Aspects of economies of scale in a regionalised low CO_2 emissions steel industry

Rutger Gyllenram
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with lots of simplifications for the sake of discussion

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Aspects of economies of scale in a regionalised low CO2 emissions steel industry

- Where we come from:

Today's steel making landscape with large blast furnaces and mega module sponge iron production in multimillion tonne per year scale has been made possible by continuous improvement over decades and the ease by which we transport ore and coal over the oceans and have access to piped natural gas.

- What is happening now:

This order is now challenged by two winds of change:

- (1) a new generation of processes with lower footprint and
- (2) regionalisation creating a more resilient supply chain.

Alternative reduction processes need either

- large volumes of electricity to produce hydrogen or
- large volumes of biomass to produce biogenic syngas.

Grid capacity and biomass logistics will no doubt limit the size of each plant. Furthermore, scaling up new technology takes time and will also limit the production on each site.

Key questions:

- Is the way we work with projects from a political, technical and financial point of view ready for this change?
- What do we need to do to fully take advantage of the new opportunities that are opening up?
- Can we make small sustainable?

Lost in the decarbonisation landscape:

Anxiety Edvard Munch - Google Art Project: pic, Public Domain, https://commons.wikimedia.org/w/index.php?curid=37623446

Lost in the decarbonisation landscape:

- Where are we?

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Lost in the decarbonisation landscape:

- Where are we?
- How did we get here?

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- How did we get here?
- Where shall we go?

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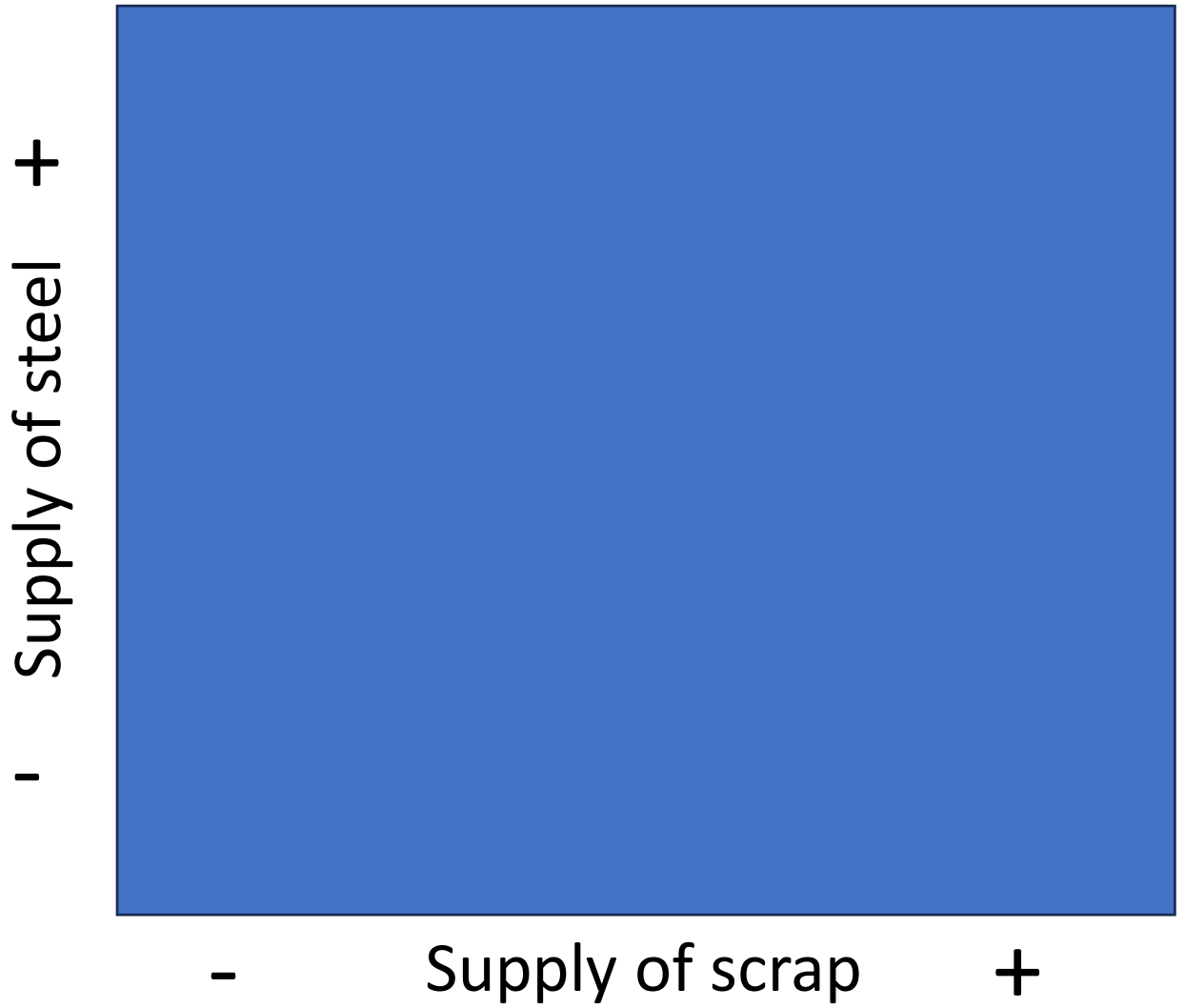
Lost in the decarbonisation landscape:

- Where are we?
- How did we get here?
- Where shall we go?

and what is the role of economies of scale?

Where are we?

Investments to abate carbon footprint



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Where are we?

