



Something
Good is
Happening
in Hiriya!



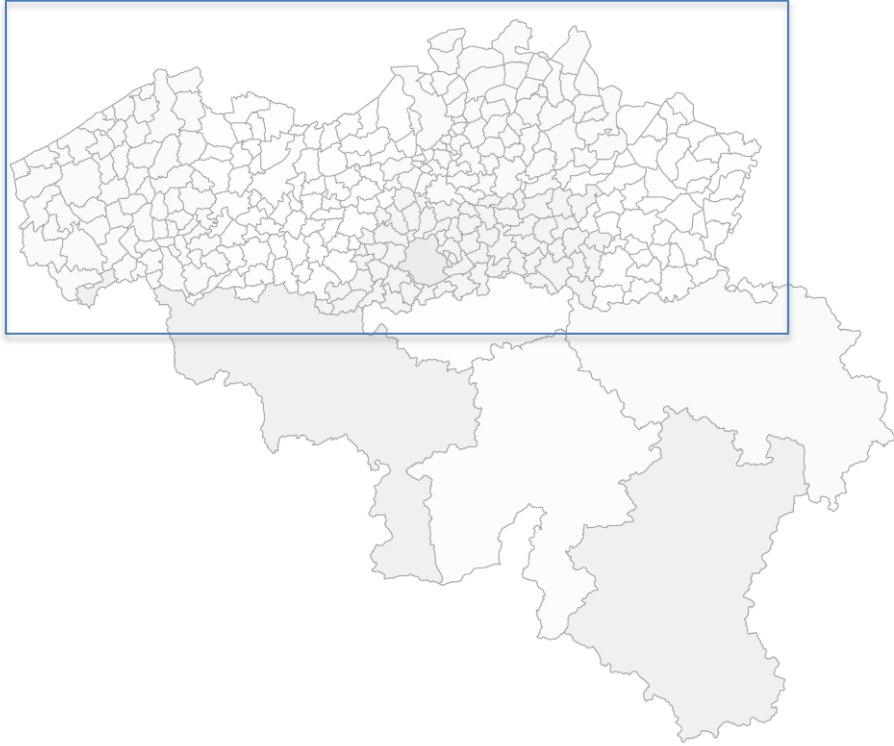
Waste incinerator or flexible energy provider? Together we're smart!

Kristof Bossuyt, Chairman of the board of ISVAG
Intermunicipal waste management organisation for Antwerp, Belgium

Tel Aviv, 16 January 2012



- Founded in 1975
- Non-recyclable residual waste
- >1 mio citizens
- 140 KT + 40 KT
- Operational since 1980
- Permit until 2025
- Electricity for >25.000 households



