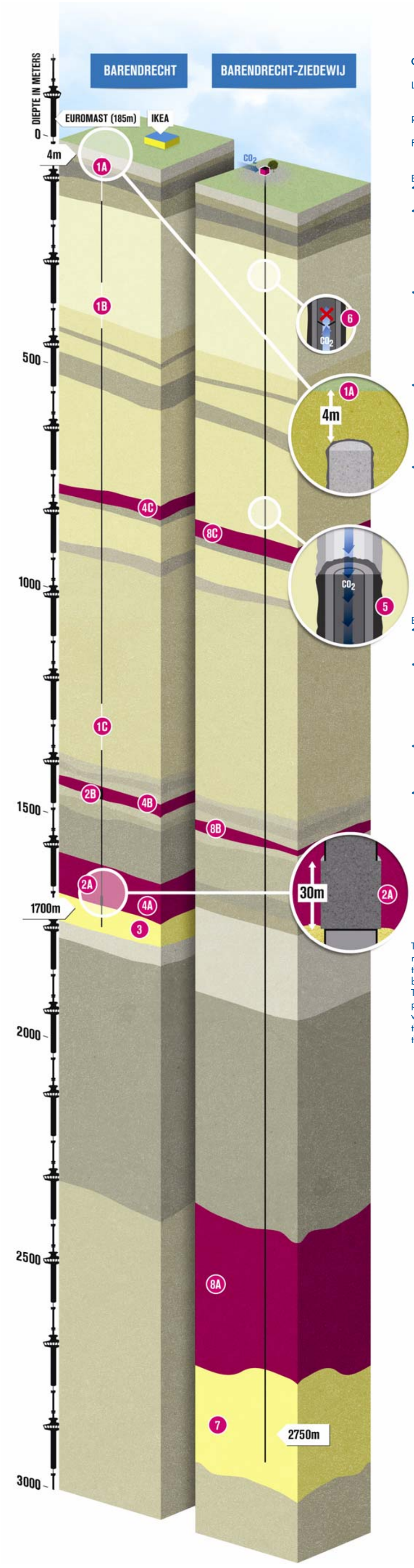


**Going deep**

Left: the Barendrecht field, after refilling with $CO_2$ and having been sealed.
Right: the Barendrecht-Ziedewij field during the refilling phase.
For reference: Rotterdam's Euromast and IKEA at Barendrecht.

Barendrecht field (after the refilling phase)

* All surface installations used for $CO_2$ injection have been removed.
* The top of the well construction has been removed to several metres below ground level, and the well construction has been sealed from here to a depth of 100 m by means of a long cement plug **(1A)**. The wellbore has also been sealed using 100 m cement plugs at two other depths **(1B, 1C)**.
* Moreover, a massive cement plug has been placed just above the gasfield **(2A)** (for the purposes of this illustration, the length of this plug (30 m) is not represented in proportion to the width of the plug). This plug replaces the entire well structure at the site and forms an additional blockage to the escape of $CO_2$ at this depth.
* $CO_2$ is held in the gasfield at a depth of approx. 1700 m **(3)**. The pressure within field containing $CO_2$ is lower than that in the surrounding strata. The porous rock comprising the gasfield is covered by a layer of shale **(4A)**, approx. 90 m thick and impermeable to gases.
* Several more of these impermeable strata **(4B, 4C)** are located above the field. A massive plug **(2B)** has also been placed in one of these strata (comparable to plug **2A** above the field containing $CO_2$). This ensures that the covering stratum in question is also impermeable at the place where the wellbore crosses the stratum.
  Strata above this also have the capacity to absorb $CO_2$ because they contain water which dissolves $CO_2$, should it permeate into them.

Barendrecht-Ziedewij (during the refilling phase)

* A compressor building is located at ground level (here, a pipeline is used to transport $CO_2$ below ground level).
* In this phase, the well is (obviously) not sealed with cement plugs. The construction comprises a double-walled pipe **(5),** secured on the outside in the borehole using cement. The internal pipe will be removed after filling and prior to the placement of the cement plugs.
* Non-return valves **(6)** prevent $CO_2$ from flowing back up the pipe if the filling pressure is removed from above.

* $CO_2$ is pumped into a depleted gasfield **(7)** located at a depth of approx. 2750 m. The pressure in the field remains lower than that in the surrounding strata during and after refilling with $CO_2$. The porous rock comprising the gasfield is covered by a layer of shale **(8A)**, approx. 350 m thick and impermeable to gases.
  Incidentally, similar impermeable strata **(8B, 8C)** are also located above the field, and higher strata have the capacity to absorb $CO_2$ (on account of the water they contain).

The main aim of this illustration is to provide the right perspective for the depths of the strata. For the purposes of the illustration, certain items have been simplified or rendered diagrammatically. This is true, for example, of the massive cement plug **(2A)**, the technical design of the non-return valves **(6)** and the shaft of the wells (in reality they are not vertical, but slope off somewhat to the gasfields deep beneath the surface).