Investments to abate carbon footprint

Replace BF-BOF with EAF + scrap

Supply of steel: - +

Supply of scrap: - +

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Replace BF-BOF with DR+EAF

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\+ Supply of steel -

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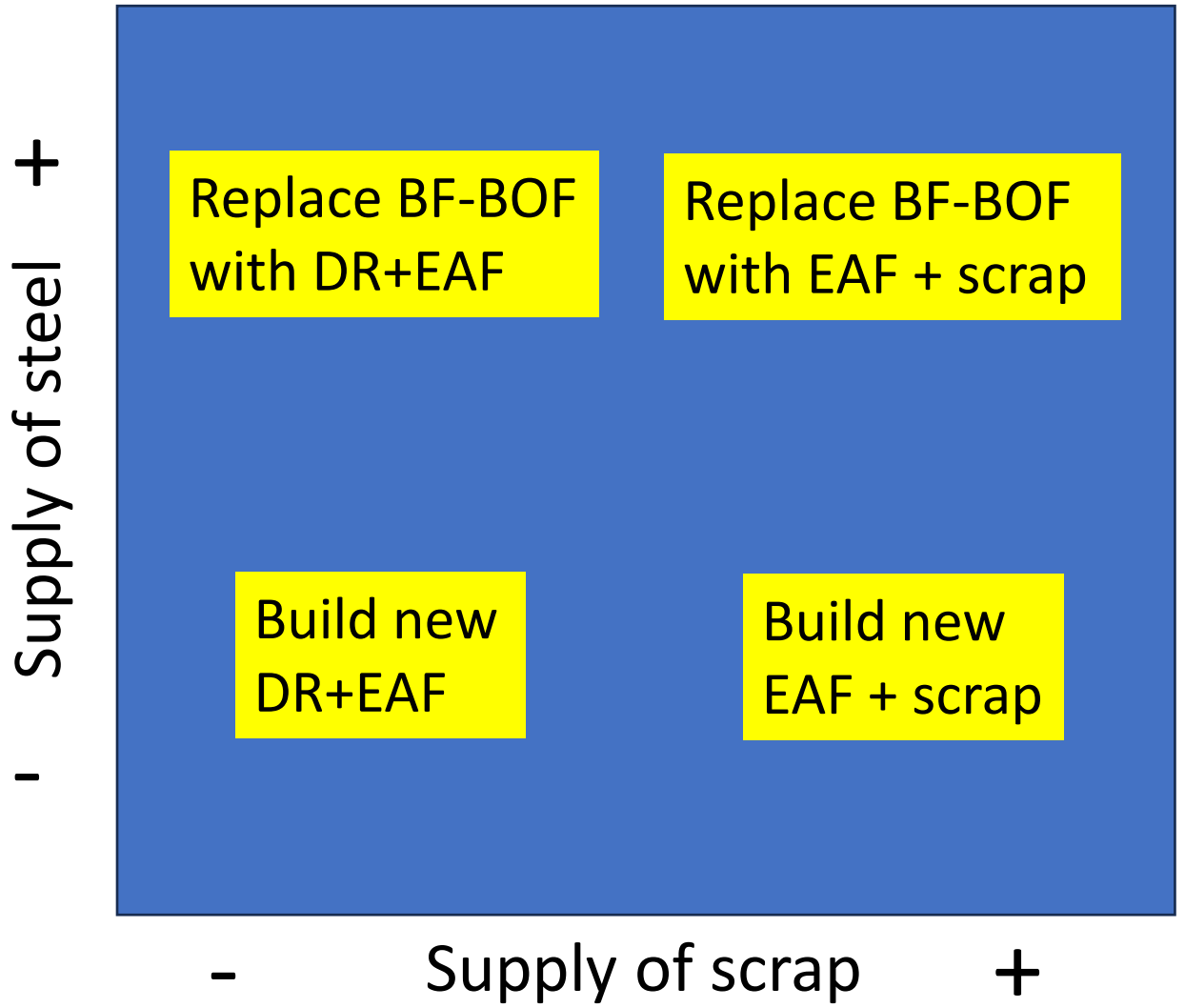

