On the heating mix of ITER

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This paper considers the heating mix of ITER for the main scenarios. Presently, 73 MW of absorbed power is foreseen in the mix 20/33/20 MW for ECH, NBI and ICH. The findings here are based on revised current drive efficiencies for beams and ECCD. The success of ITER depends, however, also on the pedestal temperature, the density profile shape and on the characteristics of impurity transport. Under the premises of sufficient edge stability Q=10 is possible with NBI or ECH. ICH heats selectively the ions and increases fusion gain additionally by ΔQ~1. A flat-top time of 350 s can be reached. The Q=5, steady-state Scenario-4 with reduced current requires discharges with improved confinement necessitating weakly or strongly reversed shear. f_{bs} > 50% and strong current drive are necessary. The various tasks have to be split within different heating methods: ECCD deposited off-axis can initiate reversed shear characteristics but not effectively drive the current. This can only be achieved by NBI. With ECCD alone, Q=5 cannot be reached. With beams, inductive discharges with f_{ni}>80% can be maintained for 3000 s. The major conclusion of this study is that the present heating mix of ITER is appropriate for Q=10 but may be marginal for the Q=5 scenario. This could be changed with Lower Hybrid heating and 20 MW should be envisaged at a later stage. A mix of heating and CD systems provides the necessary actuators to respond in a flexible way for the development of the best possible scenarios. This study has also shown that the development risks of NBI at 1 MeV can be reduced by targeting for 0.85 MeV. In order to keep the NBI power constant, the source current density has to be increased. It also has been clarified that DEMO will need NBI for steady state. In order to have more flexibility in reaching the H-mode, the addition of 20 MW ECH to ITER is recommended. The additional technical effort for this extension can be minimised by using duplexers.