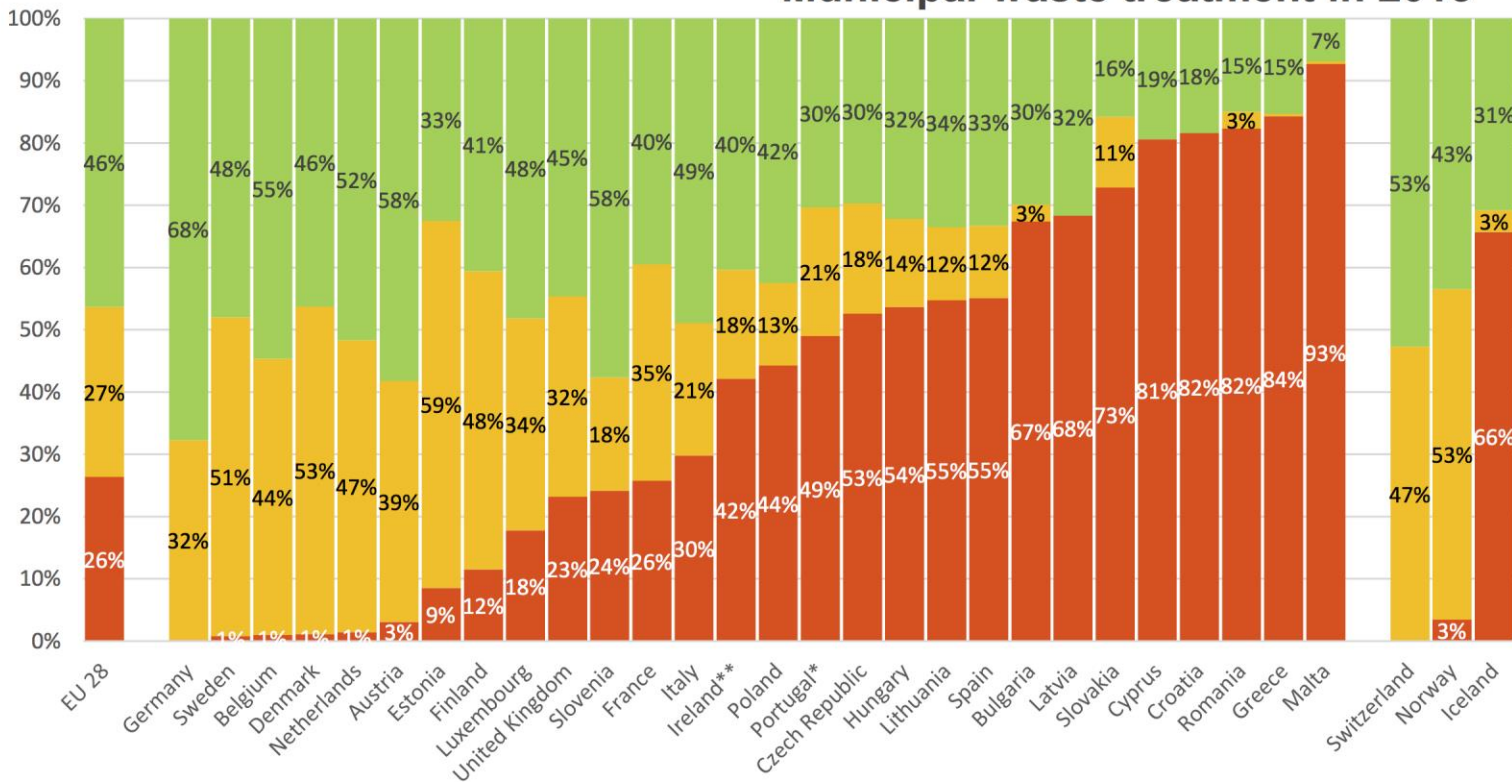
FLANDERS

- 70% sorted
- 29% waste-to-energy
- <1% landfill



Recycling & WtE complementary to divert waste from landfills

EU 28 + Switzerland, Norway and Iceland
Municipal waste treatment in 2015



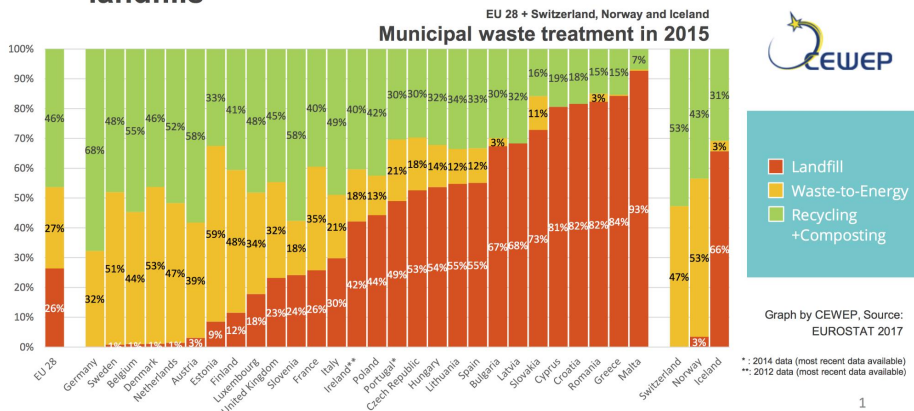
■ Landfill
■ Waste-to-Energy
■ Recycling + Composting

Graph by CEWEP, Source: EUROSTAT 2017

* : 2014 data (most recent data available)
 **: 2012 data (most recent data available)



Recycling & WtE complementary to divert waste from landfills



Does waste-to-energy threaten or substitute recycling?