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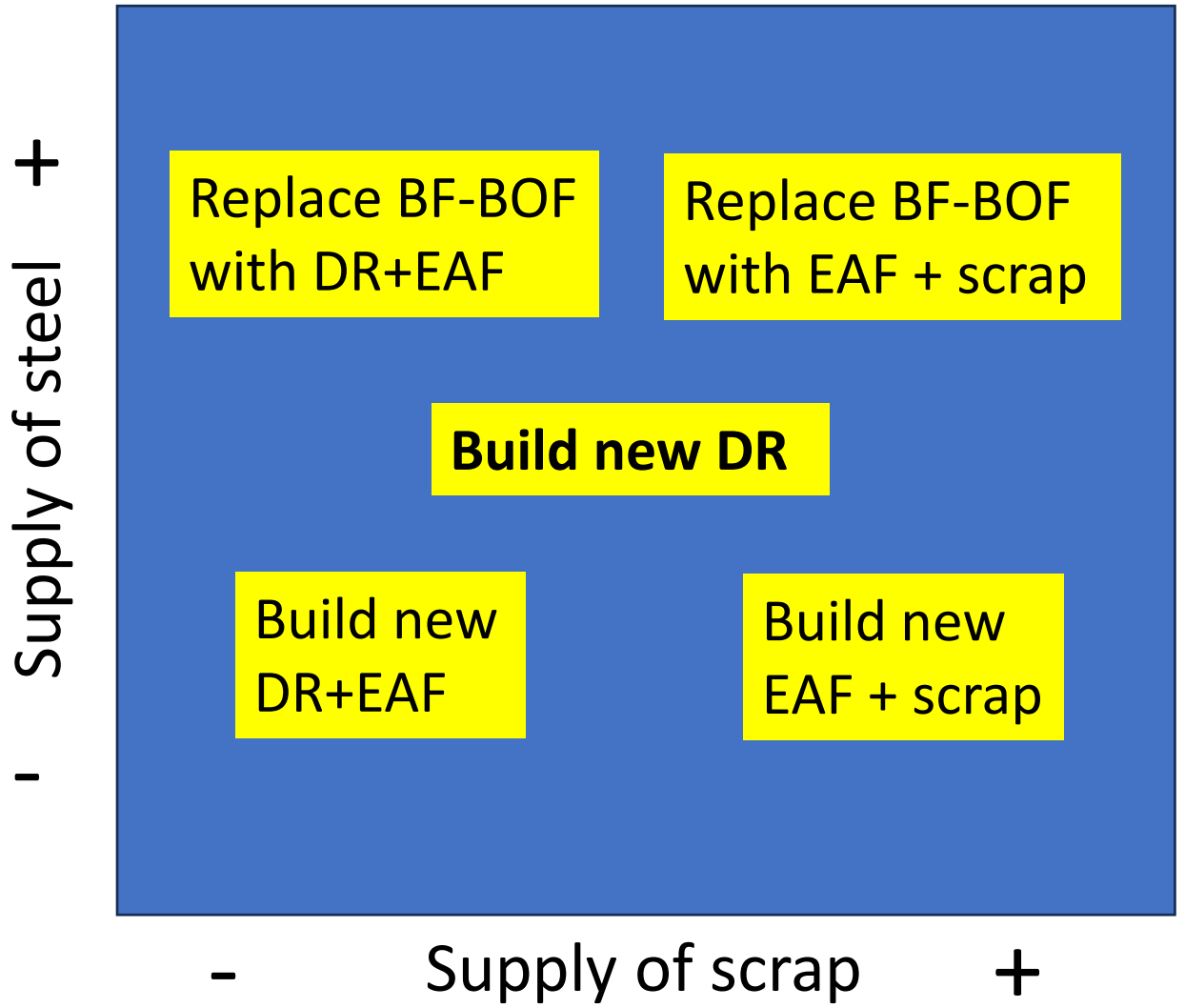

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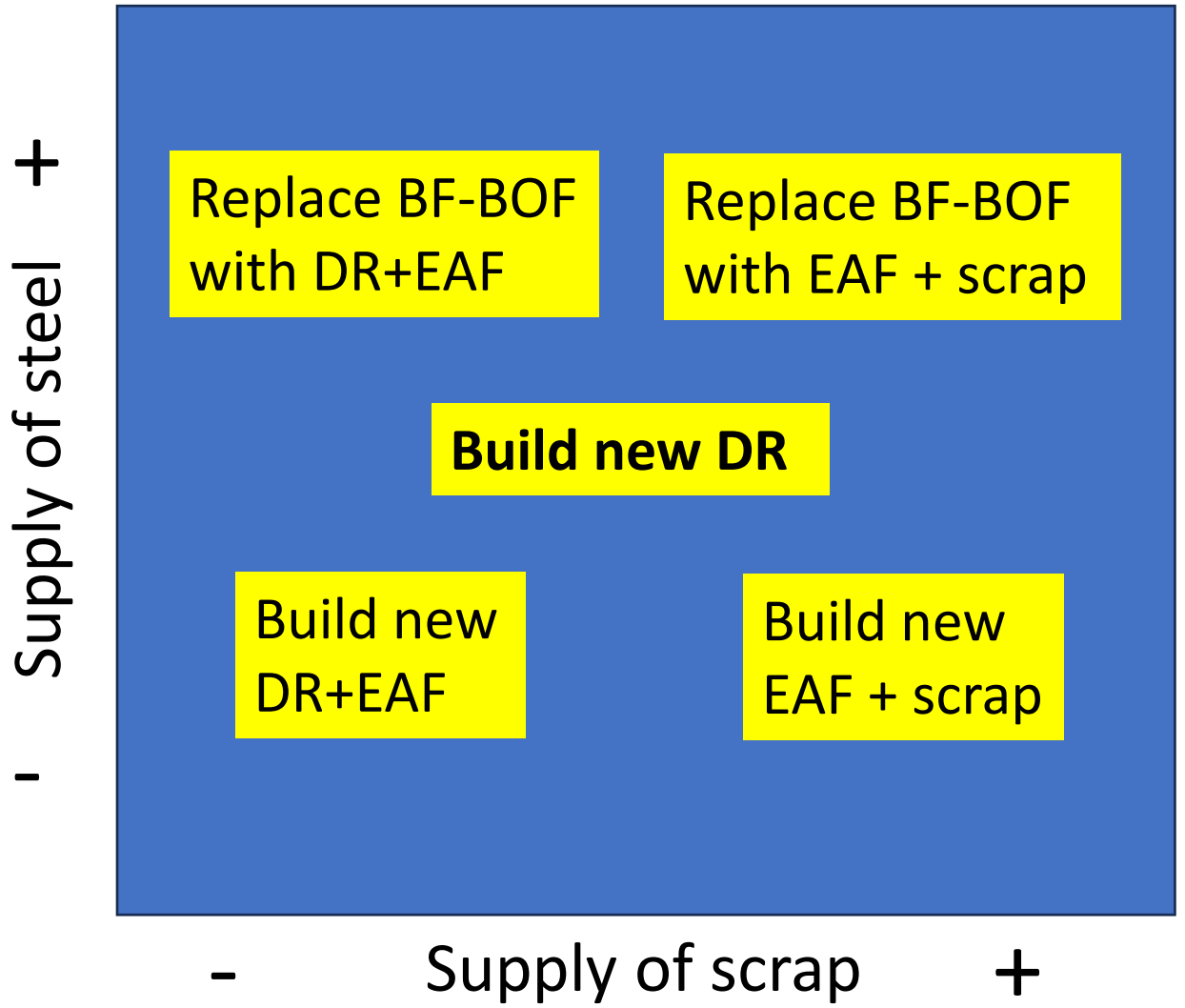
- The market is hesitant
  - Uncertainties regarding ETS
  - Hard funding new capacity
  - Hydrogen not proven

