waste Management

- Amount of waste generated (Eurostat)
- Landfill (Eurostat + IPCC + LCA)
- Incineration (Eurostat + IPCC + LCA)
- Biotreatment (Eurostat + IPCC + LCA)
- Recycling (Eurostat + LCA)
- Transport (LCA)
- No MBT ☹
- No waste prevention ☹
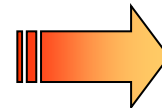
- Recognised methodologies
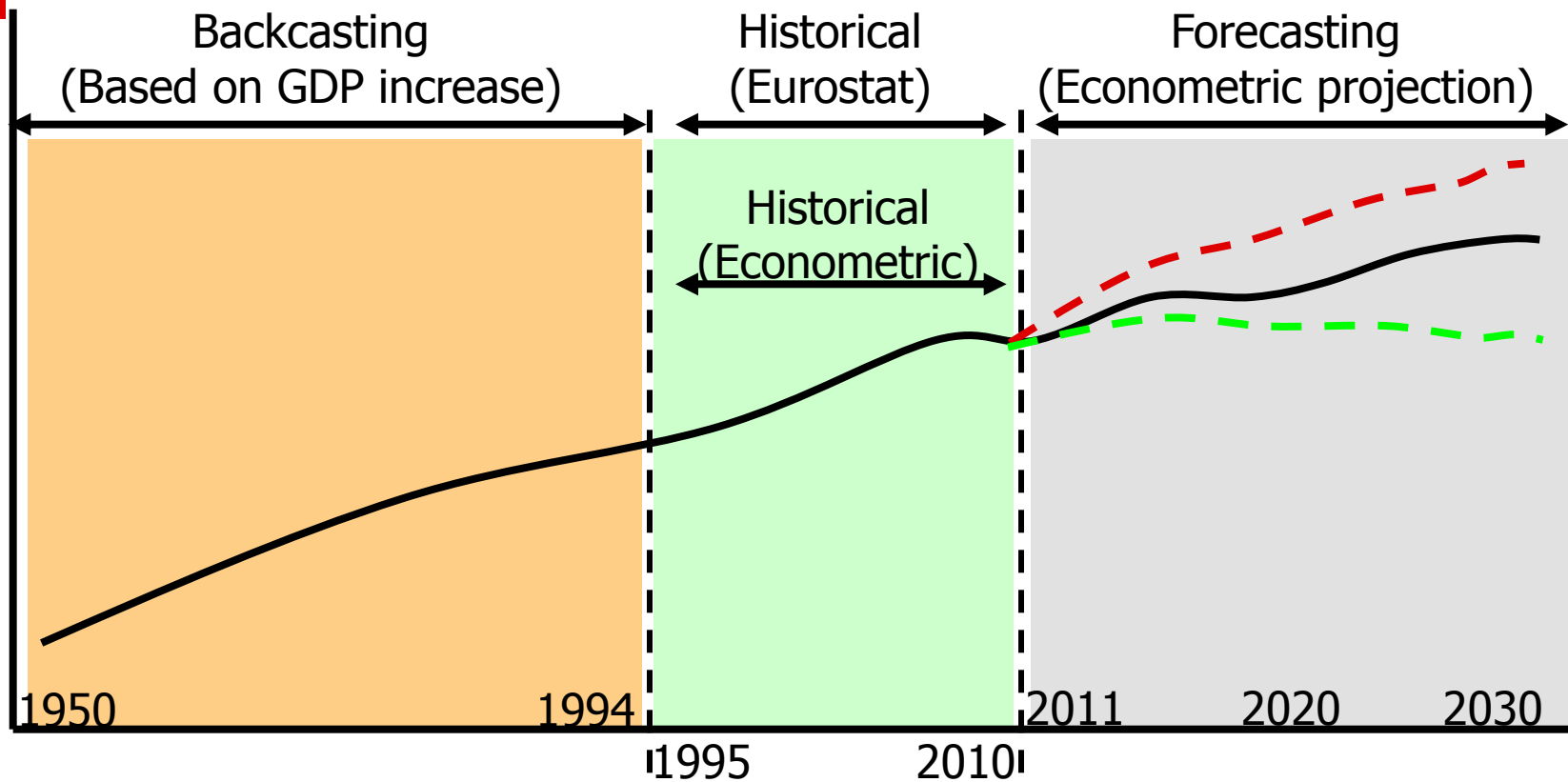- Official sources of data
- Assumptions transparency

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The limitations of the model

- It is not…
    - A LCA model
    - A technology comparison tool
    - A 'what if' model
- It is….
    - A waste statistics model using life cycle data
    - A 'snapshot' of a country / EU situation
    - An attributional system
    - Yearly time series

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MSW generation time series

Backcasting (Based on GDP increase) | **Historical** (Eurostat) | **Forecasting** (Econometric projection)

Historical (Econometric)

