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Critical Design Issues in DEMO and Solution Strategies

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The EU fusion roadmap defines as a goal the development of a DEMO, which achieves a high plasma operation time and demonstrates Tritium self-sufficiency and net electricity output. A number of design issues have been identified as critical, either because the solution chosen in ITER is not suitable in DEMO or because it is a DEMO-specific issue not present in ITER. All of these will affect in their resolution the design and possibly the technology of several tokamak and plant systems or even the DEMO architecture: (i) Feasibility of wall protection limiters during plasma transients, (ii) integrated design of breeding blanket and ancillary systems, (iii) power exhaust taking advantage of advanced divertor configurations, (iv) tokamak architecture based on vertical blanket segments, (v) direct or indirect power conversion concept, (vi) configuration of plant systems in the tokamak building, (vii) feasibility of hydrogen separation in the torus vacuum pump and direct recirculation, and (viii) plasma scenario.

For each of these issues potential solutions have been identified and activity plans have been defined for the associated developments and assessments. Four of these particularly affect the integrated design of DEMO, namely (i), (ii), (iv), and (vi). These will be introduced and discussed in this article and for each a summary of the identified risks, the rationale for the chosen solution concepts, and the identified required verifications will be given.

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