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# "Non-technical measures offer cost-effective potentials for further emission reductions"

# “Non-technical measures” ? “end-of-pipe” measures

- They include measures that do not change energy services to consumers:
  - technical changes in energy supply structures (e.g., fuel switching),
  - technical measures to reduce final energy demand (increased combustion efficiency, reduced losses),

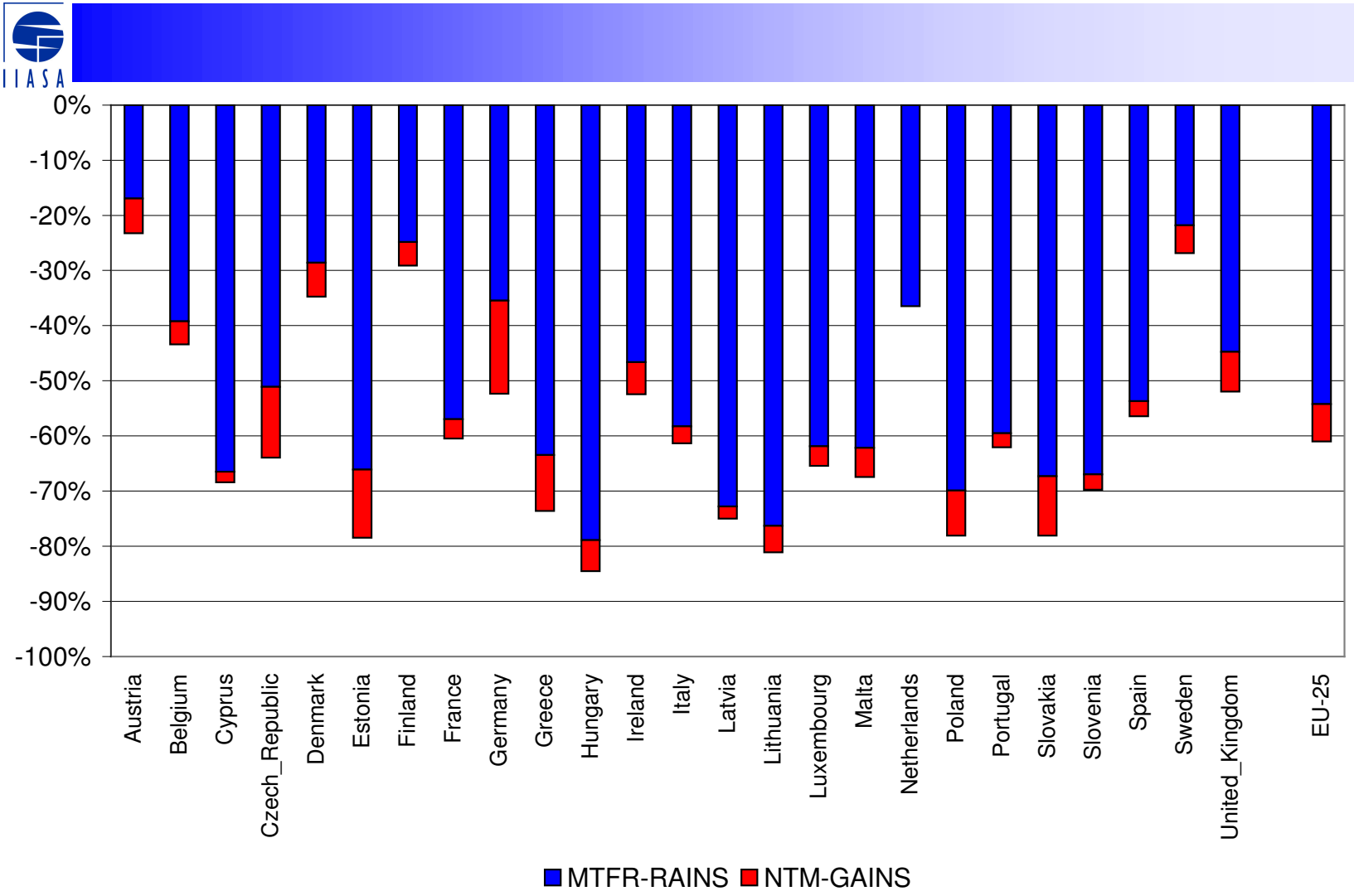
  and measures that reduce level of (energy) services to consumers:
  - Other (non-technical) measures that change demand for “useful” energy (e.g., space heated, miles driven, meat eaten, etc.)

