ENERGY EFFICIENT TECHNOLOGIES IN THE GERMAN STEEL INDUSTRY – LOW HANGING FRUITS?

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- Research Question
- Methodology
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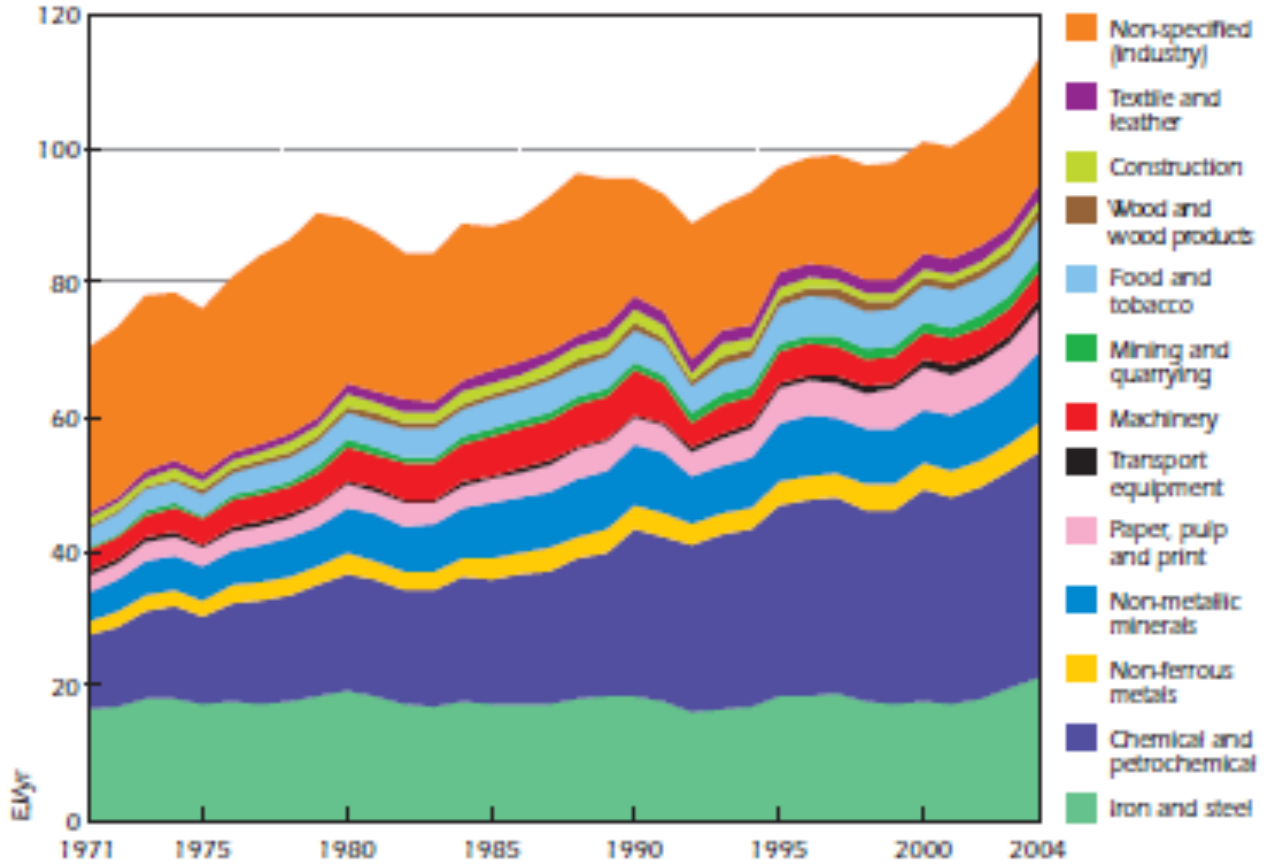
CONTEXT: INDUSTRIAL FINAL ENERGY USE