=> DR-plants start with NG

- Most EU BF still in use 2035
- Other issues:
  - Scrap availability
  - Scrap quality
  - Low gangue ore availability
- Conclusion:
  - Decarbonisation of iron ore reduction other than changing BF to NG DR has come to a halt.
  - The question is what may kick it off again before we have an abundance of electricity?

Where are we?

Investments to abate carbon footprint



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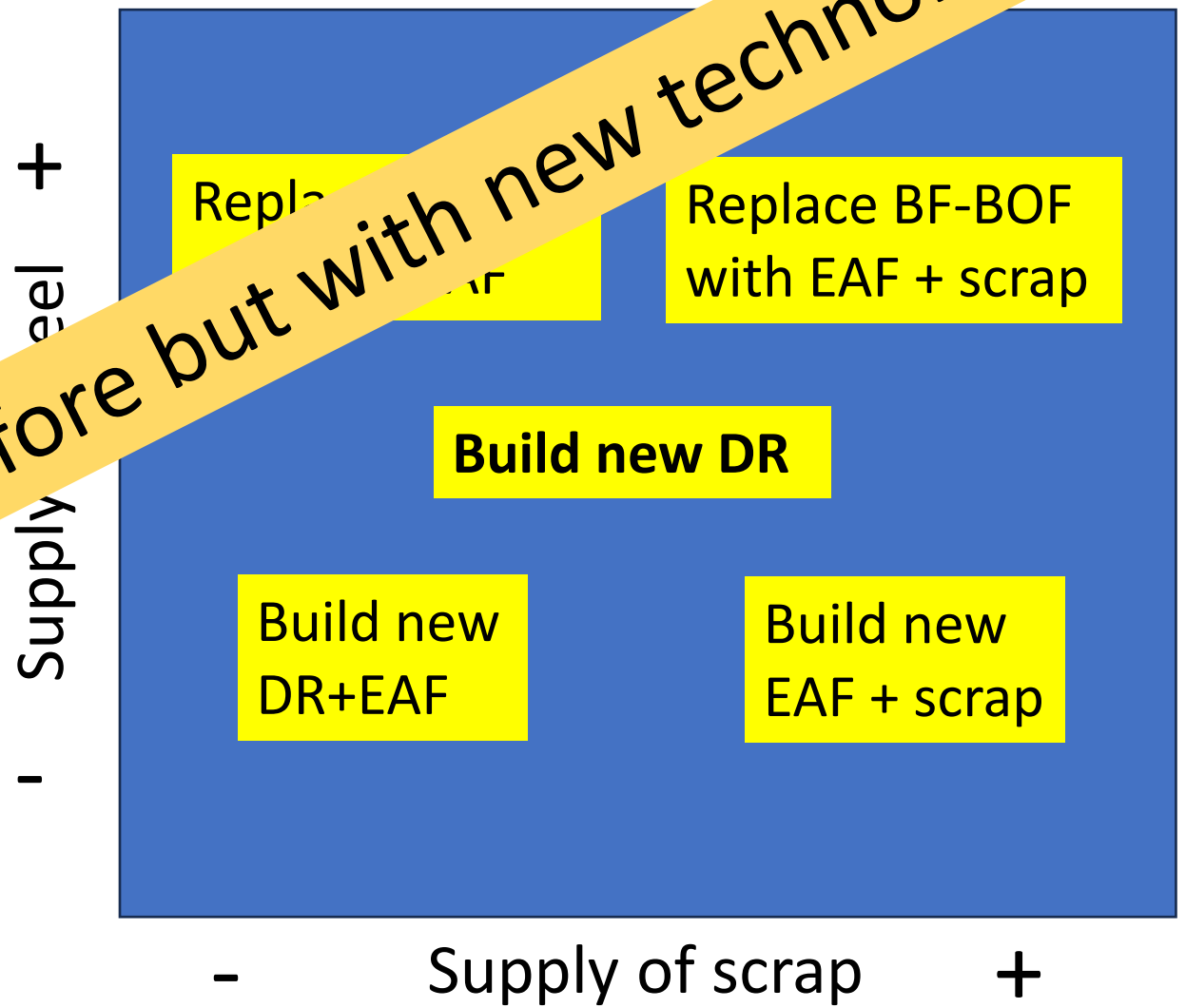
We like to continue as before but with new technology

Where are we?

