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Stellarators and small, modular fusion power plants: New ideas for sustainable fusion power.

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Nuclear fusion provides humankind with an unlimited and clean source of energy for millions of years to come. The way forward to achieve the stellar conditions needed to sustain energy producing fusion reactions on a technical scale on earth has focused on the development of ever bigger devices. The flagship of these is the ITER machine, presently under construction in Cadarache, France. The scale of this experiment is so huge that it is constructed by an international agreement including two thirds of the world's population. The complexity of a machine like this, the scale of the project, and its uniqueness implies that it is prone to even longer delays and cost overruns than the average construction project.

Recent development in the performance of high temperature superconductors and in modelling may however open alternative paths to achieve fusion on a shorter timescale and at potentially lower cost. For once there is the prospect of fusion machines relying on external magnetic fields to achieve the confinement of the hot energy producing plasma. These stellarators are demanding to design, but here newly developed technologies and available computer power make construction possible. A new machine is just coming to life in Greifswald, Germany: The Wendelstein 7 X project.

Additionally the development of high temperature superconductors has made it possible to construct compact machines with much stronger magnetic cages to hold the plasma. These machines pose a number of advantages, as scalability and initial cost per unit. This, and a prospective shorter time to market, makes these machines interesting for private and institutional investors.

In this presentation we provide an overview of these new, alternative approaches and their impact on the existing energy systems.