Source: IEA 2007

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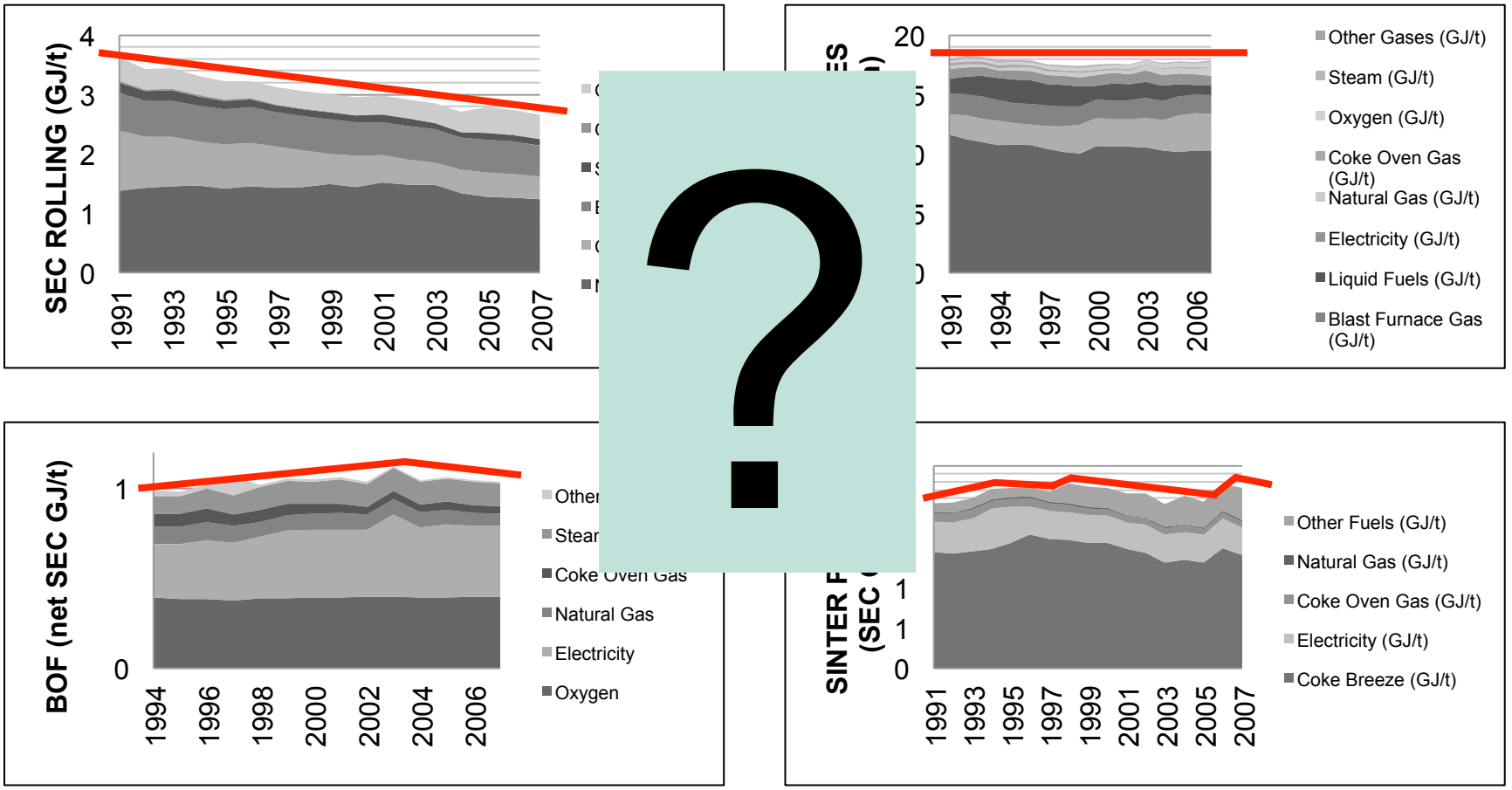
MOTIVATION: PREVIOUS RESULTS



SEC: SPECIFIC ENERGY CONSUMPTION, BOF: BASIC OXYGEN FURNACE

Source: Arens, Worrell, Schleich (2012), ECEEE.