No!



Minimizing waste in everyday life is necessary!

But...

Zero Waste = Utopia

CIRCULAR ECONOMY



Even in a circular economy, we need a sink to remove non-recyclable materials.

Waste-to-energy keeps the urban metabolism healthy by removing polluted substances.



In the coming decades, the global and Antwerp population will continue to grow. At the same time, we have ambitious objectives to further reduce the amount of residual waste per inhabitant.



Non-recyclable household waste is a very specific and heterogeneous substance.

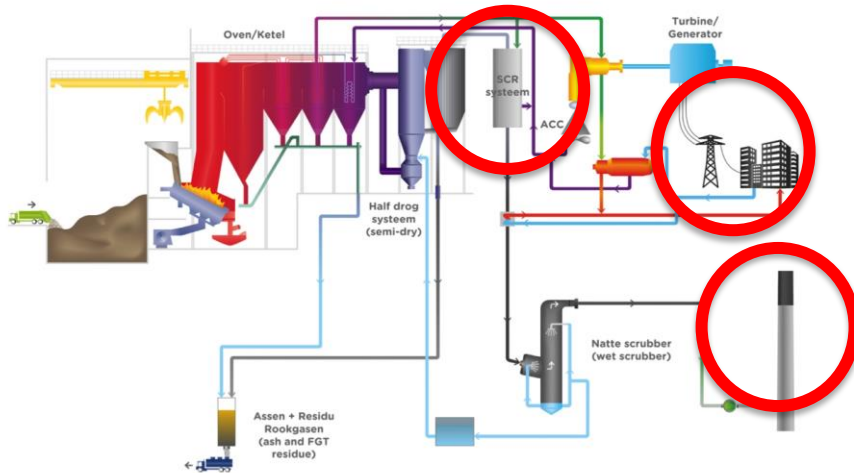


Science is evolving.
New techniques are
being developed for
specific waste streams.



Extensive research confirmed that a state-of-the-art waste-to-energy plant is the only available proven technology which is robust enough to treat residual waste today (BAT).

SUGGESTED WTE CONCEPT



RAMBOLL

ISVAG PRE-STUDY
2016-10-06

Difference?