Investments to abate carb… …int



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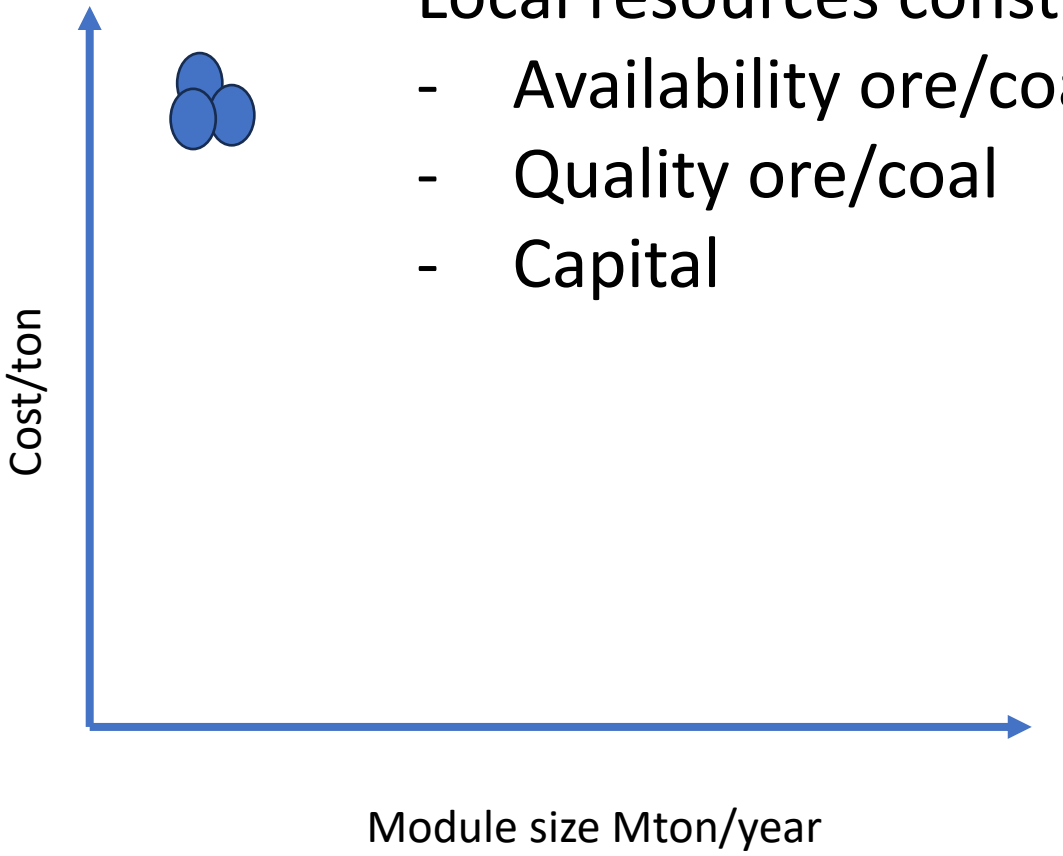
How did we get here?

Local resources constraining
- Availability ore/coal
- Quality ore/coal
- Capital



The Scream Edvard Munch - WebMuseum at ibiblioPage: http://www.ibiblio.org/wm/paint/auth/munch/Image URL: http://www.ibiblio.org/wm/paint/auth/munch/munch.scream.jpg, Public Domain, https://commons.wikimedia.org/w/index.php?curid=37610298

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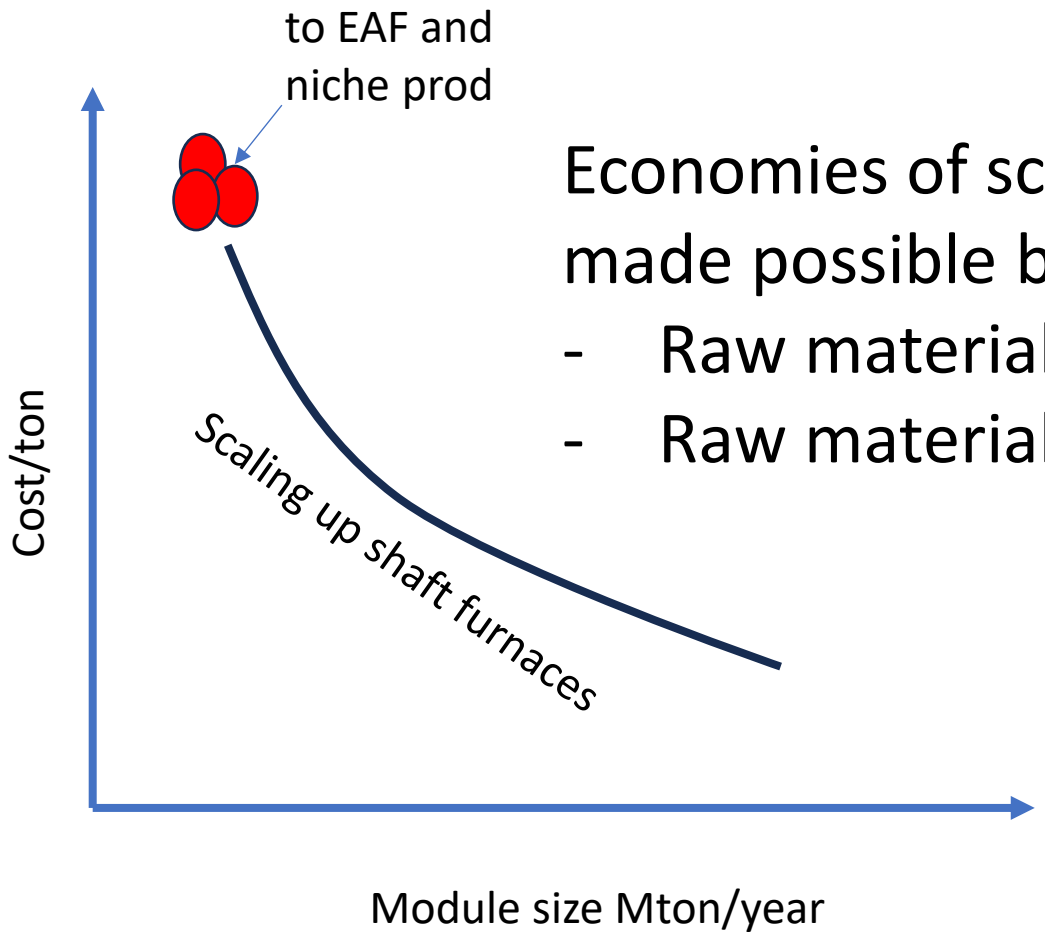