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RESEARCH QUESTIONS

1. How diffuse Energy Efficient Technologies (EETs) over time (s-shaped curve?)?

   → Result I

2. How diffuse EET compared to each other?

   → Result II

3. How does the diffusion of EET influence the specific energy consumption (SEC)?

   → Result III

4. How much is the remainng energy efficiency potential if the EETs were diffused compeletely?

   → Result IV

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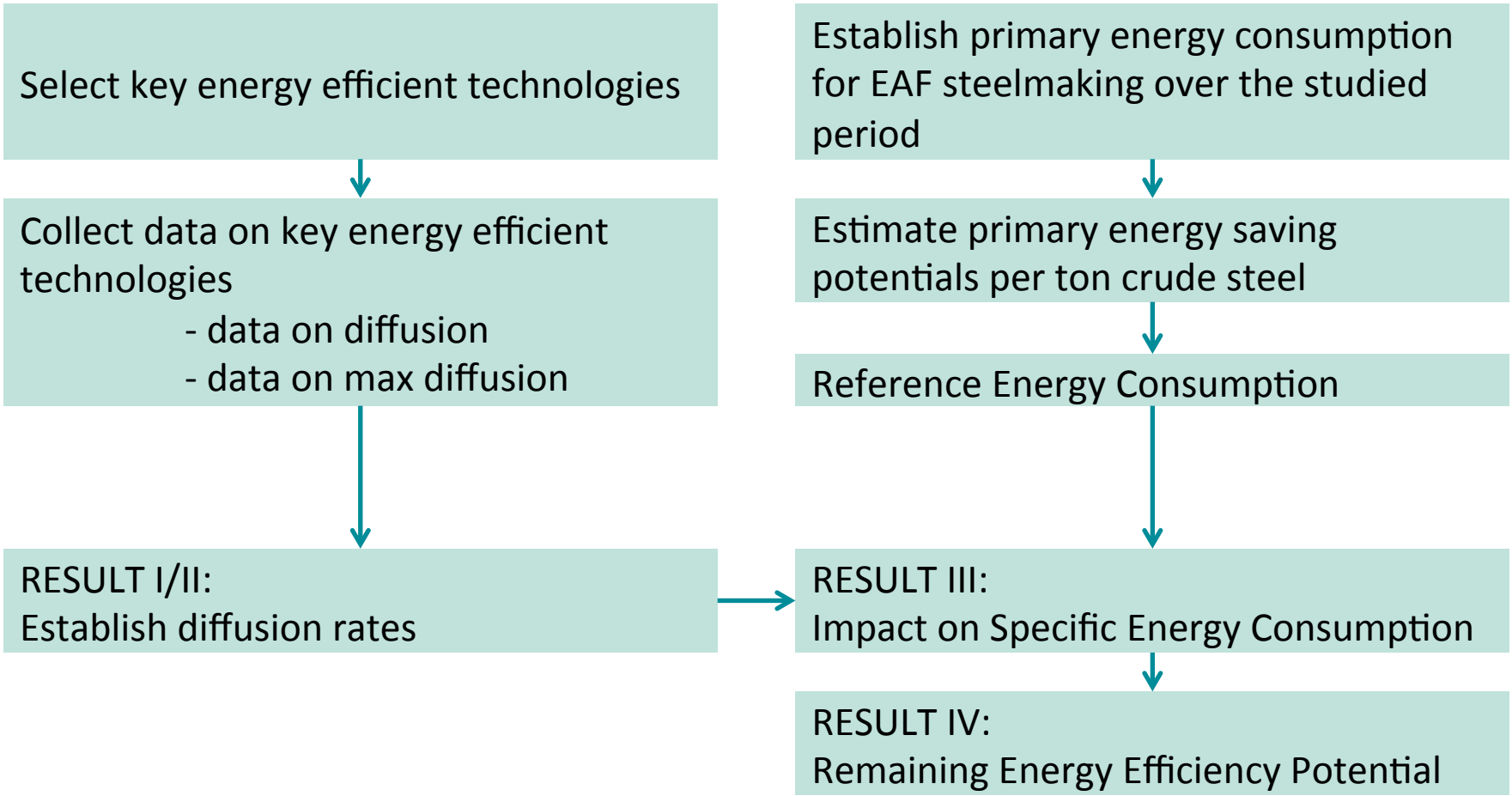
METHODOLOGY



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SELECTED ENERGY EFFICIENT TECHNOLOGIES

BOF	CCM	BOFGR	PCI	(EAF)
Basic Oxygen Furnace	Continous Casting Machines	Basic Oxygen Furnace Gas Recovery	Pulverized Coal Injection	Electric Arc Furnace
***	***	***	***	***
Replaces OHF	Replaces Ingot Casting	Add-On Technology	Process Intesification	Recycling Route/ Substitution
***	***	***	***	***
4.30 GJ/tls	1.73 GJ/tls	0.91 GJ/tls	0.82 GJ/tls	f(SEC_{prim})
***	***	***	***	***
1958	1964	1982	1986	Late 1960s