1. Catalytic DeNox
2. Power + district heating
3. Extremely low emissions



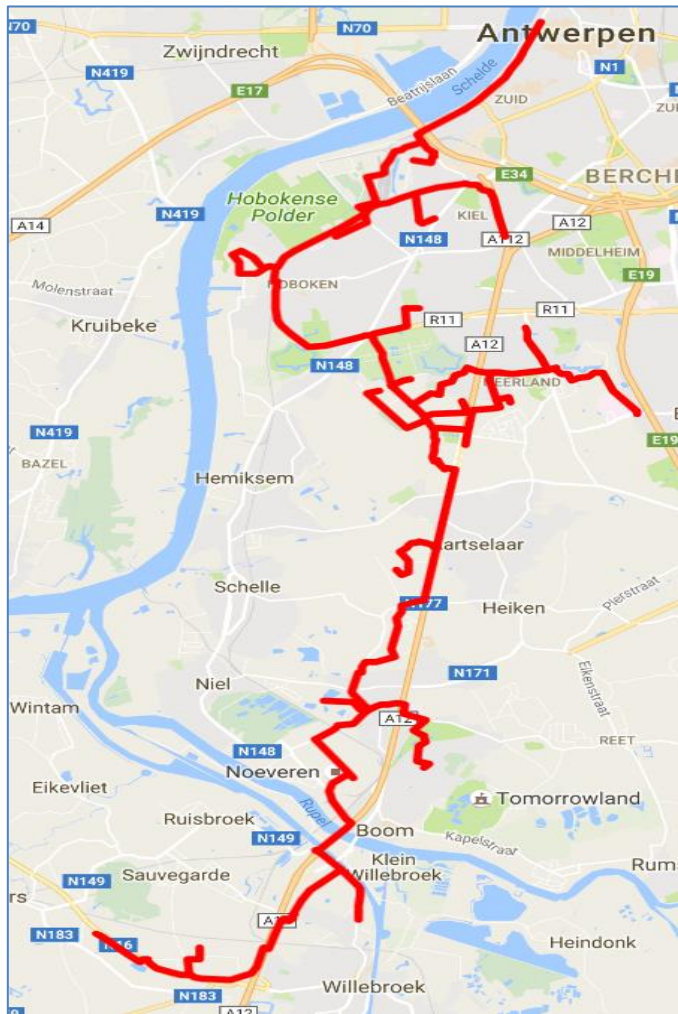
180.000 tons residual waste

=

4.000 tons of new metal



**Bottom ash recycled
into pavement tiles and
asphalt**



District heating (or cooling)

- Crucial in decision location
- Step-by-step
- First stage: 1,6 km to nearby companies (3MW)
- Second stage: 12 km to city (>50MW) + include other sources



Evolving energy landscape

- Security of supply
- From base-load to flexible peak-load
- Communicating vessels: electricity, district heating, hydrogen



WHY?

Heating of houses in Flanders is predominantly fossil.

District heating has enormous potential in terms of avoided emissions.

A city-wide district heating network is a crucial asset for Antwerp in achieving its climate targets.



NEED FOR

1. SCIENTIFIC ACCEPTANCE
2. POLITICAL ACCEPTANCE
3. PUBLIC ACCEPTANCE



- CO-OPERATION WITH LOCAL UNIVERSITIES
- INTERNATIONAL CONSULTANTS
- INTERNATIONAL EXTERNAL SCIENTIFIC ADVISORY BOARD



- INDIVIDUAL MEETINGS
- DIALOGUE
- TRANSPARANCY



- VISITOR CENTER
- INFOMEETINGS
- MEDIARELATIONS
- 1 HOUR RESPONSE

Als de rook om je hoofd
WAT IS DE INVLOED VAN ISVAG OP DE OMGEVING?
is verdwenen



Studie door Universiteit Antwerpen

TRANSLATION

- Scientists with an impeccable reputation provide studies
- Translated into comprehensible language, not milligrams or nanograms, but intelligible terms

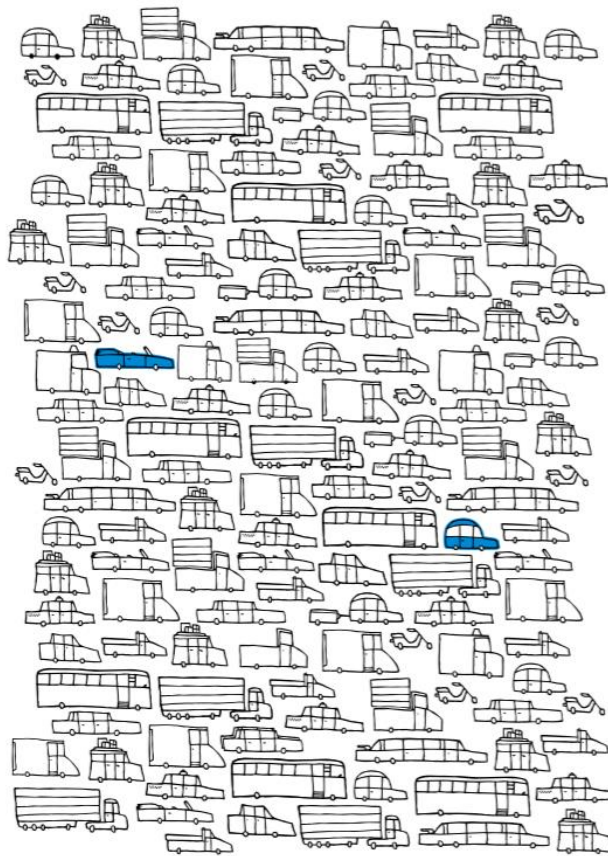
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Stikstofoxiden

