

Net Greenhouse Gas Reduction Costs of Bioenergy after Consideration of Co-Benefits

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Multiple benefits of measures to reduce GHG emissions

- GHGs
- Local environmental effects (both positive and negative); example: fine particulates
- Impacts on the economy (measured as “value added”, VA), e.g.:
 - Impacts on GDP
 - Employment impacts
 - less reliance on imported energy (trade balance)
- Energy security (considered as a qualitative criterion. Could also be included as avoided cost that reduces GHG mitigation costs)

Problem definition

- Defining the optimal climate strategy
- Cost effectiveness of domestic emission reduction sometimes contested (compared to CO₂ credit prices)
- Objective is a transparent allocation of costs to the different co-benefits

Methodology

Cost of measure

GHG reductions + other env benefits + macroecon benefits

→ Should be as low as possible

Therefore, with fixed costs of measures:

Reduction of GHG

+ Local environmental benefits

+ Domestic macroeconomic benefits

→ Maximum

Benefits made comparable through two multipliers

1. Tons of GHGs avoided that are equal in value to one ton of local pollutant

E.g., $\text{EnvFactor} = 10$, if benefits of 1 ton fine particulates avoided equals 10 tons of GHGs

2. Value added to the local economy that is considered equal to 1 ton of emission reduction.

Opportunity cost to local economy of buying credits abroad.

E.g., $\text{VAFactor} = 20$ if overseas purchase price 10 Euros and macroeconomic multiplier 2

Example:

comparing five GHG mitigation options

- Domestic with env benefits and job creation (higher cost – biomass)
- Domestic with env benefits and job creation (medium cost - building insulation)
- Domestic with env benefits (lower cost - wind energy)
- JI/CDM investment with technology export
- JI/CDM investment w/o technology export

Assumptions (examples – indicative only)

	Total cost €/ton CO2	VA / ton CO2	Improvem. of local env
5: Biomass	70	48	0
4: Buildings	60	10	1
3: Wind	30	5	1
2: JI/CDM with tech export	12	20	0
1: JI/CDM no tech export	8	0	0

Backward calculation of relative contributions to overall costs

■ Example: wind energy

- Total Costs (GHG only): 30€ / ton CO₂
- Justified through value added: 5€ / ton CO₂
- Justified through env. benefits: 14€ / ton CO₂
- Net CO₂ red costs: **11€ / ton CO₂**

