Economic assessment of nuclear damage

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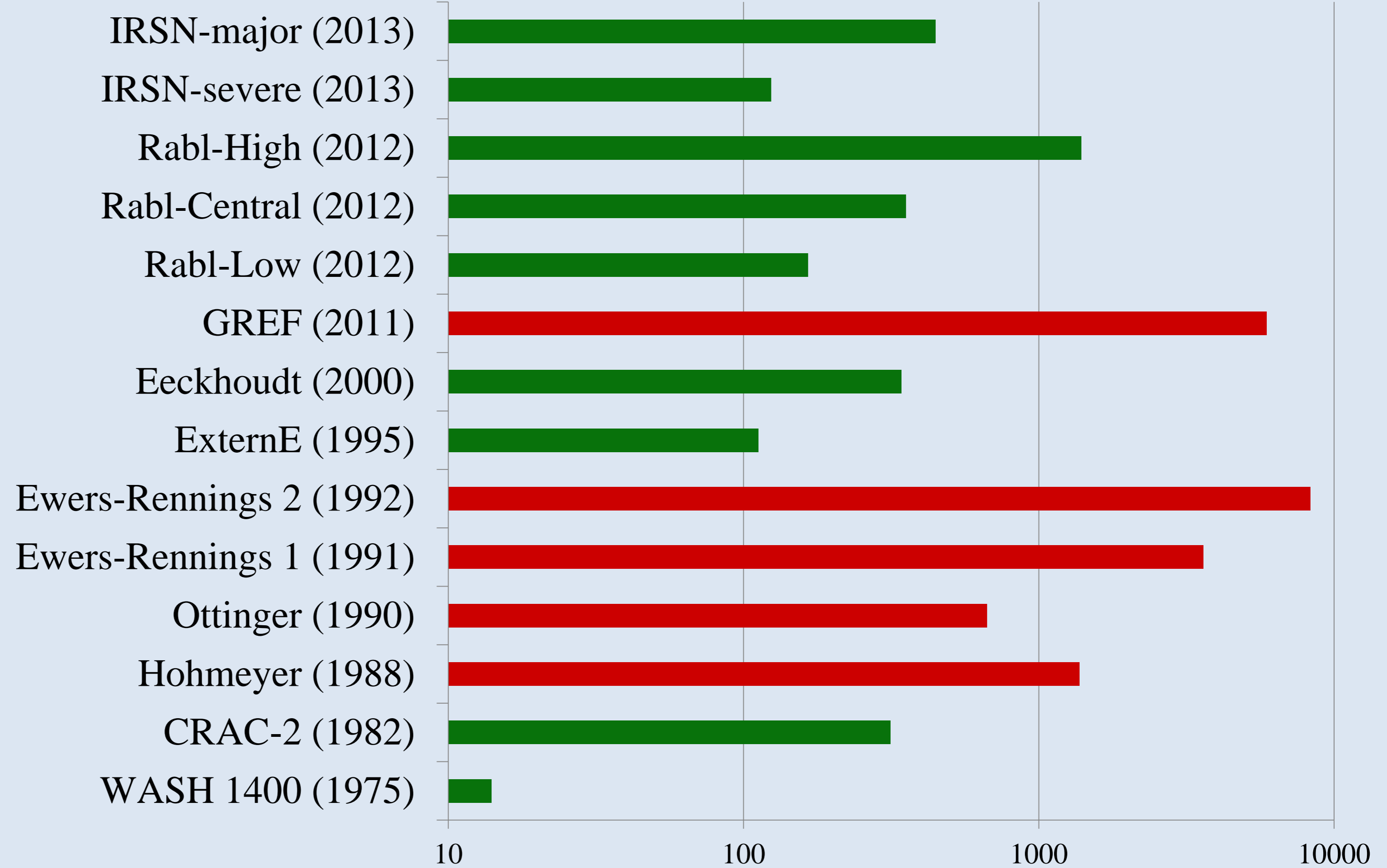
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THE AIM OF THE ASSESSMENT