Economies of scale made possible by:

- Raw material quality
- Raw material trade

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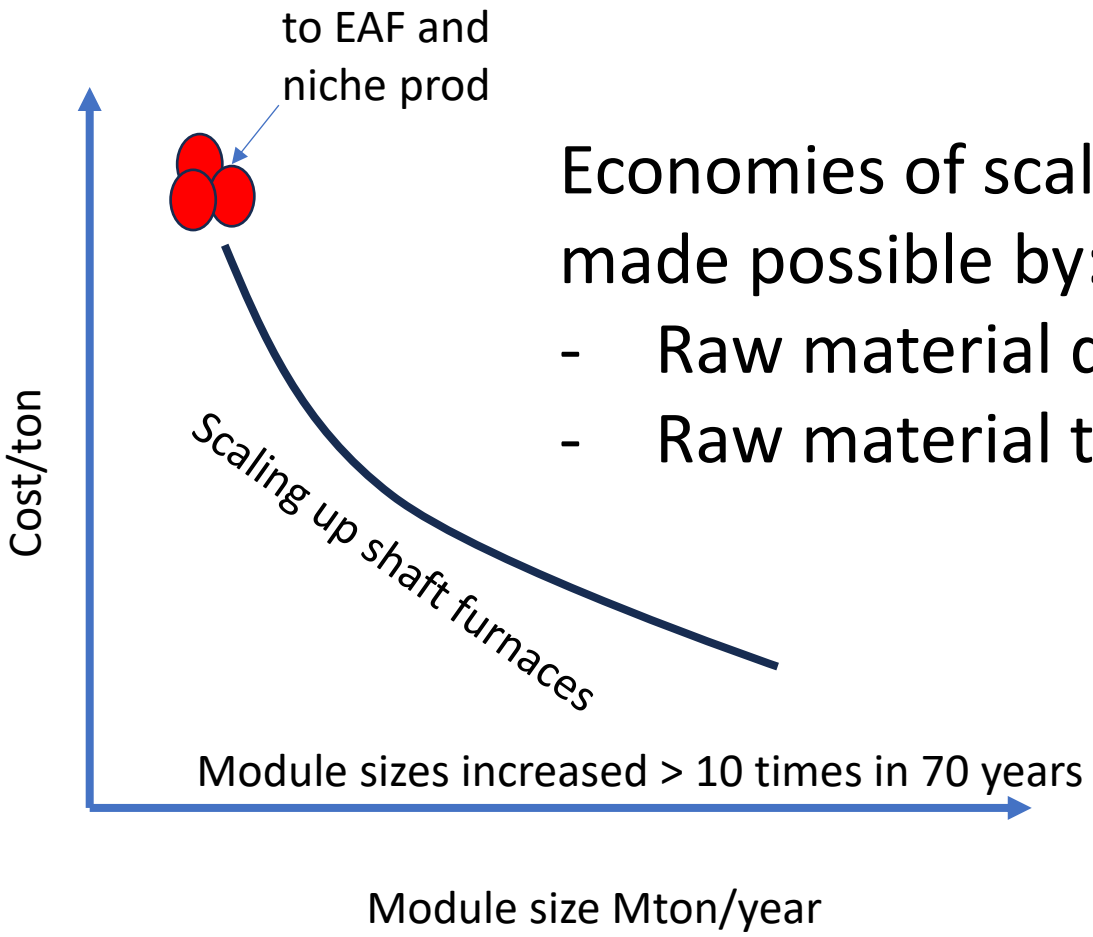