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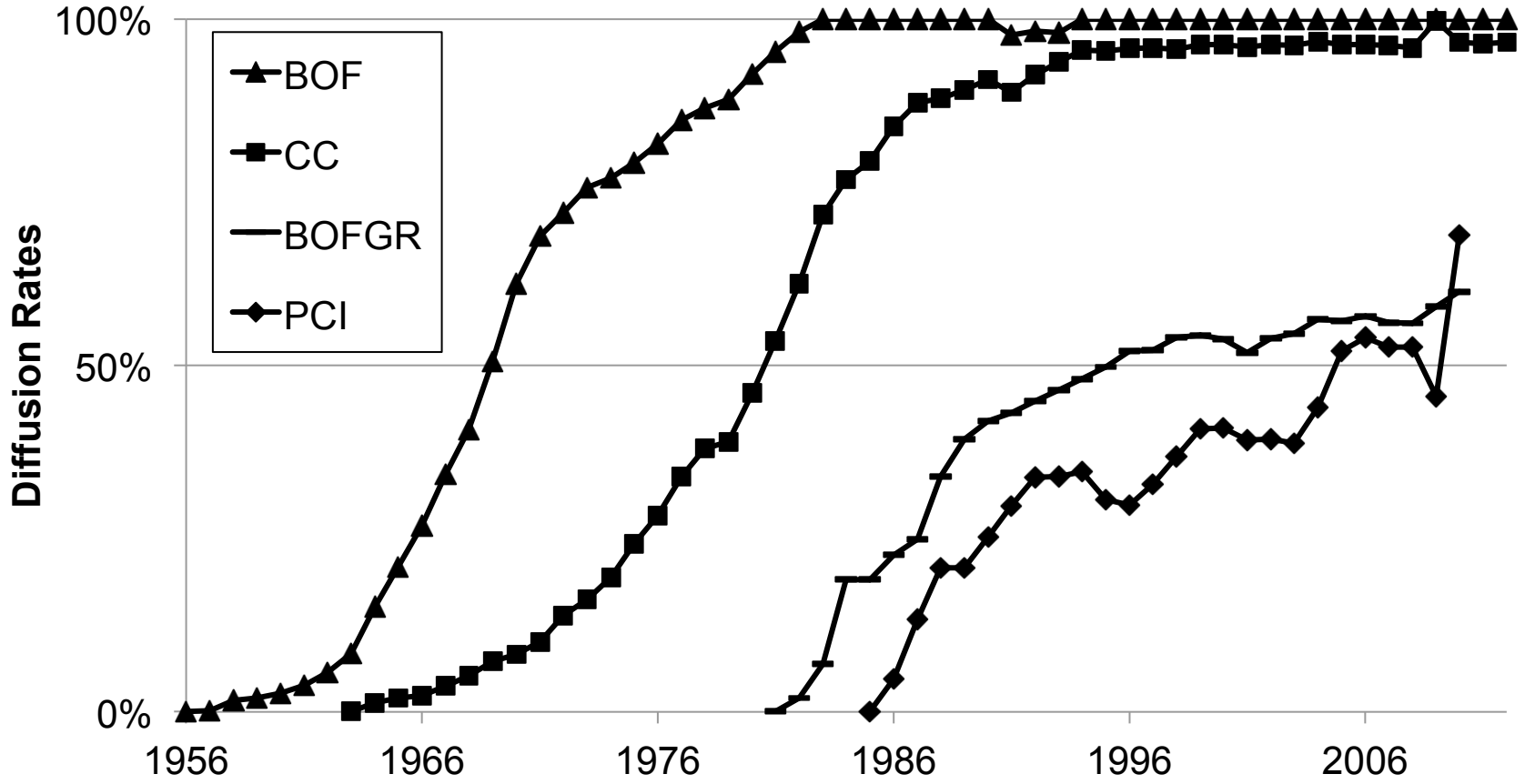
RESULT I: DIFFUSION OF ENERGY EFFICIENT TECHNOLOGIES - CHRONOLOGICALLY