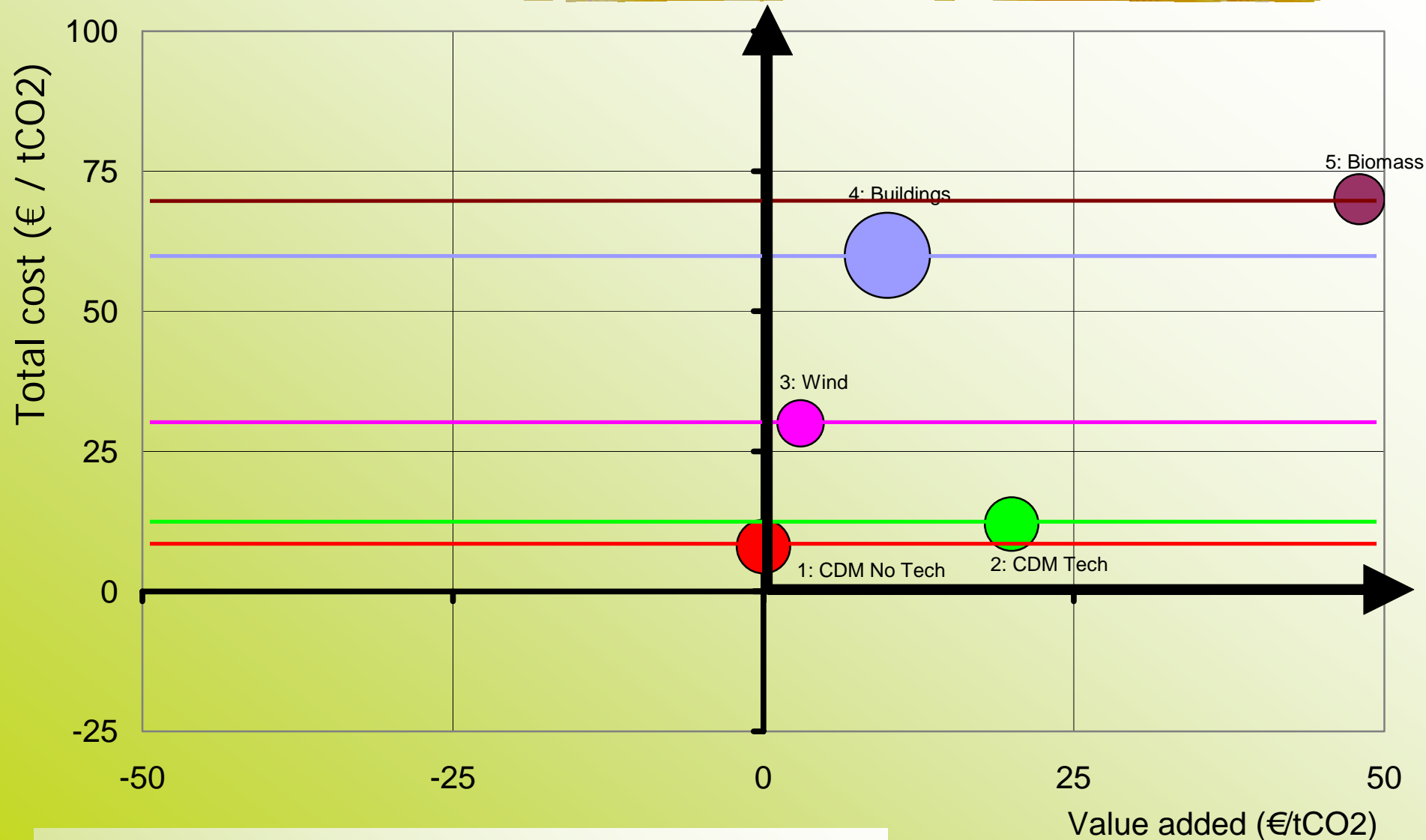
■ Example: biomass

- Total costs (GHG only): 70€ / ton CO₂
- Justified through value added: 48€ / ton CO₂
- Net CO₂ red costs thus only **22€ / ton CO₂**

Ranking - comparison

	€ / ton CO2	VA / ton CO2	Improvem. of local env	GHG+VA	GHG+VA +Env
5: Biomass	70	48	0	22 (3)	22 (4)
4: Buildings	60	10	1	50 (5)	36 (5)
3: Wind	30	5	1	25 (4)	11 (3)
2: JI/CDM with tech transfer	12	20	0	-8 (1)	-8 (1)
1: JI/CDM no tech transfer	8	0	0	8 (2)	8 (2)