# NTM offer potential for further emission reductions

- **Potential depends on assumptions**
  - **on costs/prices and other policy objectives:**
    for measures that do not change consumer's utility
    (e.g., fuel switching, energy savings, fertilizer substitution)
  - **on political/societal acceptability:**
    for measures that change consumer's utility/behavior
    (e.g., less use of cars, more vegetarian food, etc.)
- **Difficult to establish consensus on these assumptions as a basis for policy analysis, also because some of them are policy objectives (e.g., consumption levels).**
- **In principle, one can model these potentials. However, they are linked to other policy areas and/or private consumption, which are outside the traditional system boundaries of IAM. Modelling is possible, e.g., through linkages with disciplinary models (done, e.g., with GAINS).**

# $SO_2$ reduction potentials from end-of-pipe and other measures

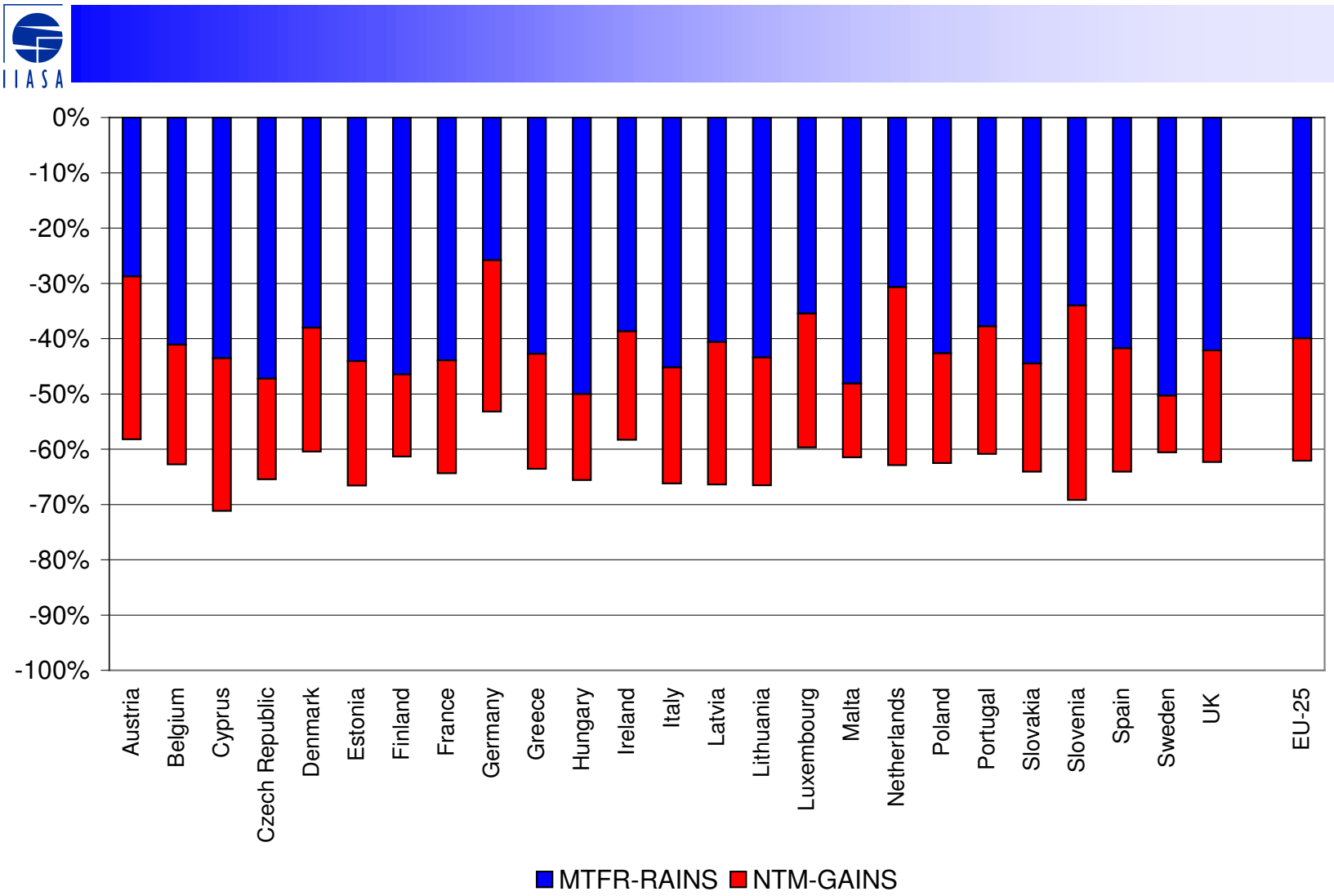
(compared to the CAFE baseline 2020)