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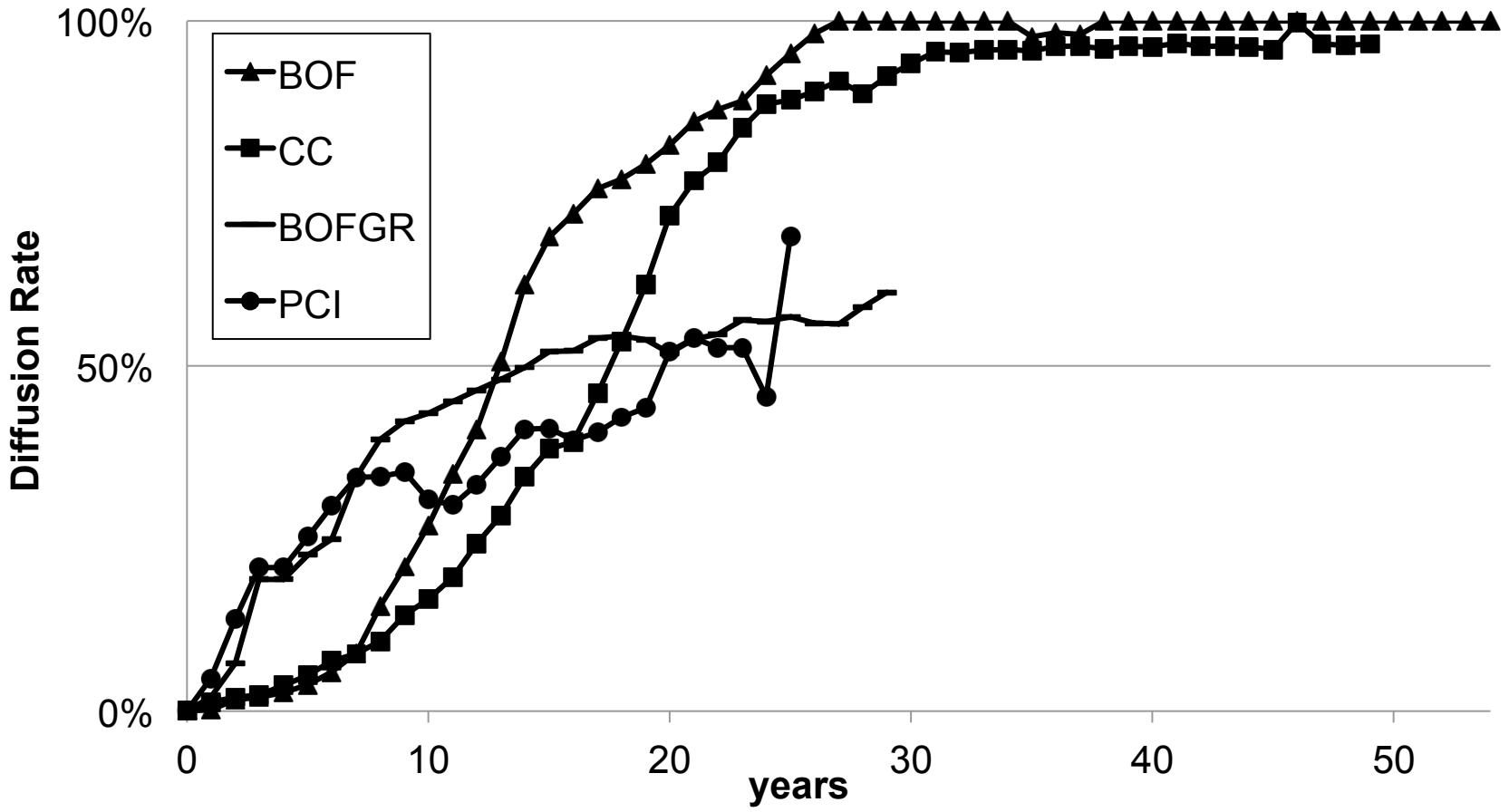
RESULT II: DIFFUSION OF ENERGY EFFICIENT TECHNOLOGIES BY YEAR AFTER 1ST IMPLEMENTATION