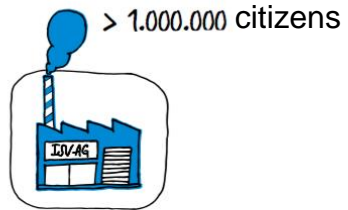
Stikstofoxiden (NOx) zijn gassen die ontstaan bij verbrandingsprocessen op hoge temperaturen. Ze spelen een rol bij verzuring, smog en ozonvorming.

Uit het onderzoek van Universiteit Antwerpen blijkt dat meer dan de helft van de totale uitstoot van NOx in Vlaanderen afkomstig is van het verkeer. De volledige sector van de afvalverwerking draagt 0,88% bij aan de uitstoot van stikstofoxiden.

Als we weten dat er elke dag ongeveer 50.000 auto's en vrachtwagens op de A12 voor deur van ISVAG passeren, dan blijkt dat de uitstoot van NOx door ISVAG gelijk is aan 687 extra auto's per dag in een straal van 1 km rond het bedrijf. Dit is slechts 1,38% van de dagelijkse verkeersstroom op de A12.



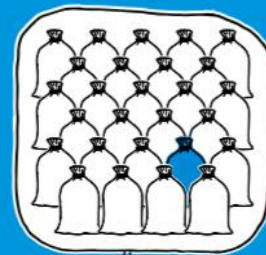
NOx ISVAG = 1,38% NOx van het verkeer A12.



=



FINE DUST EMISSIONS



A close-up photograph of a brown paper-wrapped package. The package is secured with a white twine bow. The twine is wrapped around the package in a cross pattern, with the ends of the twine forming a bow on the left side. The background is a textured, brown paper surface.

To wrap up...



$$\begin{pmatrix} \sum_{i=1}^N x_{i1} y_i \\ \vdots \\ \sum_{i=1}^N x_{ik} y_i \end{pmatrix} = \begin{pmatrix} \sum_{i=1}^N x_{i1} \sum_{j=1}^k x_{ij} \beta_j \\ \vdots \\ \sum_{i=1}^N x_{ik} \sum_{j=1}^k x_{ij} \beta_j \end{pmatrix}$$

$$\begin{pmatrix} p_1 D_1 & x_{c1} & p_1 I_1 \\ p_1 D_1 & x_{c1} & p_1 I_1 \\ \vdots & \vdots & \vdots \\ p_1 D_1 & x_{c1} & p_1 I_1 \\ \Delta_1 D_1 & x_{c1} & E_1 D_1 \end{pmatrix} \begin{pmatrix} \beta_1 \\ \vdots \\ \beta_k \end{pmatrix}$$

$$E(Y | X = x) = \Lambda(x\beta_0) = \frac{e^{x\beta_0}}{1 + e^{x\beta_0}} = \frac{1}{1 + e^{-x\beta_0}}$$

$$\Delta := \frac{\Gamma_x \Gamma_x \Gamma_y^2}{\Gamma_x^2 \Gamma_y \Gamma_y} - \frac{\Gamma_x \Gamma_y}{\Gamma_x \Gamma_y} p^* = \frac{\Gamma_x \Gamma_x \Gamma_y^2}{\Gamma_x^2 \Gamma_y \Gamma_y} (p_x - p_y) > 0 \Leftrightarrow p_x > p_y$$

