ENERGY DEMAND FROM IRRIGATION

The service demand for irrigation from pumping is based on several factors including the growth of the sector, cropping patterns, other irrigation facilities, and water management practices. These influence the ownership of pump-sets and the average hours of operation of a pump-set. Efficiency of pump-sets in turn determines the energy requirement to meet this service demand. This, along with the demand from mechanization constitutes the overall demand from the agriculture sector.

Demand from Irrigation

Level 1

This is a pessimistic picture for the sector whereby electrical pumping efficiency improves by merely 7 percent as pump replacements don't pick due to lack of support mechanisms, while diesel pumps don't improve at all. At the same time, higher HP pumps are employed for greater hours in response to depleting water table, exacerbating the problem. Micro irrigation and advanced water management practices (AWMPs) are still employed at less than 5 percent of their potential (Rajput & Patel, 2012). All this coupled with increase in gross cropped area (GCA) to meet the requirements of growing population results in demand growing by 7.25 percent till 2022, reducing to around 2 percent till 2047. Aggregate demand so obtained is 826 TWh in 2047.

Level 2

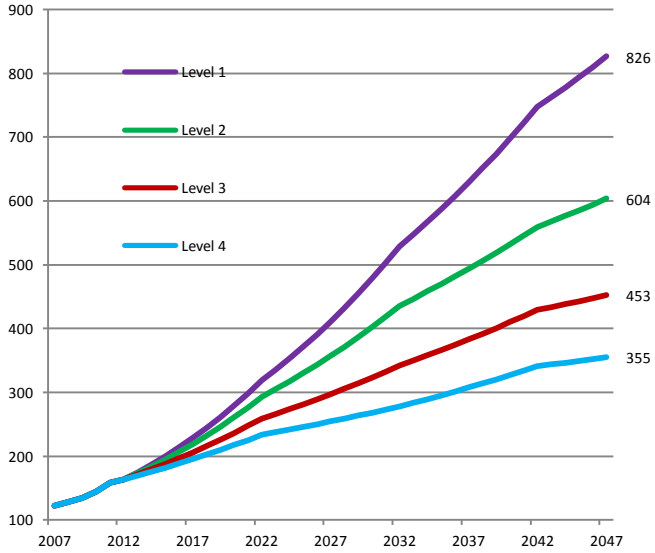
In Level 2, electrical pumping input improves by 18 percent and diesel pumping by 8 percent, yielding an average improvement of 17 percent. Ag-DSM, and various complementary watershed development programmes meet with limited success and micro-irrigation facilities are expanded, yielding an overall reduction of 27 percent from level 1 in 2047. Energy demand grows by 7 percent till 2022, and growth rate declines to 1.5 percent by 2042 and stabilise thereafter, yielding an aggregate demand of 604 TWh in 2047.

Level 3

Further improvement of 29 percent in pumping input requirement results from aggressive replacement of old pumps, slow increase in agricultural tariffs and improvement in reliability of power supply. Micro-irrigation is extensively used to 50 percent of its potential. At the same time, complementary schemes of inter-basin transfers reduce pumping needs and hours of use. All these result in a reduction of 45 percent from level 1 in 2047. Energy demand grows by 6.5 percent till 2022, and the growth rate declines to 1 percent by 2042, yielding an aggregate demand of 604 TWh in 2047.

Level 4

Level 4 envisages modern practices such as mulching (GHG technology) and vertical farming to optimise on water-use in response to scarcity of water resources. Government fast-tracks support to rain-fed areas, and increase in pumping demand from these areas slows down. Electrical pumping takes place at optimum loads, reducing losses and resulting in best efficiencies. Electricity supply is augmented and monitored for consistency. Diesel pumps achieve optimum efficiencies too, and weighted improvement in pumping input is 38 percent. As a result, energy demand grows by 6 percent till 2022, and growth rate falls to 0.75 percent in the 2040s. Overall demand reduces by 57 percent from Level 1 to 355 TWh.



ENERGY DEMAND FROM MECHANIZATION

The number of tractors in the country was about 5.3 million in 2011 and has been growing at 6 percent annually. This trend is expected to continue as only 19 percent of the potential market has been exploited (Ministry of Road Transport and Highways, 2012; Goel & Kumar, 2013). Total annual demand for diesel from tractors is estimated to be about 6 million tonnes (MT) in 2011. This, along with the demand from irrigation constitutes the overall demand from the agriculture sector.

Level 1

There is no improvement in fuel efficiency of tractors, and demand side incentives to improve efficiency are absent. Tractors continue to use 4.5 lph. The demand for diesel reaches saturation at 32 million tonnes (MT) by 2031.

Level 2

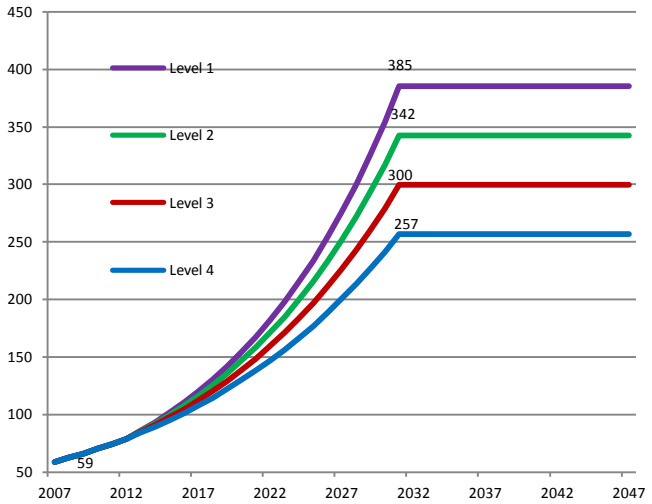
Fuel efficiency improves reducing fuel requirement for an hour of operation to 89 percent of the present value. The improvement in specific fuel consumption (SFCs) is autonomous and by 2031, tractors use 4 lph of diesel. Average hours of use remain at 500 hours per year. The demand for diesel reaches saturation at 28 MT.

Level 3

In Level 3, fuel efficiency further improves, with only 3.5 litres needed to run for an hour, a 22 percent improvement from Level 1. The ceiling for maximum SFCs is tightened by Bureau of Indian Standards (BIS). Tractors are used for 500 hours per year. The demand for diesel grows to 25 MT by 2031 and stabilizes thereafter.

Level 4

Level 4 assumes that fuel efficiency of tractors improves significantly, resulting in fuel savings of 33 percent. BIS restricts the penetration inefficient tractors with fuel consumption above specified SFC norms. Deregulation of diesel prices for agriculture sector also pushes up the sale of fuel efficient tractors. Demand for diesel in this level reaches saturation at 21 MT.



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Note: Please see detailed documentation for fact references