

Zero Emission Dialysis Clinic - A Concept Study

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Introduction and aims:

Haemodialysis treatment is an energy resource demanding treatment, requiring 15-20 kWh total energy per treatment, which is significant CO₂ emissions. With this concept study we demonstrated that it is possible to run a dialysis clinic carbon neutral.

Methods:

We analysed two clinics, one in Germany and one in Portugal, representing typical dialysis clinics in different climate zones. We selected the state of the art technologies to increase energy efficiency. To achieve carbon neutral operations, we calculated the needed energy compensation and arranged suitable photovoltaic panels on the roof of the building. The concept study was performed with the help of our project partner DENA (German Energy Agency).

Results:

The energy efficiency of a standard dialysis clinic (1,000m²; single floor; approx. 12,500 dialysis treatments per year; located in Germany, Cologne) can be reduced to 7 kWh/treatment using the following features:

1. Building envelope: A well-insulated envelope with reduced heat bridges and excellent air-tightness can save up to 40 % of heating- and cooling energy compared to a conventional new building.
2. Daylight concept: Daylight reduces the energy demand for lighting and cooling load for the HVAC systems.
3. Lighting concept: The electric power demand for lighting is minimized by an efficient lighting concept.
4. Mechanical ventilation: A centralised ventilation system with a heat recovery rate of 85% can reduce ventilation heat losses.
5. Chilled and heated ceiling with capillary tubes are linked to the heat pump system.
6. Heat pump: A reversible heat pump (15 kWh) provides heating and cooling energy. It uses warm waste water from dialysis as a heating and cooling source.



Fig 1: Model of the Zero Emission Dialysis Clinic

Energy Analysis of existing Dialysis Clinics	Portugal (Coimbra)	Germany (Cologne)
Size of the dialysis clinic	2,123 m ²	1,460 m ²
No of treatment per year	22,576	12,534
Year of construction	2005	2005
Total energy consumption per square meters (m ²) and year (a)	179 kWh/(m ² a)	127 kWh/(m ² a)
Energy consumption per dialysis station	13,138 kWh/ (station x a)	6,000 kWh / (station x a)
Energy consumption per dialysis treatment	17 kWh/treatment	14 kWh/treatment

Table 1: Comparison of the two existing dialysis clinics in the two different climate zones