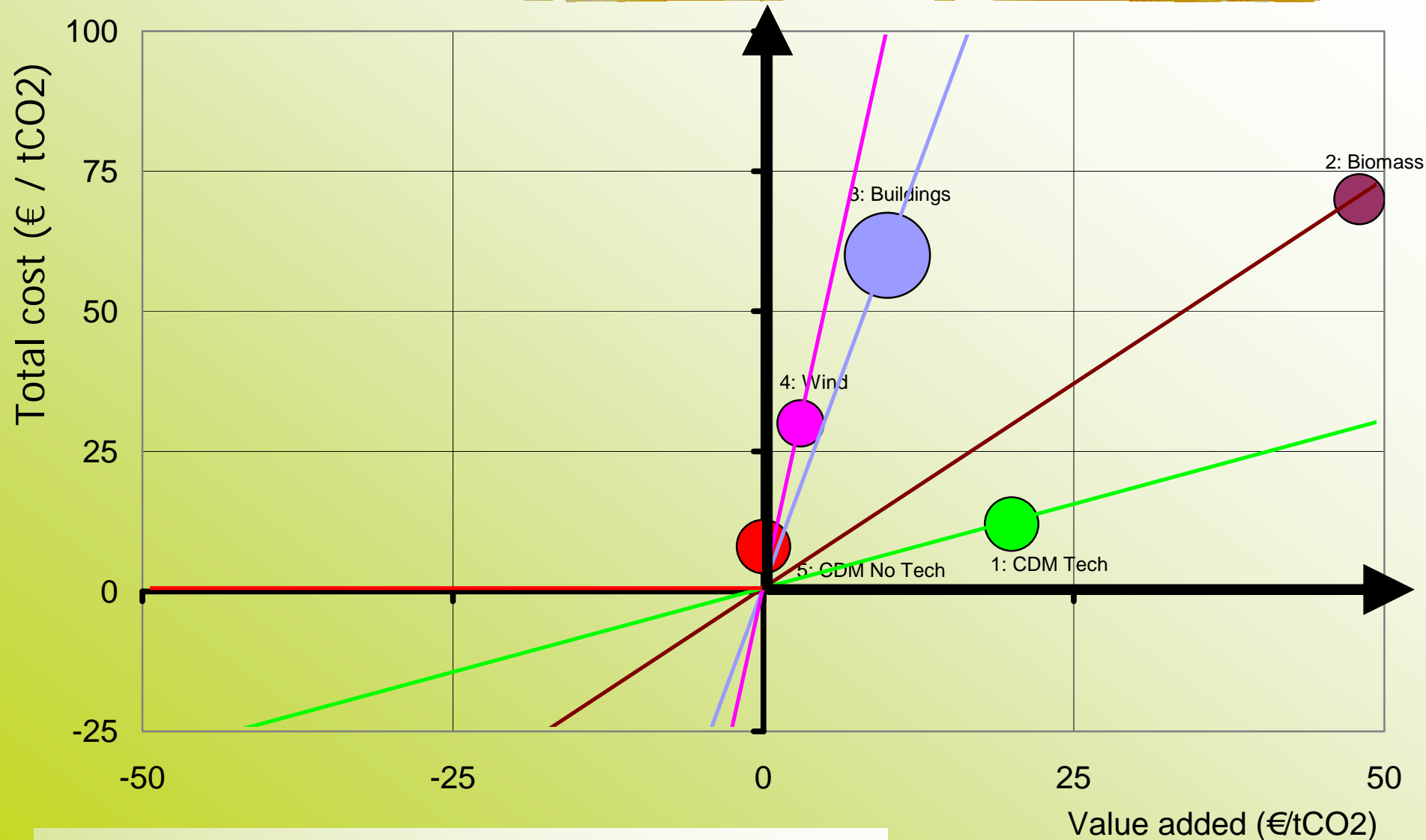
Ranking: conventional (GHGs only)