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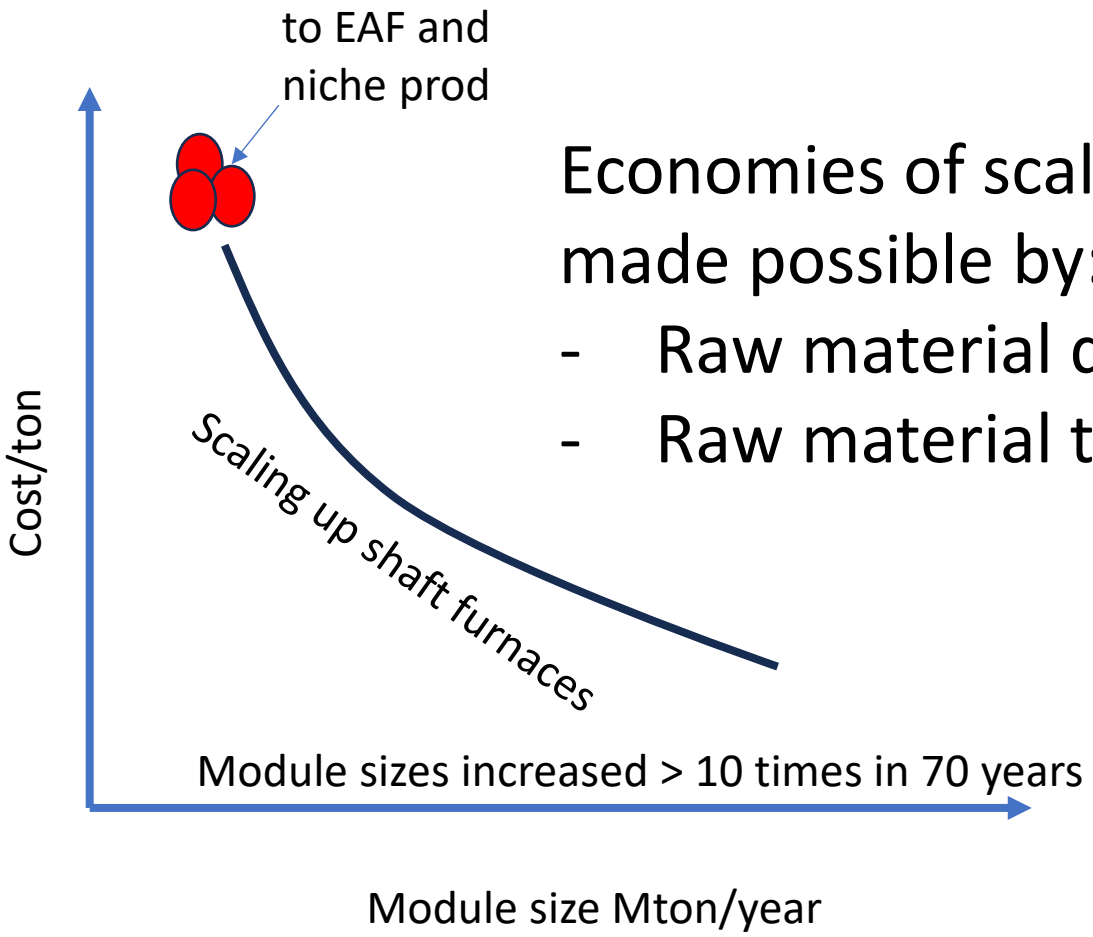


Economies of scale made possible by:

- Raw material quality
- Raw material trade

Technology:

- Cheap ore, coal and NG
- Cheap transport
- Processes significant scaled up over 70 years
  - BF/DR shaft with high efficiency and quality
  - Smaller BF-plants converted to EAF and scrap
  - Cheap scrap diluted with cheap VI rather than sorted

Market:

- Global economy
- Regional growth strategies
- Decarbonisation strategies lag in realism?

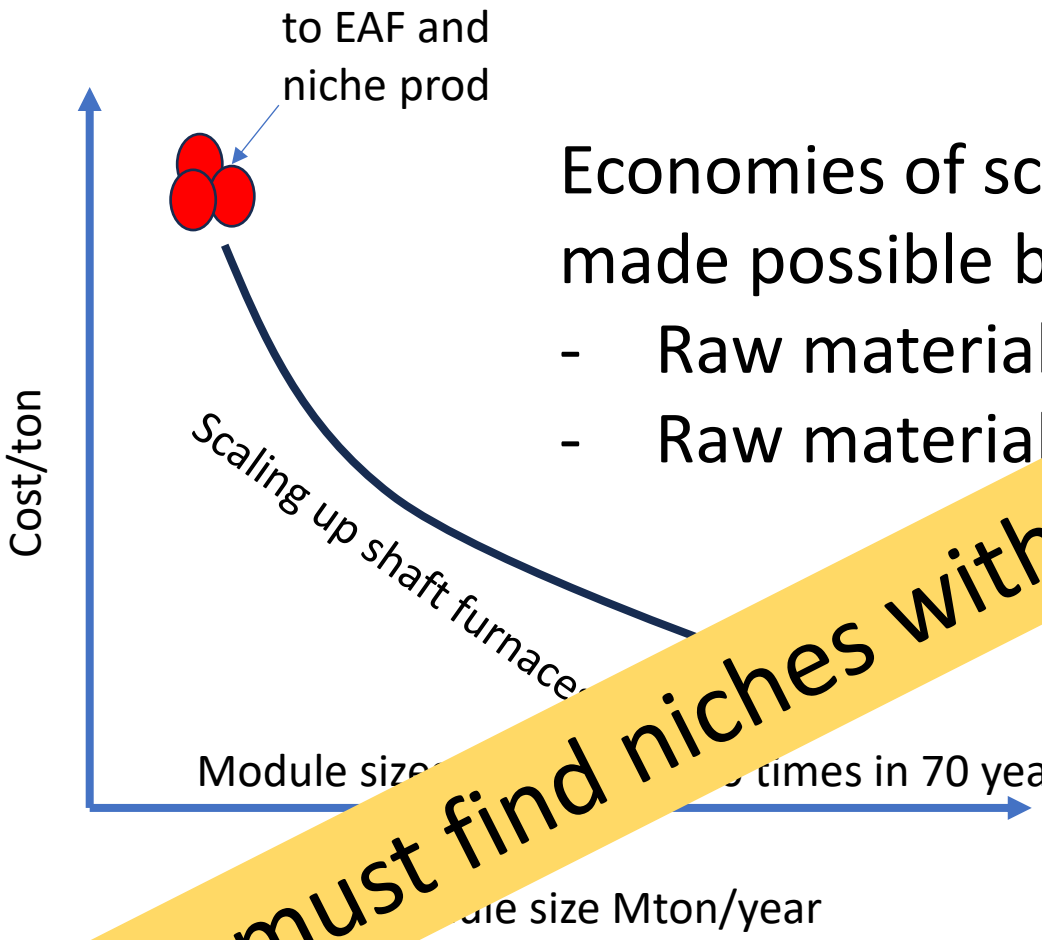
Drivers:

- Cost
- Quality

Conclusion:

- New processes will have immense difficulties scaling up to meet the competition

How did we get here?