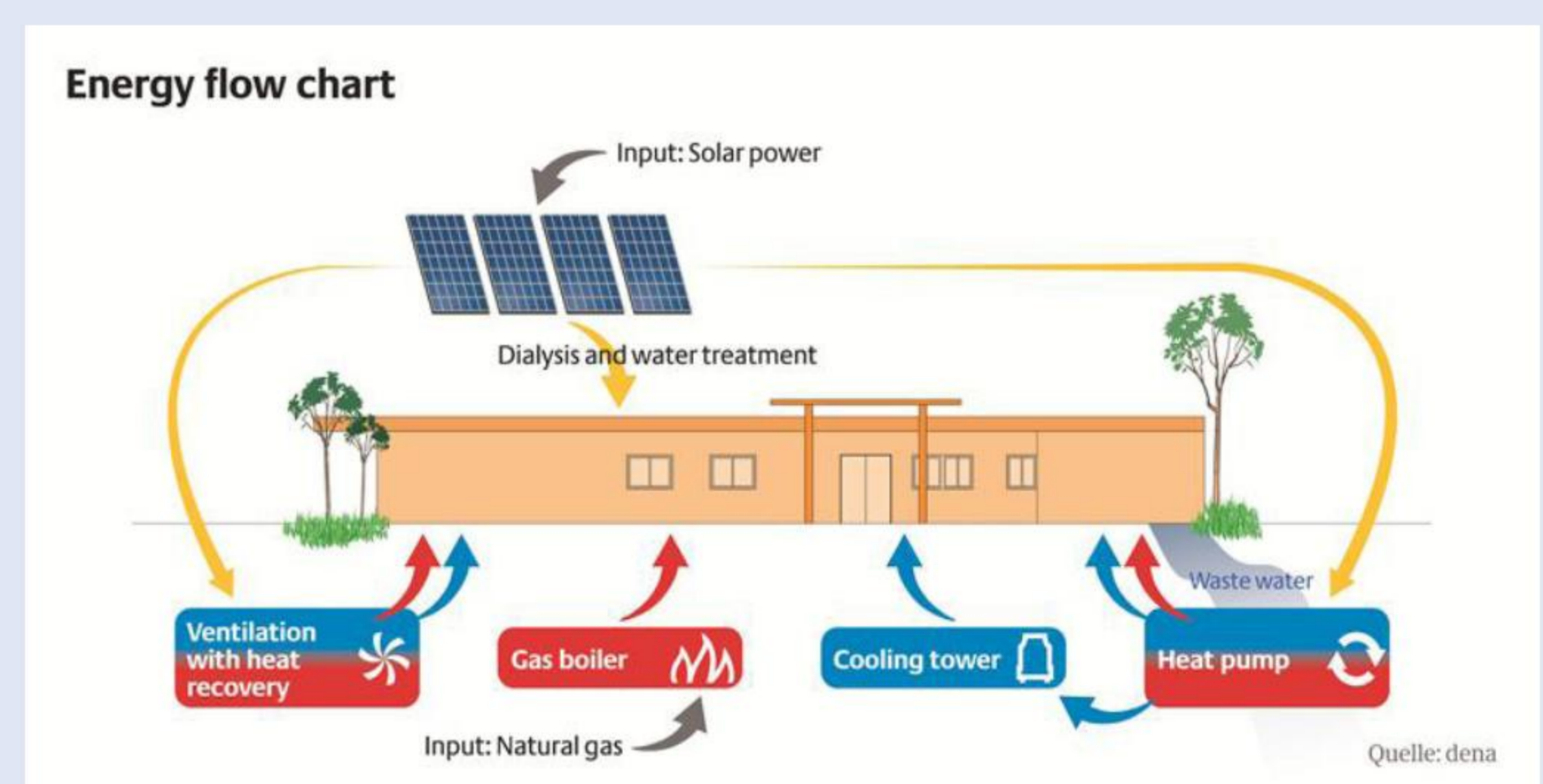


Fig 2: Energy flow chart of the Zero Emission Dialysis Clinic



Fig 3: Three major steps towards a CO₂ neutral dialysis centre

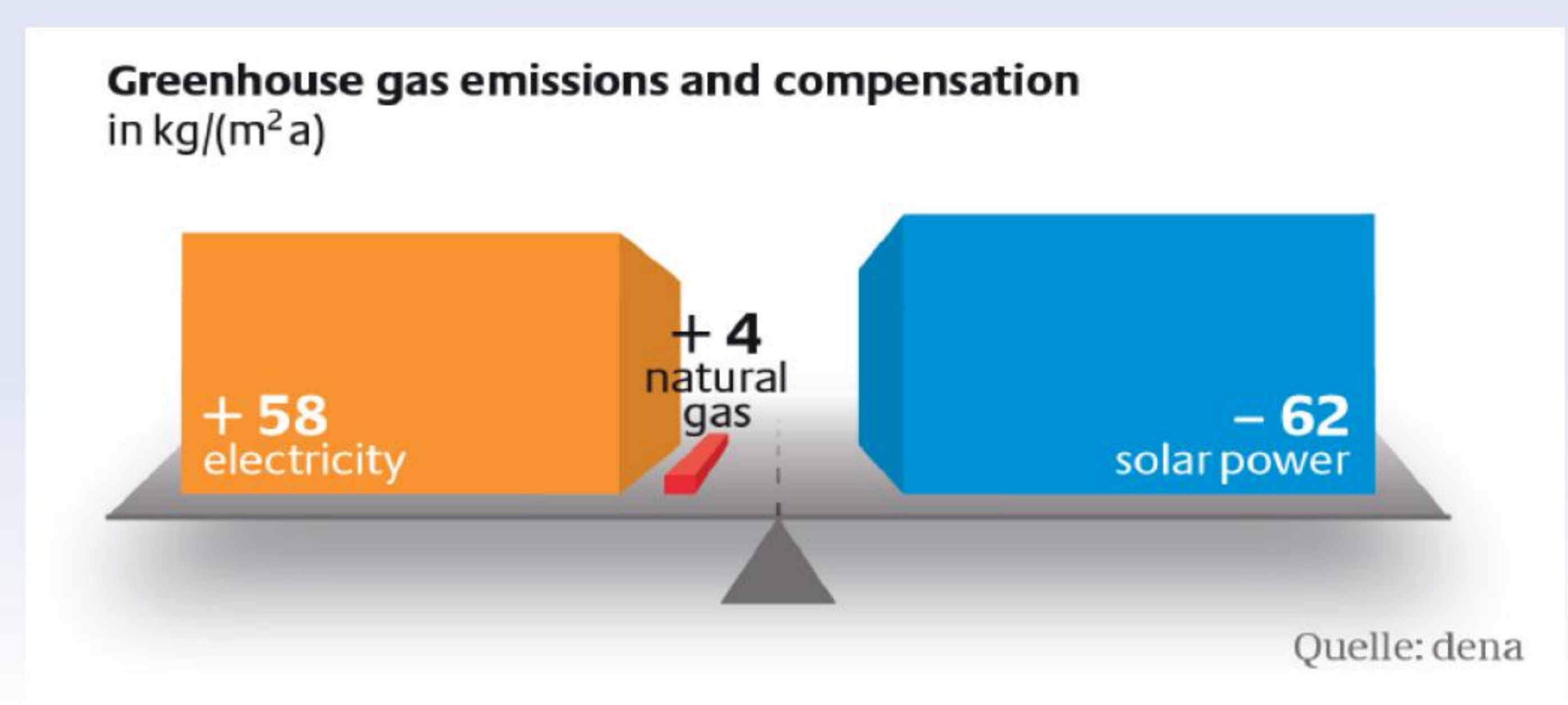


Fig 4: CO₂ balance and compensation based on total year energy simulation