1950   1994   1995   2010   2011   2020   2030
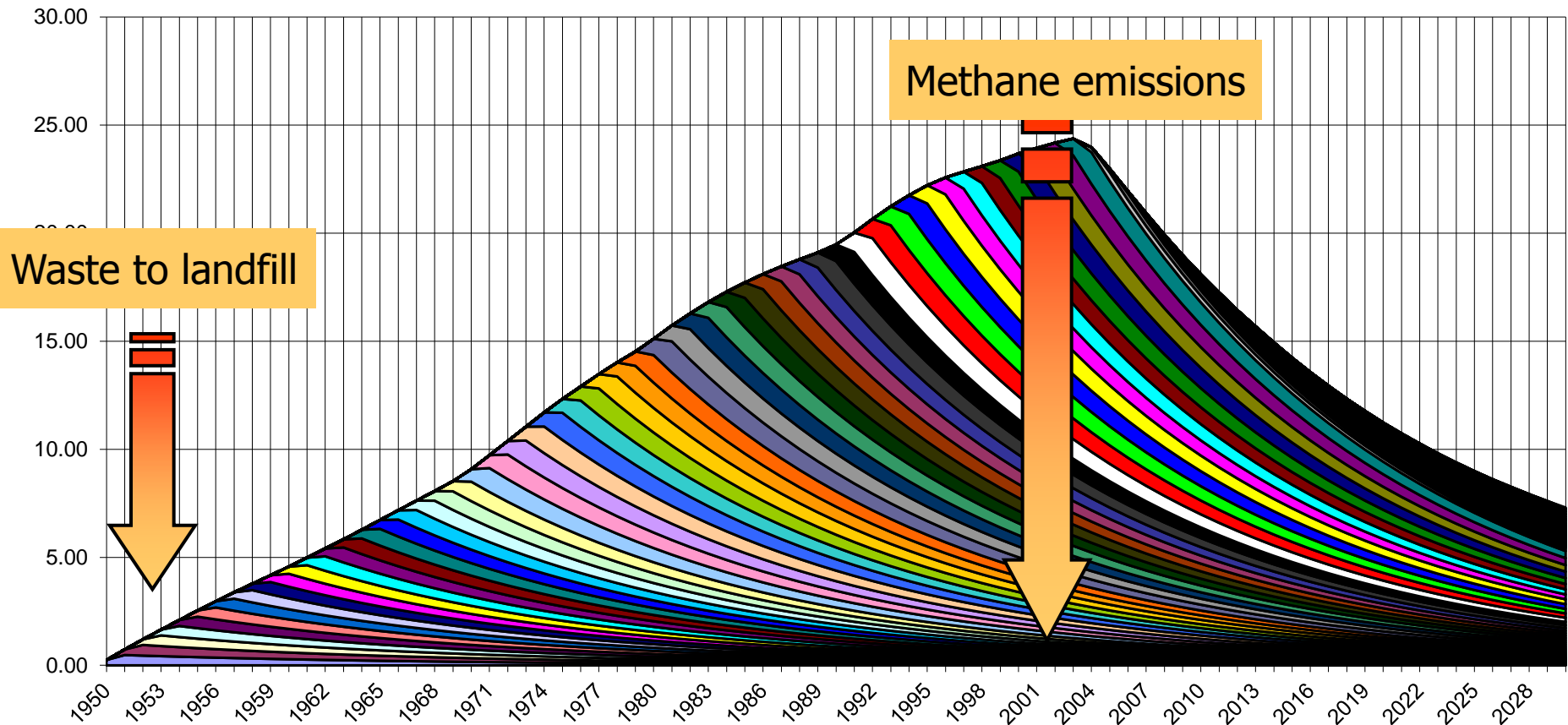
Landfill module: challenging

- **First order decay method**
  - IPCC Tier 2 (IPCC, 2006)
- **Calculated time series (1950-2008)**
  - Municipal waste quantities & composition
  - Backcasting (based on GDP growth)
  - Forecasting (based on private consumption forecast)
- **Many assumptions (some controversial…)**
  - We don't know much about the past…
  - Better to have inaccurate data than no data

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Delayed emissions from landfills

Methane emissions

Waste to landfill

Landfill: challenges

- Composition of waste
  - Assumed constant over time ☹
- Landfill gas recovery
  - Reported (IPCC) + expert assessment
  - Assumed 100 % of recovery to electricity
  - Assumed 0% flaring
- Carbon sequestration excluded
- Landfill electricity substitutes country mix
  - Country mix constant over time

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Direct landfill emissions: IPCC vs EEA model

- IPCC
  - MSW + Industrial organic waste
- EEA model
  - MSW only (Directive definition)
- $CH_4 = 25$ x CO_2
- Cannot compare directly with IPCC...

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Incineration (1990-2020)

- Same waste composition as landfill

- Efficiency factor (same for all countries)

- 100 % assumed to recover energy

  - Electricity (subst. Average country mix)

  - Heat (subst. Average European mix)

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Incineration: challenges

- 2 types of incinerators only
  - Country average efficiency needed
- Substitution of energy
  - Need to change the mix when needed
- Ancillary material for completeness

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Biotreatment

- Anaerobic digestion

- Centralised composting

- Home composting
  - Weak home composting data

- Methane produces electricity
  - Include other end uses (Vehicle fuel)

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Recycling

- Benefits of recycling based on LCA

  - Needs update (emission factors)

- Question: what does recycling substitute?

  - 100 % virgin?

    - High C virgin? Low C virgin? World average?

  - 100 % virgin (after reject has been subtracted?)

    - Eq to substitution ratio

  - A ratio virgin / recycled?

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How should we communicate outside the waste sector?

- **According to IPCC…**
  - All industries have direct emissions
    - Except forestry and landfilled wood (sink)
  - GHG mitigation = direct emissions reduction
    - No 'benefits' or negative number
- **Benefit ← waste = mitigation in other sectors**
  - Reduction of direct emissions

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