*) Derived from a PRIMES energy projection with 90 €/t $CO_2$

# $NO_x$ reduction potentials from end-of-pipe and other measures

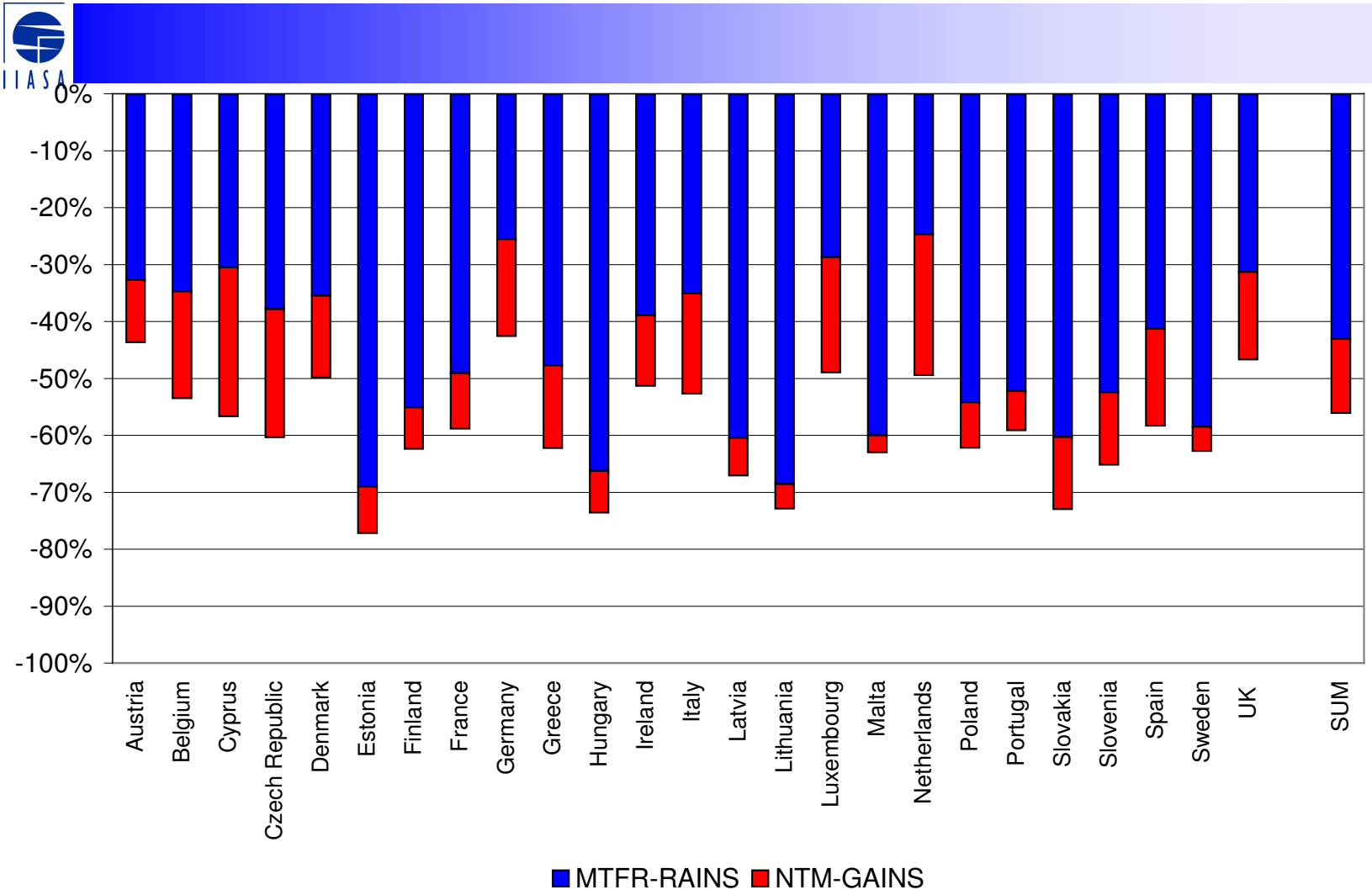
(compared to the CAFE baseline 2020)




