Paper 20: Optimisation of operating sequence of electrolyser units for hydrogen production

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Abstract:

A sequencing methodology that aligns hydrogen production with available power is proposed here. In a system with eight electrolyser units (each rated at X/8 MW), each unit (T1 to T8) receives DC power via a 12-pulse converter through a zigzag to wye-delta transformer. Each unit has the transformer primary MMF phase angle shifted by 3.75 degrees (360/ {12*8}) with respect to the previous unit to increase the harmonic order of the grid side current, eliminating the need for bulky filters.

The efficiency of the units come down when operating in light load. For maximising efficiency, the units need to be operated close to their full load. When power availability is low, some units need to be shut down, and the system operates with a reduced load. Considering this, an optimal loading strategy is given below:

- 0 to X/8 MW: Operate T1 (12-pulse)
- X/8 to X/4 MW: Operate T1, T5 (24-pulse)
- X/4 to X/2 MW: Operate T1, T3, T5, T7 (48-pulse)
- X/2 to X MW: Operate all units (96-pulse)

As the number of operating units increase, the harmonic order goes up, and the filter requirement comes down. An optimization study is done between the number of operating units and efficiency of each unit.