Cost of measure

GHG reductions + other env benefits + macroecon benefits

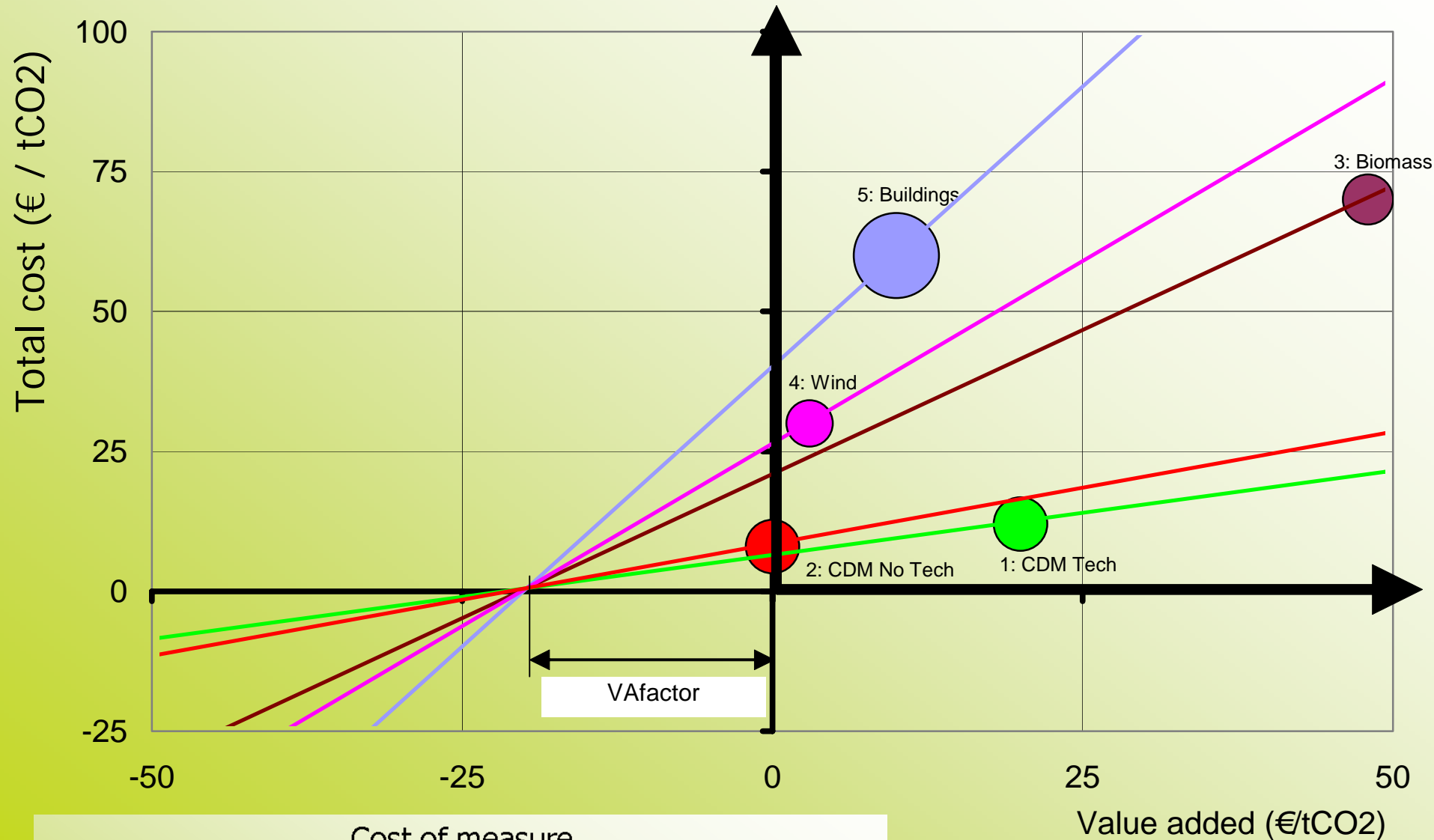
Ranking – value added only



Cost of measure

GHG reductions + other env benefits + macroecon benefits

Ranking – GHGs and Value added

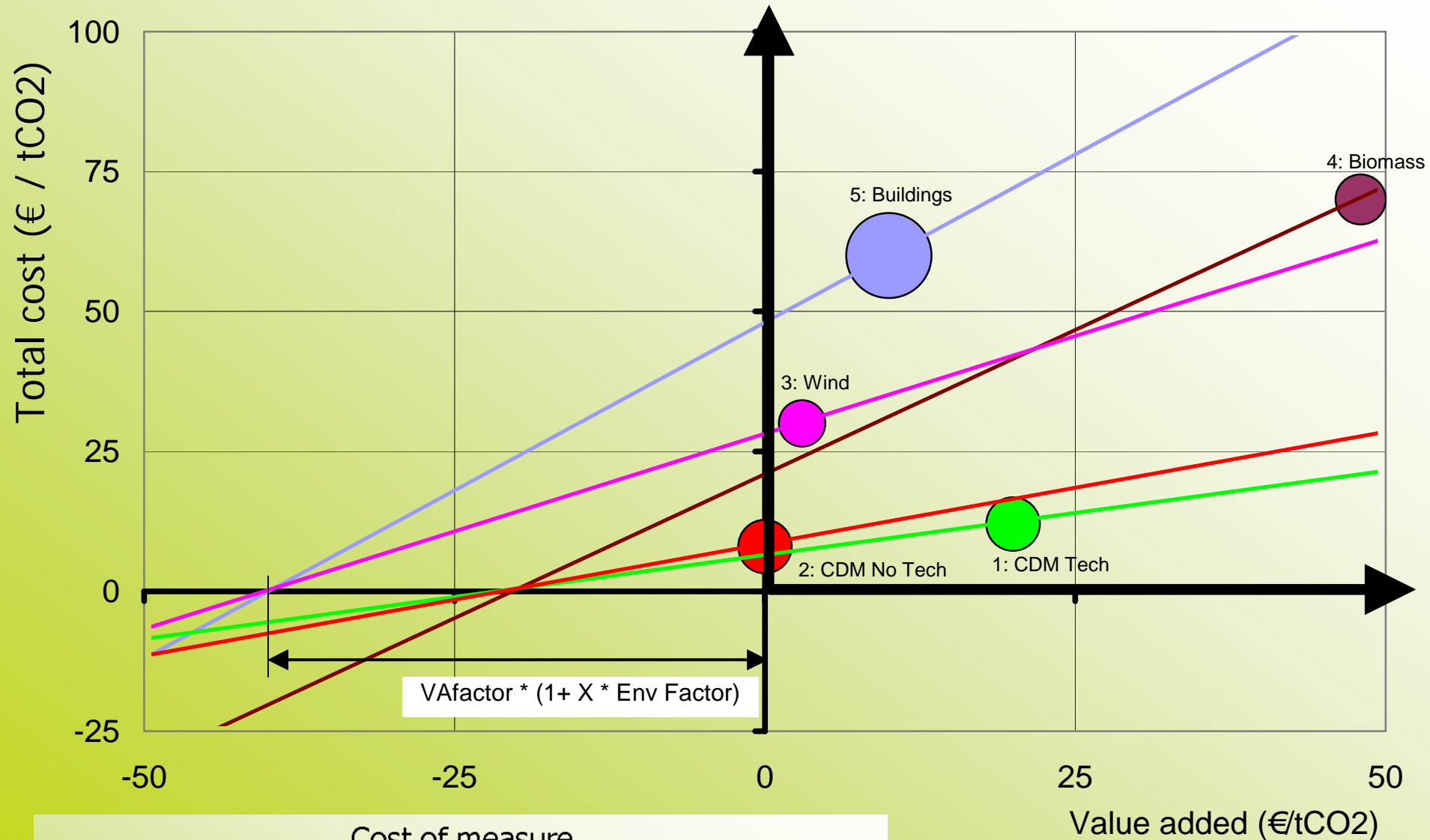


Cost of measure

GHG reductions + other env benefits + macroecon benefits

Value added (€/tCO₂)

Ranking with all objectives included



Cost of measure

GHG reductions + other env benefits + macroecon benefits

Value added (€/tCO₂)

Summary

- Allocating all costs to GHG mitigation can be misleading
- Adding VA and/or local env. benefits can strongly impact the ranking of priorities
- Methodology can be used for evaluation of mitigation measures in national climate action plans