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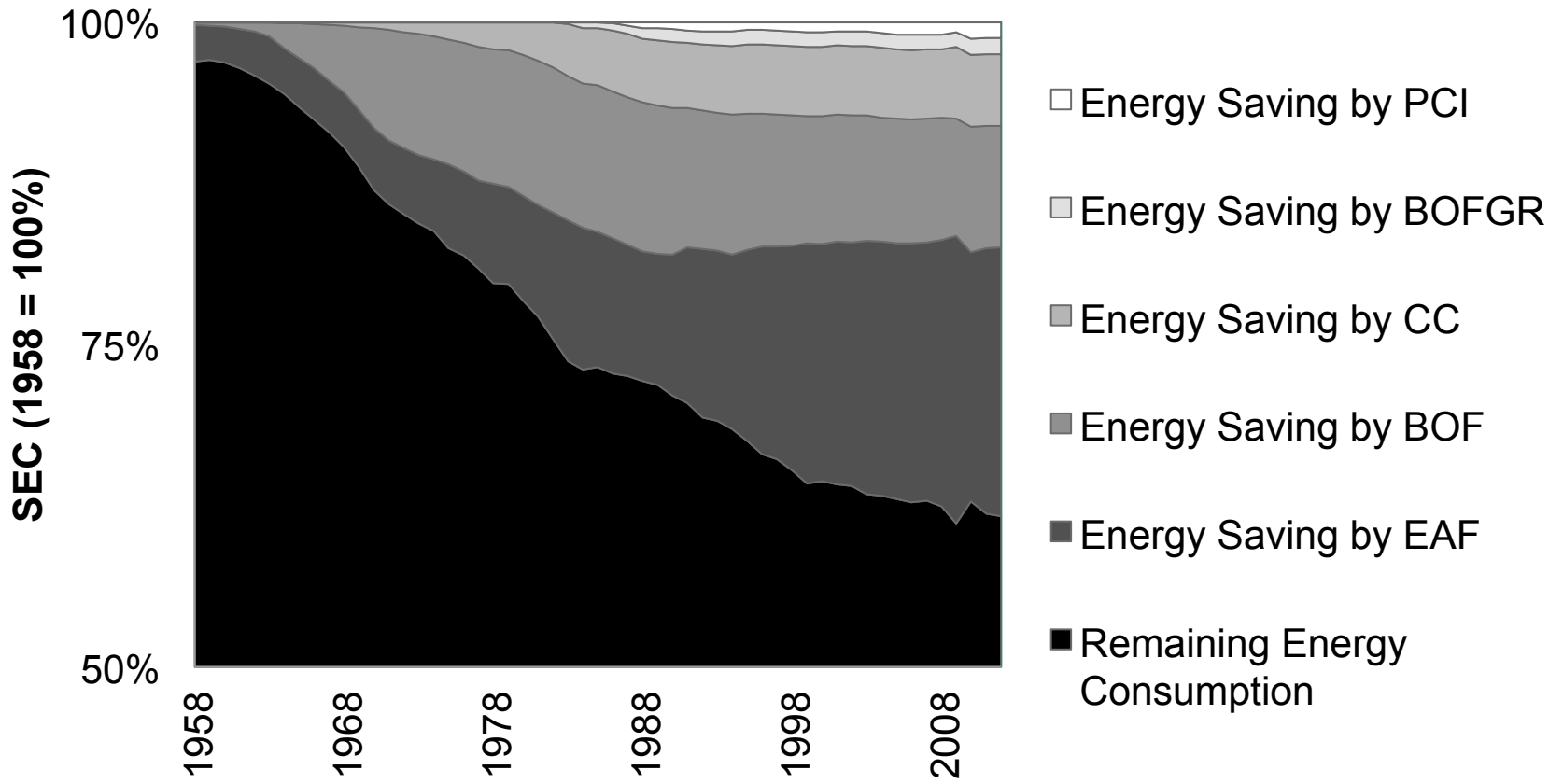
RESULT III:IMPACT OF THE DIFFUSION OF ENERGY EFFICIENT TECHNOLOGIES ON THE SPECIFIC ENERGY CONSUMPTION