Provide guidelines to **policy-makers**

- *Ex ante*: safety standard, **technological diversity**
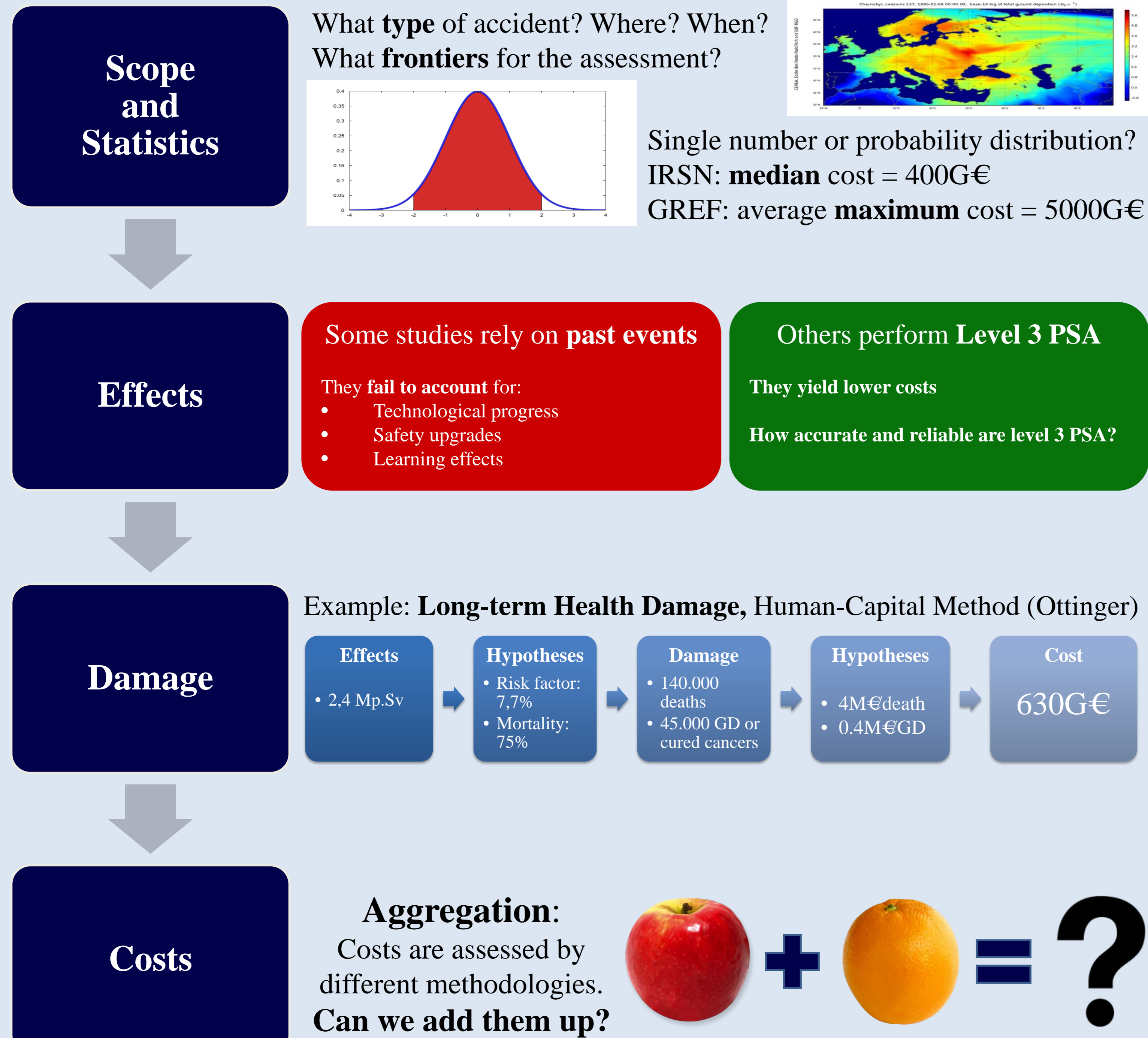- *Ex post*: fair **compensation**

MAIN REFERENCES

1. **IRSN.** *Méthodologie appliquée par l'IRSN pour l'estimation des coûts d'accidents nucléaires en France.* 2013.

2. **Rabl, A. and Rabl, V.A.** External costs of nuclear: Greater or less than the alternatives? *Energy Policy.* 2013, 57, pp. 575-584.

3. **German Renewable Energy Federation (BEE).** *Calculating a risk-appropriate insurance premium to cover third-party liability risks that result from operation of nuclear power plants.* 2011.

4. **Eeckhoudt, L., Schieber, C. and Schneider, T.** Risk aversion and the external cost of a nuclear accident. *Journal of Environmental Management.* 2000, 58, pp. 109-117.

5. **CEPN.** *ExternE : Externalities of Energy - Volume 5 : Nuclear.* 1995.

6. **Ewers, H.-J. and Rennings, K.** *Prognos-Schriftenreihe Identifizierung und Internalisierung externer Kosten der Energieversorgung.* 1992.

7. **Ottinger, R. L., et al.** *Environmental Costs of Electricity.* 1990.

8. **Hohmeyer, O.** *Latest Results of the International Discussion on the Social Costs of Energy - How Does Wind Compare Today?* 1990.

9. **U.S.N.R.C.** *CRAC-2 Report NUREG/CR-2239.* 1982.

10. **Rasmussen, N.** WASH-1400. *An assessment of accident risks in US Commercial Nuclear Power Plants.* 1975.

