**Steady state tokamak operation using Lower Hybrid Current Drive**

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Long Pulse and Steady-state operation of tokamaks requires driving the total amount of plasma current non inductively. The two possible sources of non inductive plasma current in tokamaks come from the self-consistent bootstrap current effect and the additional heating & current drive systems. The use of additional heating power to sustain non inductively the tokamak magnetic configuration in fusion reactors raises the question of global efficiency. The intimate link between the current density profile and the plasma confinement properties brings further constraints the optimisation and raises the question of the current drive capability mix. The paper summarizes the present understanding and situation of the current drive capability mixes in existing fusion devices, as well as in ITER.

A particular attention is then paid to the role played, or to be played, by Lower Hybrid Current Drive. The paper discusses the recent progress and achievements of Lower Hybrid Current Drive Technology in Tokamaks, and its evolutions towards ITER relevance. The review updates the situation with the latest results of the new Passive-Active Multi-junction launcher, operated on Tore Supra since October 2009, together with the commissioning of the new transmitter, powered by 750kW/CW/3.7GHz TED 2103C klystrons. The paper then summarizes the present activity on Lower Hybrid Current Drive in the existing long pulse operation tokamaks, and gives the outcome of the worldwide conceptual design activity of the ITER Lower Hybrid Current Drive system, as well as the status of the on-going design, R&D and procurement efforts on LHCD, for the present and future long pulse operation tokamaks.