Overview of possible key technologies for nearly carbon-neutral basic materials industries Figure ES.2

Steel	Key technology	Earliest possible market readiness
	Direct reduction with hydrogen and smelting in the electric arc furnace	before 2025 (initially with natural gas)
	Alcaline iron electrolysis	2040 – 2045
	HIsarna® process in combination with CO_2 capture and storage	2030 – 2035
	CO_2 capture and utilisation of waste gases from integrated blast furnaces	2025 – 2030
Chemicals	**Key technology**	**Earliest possible market readiness**
	Heat and steam generation from power-to-heat	From 2020
	CO_2 capture at combined heat and power plants	2030 – 2035
	Green hydrogen from renewable energies	2020 – 2030
	Methanol-to-olefin/-aromatics route	2025 – 2030
	Chemical recycling	2025 – 2030
	Electric steam crackers	2030 – 2040
Cement	**Key technology**	**Earliest possible market readiness**
	CO_2 capture with the oxyfuel process (CCS)	2025 – 2030
	CO_2 capture in combination with electrification of the high temperature heat at the calciner	2025 – 2030
	Alternative binders	2020 – 2030 (depending on product)

Agora Energiewende/Wuppertal Institute, 2020