11. **Munro, A.** The economics of nuclear decontamination. *Environmental Science & Policy* (33), pp. 63-75. 2013.
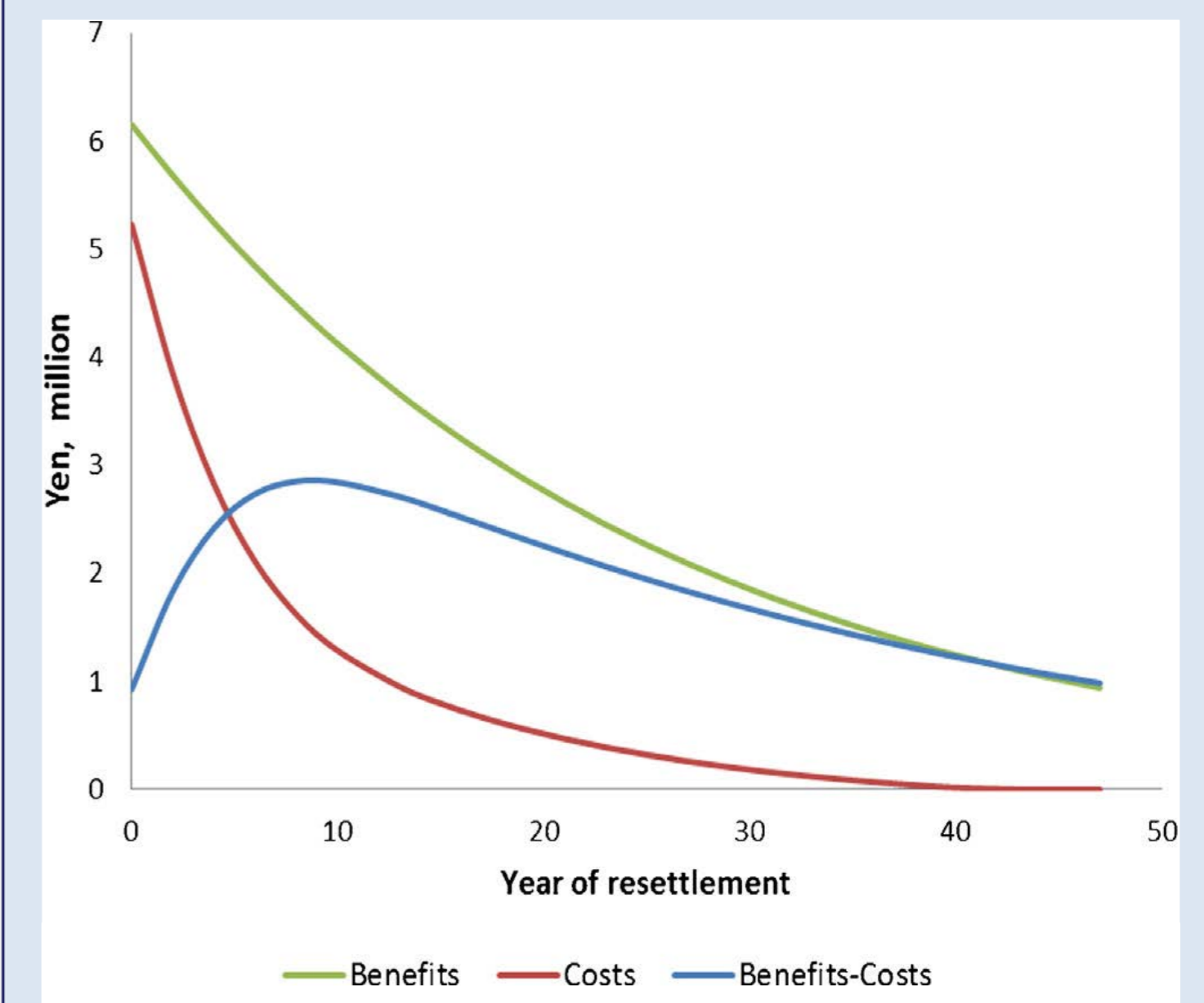

EXISTING ASSESSMENTS (G€)

Bar chart (horizontal axis: 10, 100, 1000, 10000):
IRSN-major (2013), IRSN-severe (2013), Rabl-High (2012), Rabl-Central (2012), Rabl-Low (2012), GREF (2011), Eeckhoudt (2000), ExternE (1995), Ewers-Rennings 2 (1992), Ewers-Rennings 1 (1991), Ottinger (1990), Hohmeyer (1988), CRAC-2 (1982), WASH 1400 (1975)

SOURCES OF "UNCERTAINTIES"

Scope and Statistics

What **type** of accident? Where? When?
What **frontiers** for the assessment?

Single number or probability distribution?
IRSN: **median** cost = 400G€
GREF: average **maximum** cost = 5000G€

Effects

Some studies rely on past events

They **fail to account** for:
- Technological progress
- Safety upgrades
- Learning effects

Others perform Level 3 PSA

They yield lower costs

How accurate and reliable are level 3 PSA?

Damage

Example: **Long-term Health Damage,** Human-Capital Method (Ottinger)

Effects	Hypotheses	Damage	Hypotheses	Cost
• 2,4 Mp.Sv	• Risk factor: 7,7% • Mortality: 75%	• 140.000 deaths • 45.000 GD or cured cancers	• 4M€/death • 0.4M€/GD	630G€

Costs

Aggregation:
Costs are assessed by different methodologies.
Can we add them up?

🍎 + 🍊 = **?**

MITIGATION POLICIES

Cost-Benefit analysis of decontamination measures. Taken from Munro, 2013, *Environmental Science and Policy*, 33

FUTURE RESEARCH

- Can we **combine past events** and **level-3 PSAs** to better assess the damage of a nuclear accident?
- Cost assessments could provide **guidelines for mitigation policies**
  - Tradeoffs
  - Cost-Benefit Analysis
  - Optimal allocation of mitigation resources