*) Derived from a PRIMES energy projection with 90 €/t $CO_2$

# PM2.5 reduction potentials from end-of-pipe and other measures

(compared to the CAFE baseline 2020)




*) Derived from a PRIMES energy projection with 90 €/t $CO_2$

# Cost-effectiveness of NTM

- **Cost-effective measures identified by models are often not implemented in reality, because of**
  - **Market imperfections:**
    - Lack of (technical and economic) knowledge
    - Implementation barriers (e.g., ownership of buildings).
  - **Different consumer's preferences:**
    - E.g., choice of transport modes.
  - **Conceptual reasons:**
    - The cost-optimality concept used in IAM models is different from the cost concept of individual actors.

# Cost effectiveness

as seen by models and individual actors

- **"Cost-effectiveness" is related to a specific costing concept.**

- **E.g., for RAINS/GAINS, to decide about the optimal use of resources for a society:**
  - **Minimize resource costs to the society**
  - **Excluding taxes, profits, transfer payments**
  - **Full life cycle costs**
  - **4% interest rates for capital**
  - **Perfect foresight.**
- **Individual actors apply different cost concepts and thus do not behave according to the modeled cost-effectiveness.**
  - **Profit maximization based on prices, taxes, etc.**
  - **Short pay-back times, high private interest rates, accepted risk**
  - **Costs are not the only criterion (e.g., alternative use of money, consumer's preference for certain transport modes, time, etc.)**

# Mainstream economic analysis: Negative cost options do not exist

| Energy technology approach/ Bottom-up analysis/ Engineering cost analysis | Mainstream economic analysis |
|---|---|
| There exists an energy efficiency gap. | The market is exploiting such opportunities at reasonably efficient rates. |
| There are market barriers. | Market barriers are benign characteristics of functioning markets; they reflect costs of market adjustments. |
| Households apply too high discount rates. | Market discount rates reflect efficient investment decisions and willingness to pay. |

# Cost-effective baseline projections

- Baseline (energy) projections are often produced with engineering cost-minimizing models. If so, there are per definition no further cost-effective measures.
- Such projections do not necessarily predict consumer's behavior in a realistic way (e.g., for transport).
- Thus they underestimates the real potential for cost-effective measures from a (more realistic) non-optimal baseline.
- If a partial RAINS/GAINS analysis finds additional cost-effective measures, this is only because system boundaries of RAINS/GAINS and the energy model are not the same. RAINS/GAINS presumably too simplistic.

# Conclusions

- “NTM” offer potential for further emission reductions. This can be modeled, but it is strongly depending on subjective assumptions.

- Their cost-effectiveness depends on the costing concept. There is disagreement in the economic literature about the validity of the costing concept used in engineering/bottom-up costing studies.

- This calls for caution against the cost-effectiveness potentials derived from least-cost baseline projections.