No rocket science

$$f(y_1, \dots, y_n; \theta) = \prod_{i=1}^n \frac{e^{-\theta y_i}}{1 + e^{-\theta y_i}}$$

$$D = N \left(\sum_{i=1}^N x_{i1}^2 \right) \left(\sum_{i=1}^N x_{i2}^2 \right) + 2 \left(\sum_{i=1}^N x_{i1} \right) \left(\sum_{i=1}^N x_{i2} \right) \left(\sum_{i=1}^N x_{i1} x_{i2} \right) - \left(\sum_{i=1}^N x_{i2} \right)^2 \left(\sum_{i=1}^N x_{i1}^2 \right)$$

$$\frac{d^2 y}{dx^2} = \frac{\left(\frac{\partial x}{\partial a_x} \frac{\partial^2 y}{\partial a_y^2} + \frac{\partial y}{\partial a_y} \frac{\partial^2 x}{\partial a_x^2} \right) D_a + \left(\frac{\partial x}{\partial a_x} \frac{\partial^2 y}{\partial a_y \partial k_y} + \frac{\partial y}{\partial a_y} \frac{\partial^2 x}{\partial a_x \partial k_x} \right) D_k}{\left(\frac{\partial x}{\partial a_x} \right)^2 D}$$

$$E_x[E(Y | X = x)] = E_x \left[\int_{-\infty}^{\infty} y \frac{f(y, x)}{f_x(x)} dy \right] = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} y \frac{f(y, x)}{f_x(x)} f_x(x) dy dx = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} y f(y, x) dy dx = \int_{-\infty}^{\infty} y \left[\int_{-\infty}^{\infty} f(y, x) dx \right] dy = \int_{-\infty}^{\infty} y f(y) dy = E(Y)$$

$$Cov_y(\hat{a}_{N2}, \hat{\beta}_{N2}) = \frac{1}{N-1} \sum_{i=1}^N \hat{a}_{N2} (y_{N2} - \bar{y}_N)$$

$$\begin{aligned} &= \frac{1}{N-1} \sum_{i=1}^N (y_i - \hat{a}_N - x_i \hat{\beta}_N) (a_N + x_i \hat{\beta}_N - \hat{a}_N - \bar{x}_N \hat{\beta}_N) \\ &= \frac{1}{N-1} \sum_{i=1}^N (y_i - \bar{y}_N + \bar{x}_N \hat{\beta}_N - x_i \hat{\beta}_N) (x_i - \bar{x}_N) \hat{\beta}_N \\ &= \hat{\beta}_N \frac{1}{N-1} \sum_{i=1}^N [(y_i - \bar{y}_N) - (x_i - \bar{x}_N) \hat{\beta}_N] (x_i - \bar{x}_N) \\ &= \hat{\beta}_N \left[\frac{1}{N-1} \sum_{i=1}^N (y_i - \bar{y}_N) (x_i - \bar{x}_N) - \hat{\beta}_N \frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x}_N) (x_i - \bar{x}_N) \right] \\ &= \hat{\beta}_N [Cov_N(y_i, x_i) - \hat{\beta}_N Var_N(x_i)] = \hat{\beta}_N \cdot 0 = 0 \end{aligned}$$



$$sk_N = \frac{1}{N} \sum_{i=1}^N u_{i,N}^2; \quad k_N = \frac{1}{N} \sum_{i=1}^N u_{i,N}^4$$

$$FR(2) = \frac{Var(r_{2,2+4} + r_{3,3})}{2 \cdot Var(r_{2,2})} = \frac{2 \cdot Var(r_{2,2}) + 2 \cdot Cov(r_{2,2+4}, r_{3,3})}{2 \cdot Var(r_{2,2})}$$

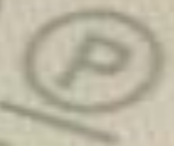
$$FR(2) = 1 + \rho(1)$$

A close-up photograph of a magician's hands and arms. The magician is wearing a black tuxedo jacket over a white shirt. The right hand holds a black wand with a white tip, pointing towards the center. The left hand holds a black top hat. The background is a red, vertically pleated curtain. The text "Not magic" is overlaid in the center in a large, white, sans-serif font.

Not magic

F I GB USA MEX

**ONE SIZE
DOES NOT
FIT ALL**



Von links bügeln/ iron inside out/
repasser sur l'envers /只熨反面



Questions?

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