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We must find niches with other advantages than scale

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Which “green” processes will be dancing 2035?

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Where shall we go?

Which “green” processes will be dancing 2035?

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Where shall we go?

1. Substitute part of legacy production with new process
   - DRI
   - Hot Metal

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1. Substitute part of legacy production with new process
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2. Production from local raw materials for local markets
   - Biomass
   - Electricity/H2

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3. Value-added products
   - Powders
   - Alloys
   - Co-products

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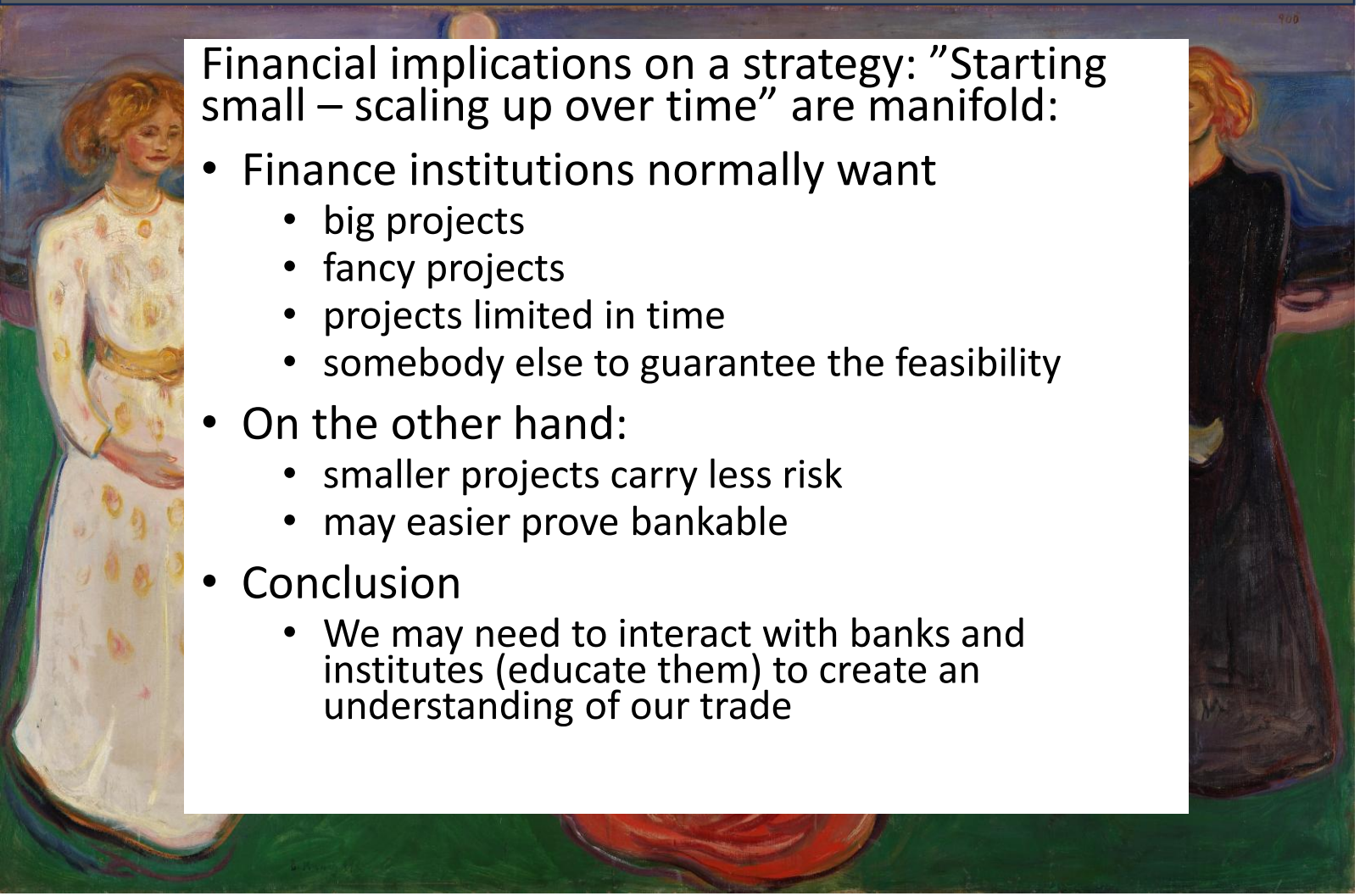

Financial implications on a strategy: ”Starting small – scaling up over time” are manifold:

- Finance institutions normally want
  - big projects
  - fancy projects
  - projects limited in time
  - somebody else to guarantee the feasibility
- On the other hand:
  - smaller projects carry less risk
  - may easier prove bankable
- Conclusion
  - We may need to interact with banks and institutes (educate them) to create an understanding of our trade

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We must attract capital also to small projects

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Conclusion

Decarbonising the steel industry by developing new net zero reduction processes is like planting an oak tree and wait to be able to harvest the acorns.

It has to be done but there are so many other things that we must work on.

To go for reductions without reaching zero is less fancy and has smaller gains but may be ready to reap in the near future.

We should never let “perfect” be the enemy of “good”.

Reaping the corn, Edvard Munch,
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There will be some sunshine after all if we are patient and persistent and avoid wishful thinking!

Thanks for listening!

Comments are welcome to:
rutger.gyllenram@kobolde.com

And thanks also to
Edward Munch
1863-1944

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