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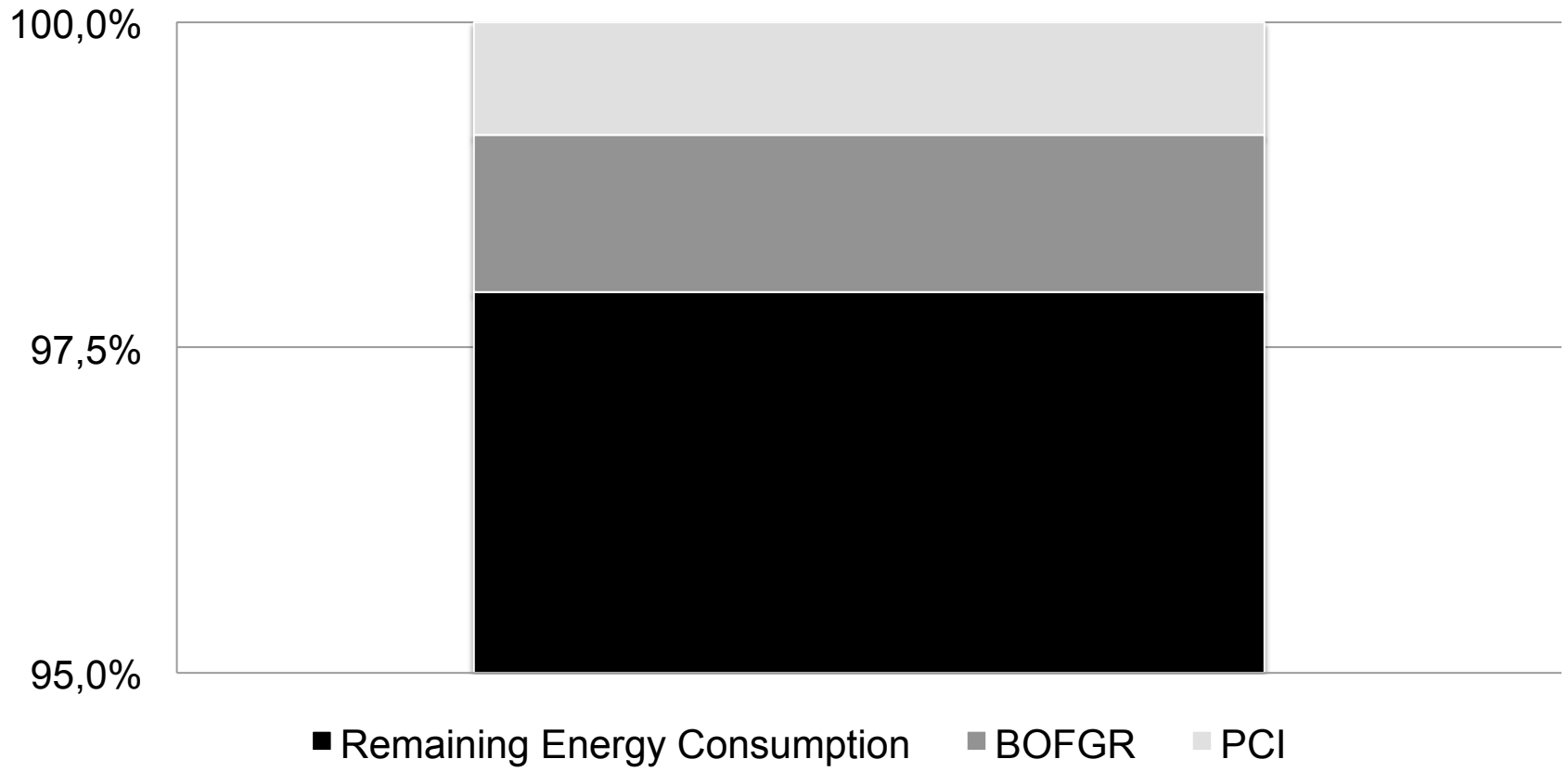
RESULT IV: ENERGY SAVING POTENTIAL (2012)



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CONCLUSIONS

- Development of SEC in the German steel industry is mainly driven by 3 technologies: EAF, BOF and CCM
- BOF, CCM: rapid uptake in the past, provide essential productivity benefits next to energy savings
- BOFGR, PCI: implementation rates levelled off since the 1990s (after 25 years 50-60%, while BOF and CCM had reached complete diffusion after the same period)
- observed diffusion rates are affected by developments in the sector (new constructions, contractions).
- Even 30 years after the first introduction there is still room for further diffusion of BOFGR and PCI (further primary energy efficiency potential of 2.1% for 2012.)

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Thank you very much for your attention!

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