Case 01: Incentives for Demand Management, Westlands, Pima Cotton

Location: Westlands irrigation district / Fresno County (Western San Joaquin Valley)

- 10,000 acres
- Pima cotton, tomatoes, garbanzos, onions, pistachios, almonds, grapes
- Subsurface drip, fan jets, double line drip
- 7 deep wells
- Surface water from Westlands irrigation district
- 63 booster pumps
- Integrated network of submains (70+ miles of pipe)

Introduction

This example considers scheduling of irrigation water and energy for a single 160-acre field of cotton in 2018.

The producer uses multiple pumps operating in parallel to deliver water through a pipe network to multiple fields. The pumps are normally running 24/7 for the entire season, so when pumping is curtailed the irrigation schedules for the particular fields being irrigated at the time will be altered.

TOU scheduling was quickly ruled out due to the pressure requirements during peak season of the integrated pipe network used to deliver the water across the ranch. We then looked at demand response (DR) incentives.

Demand Response opportunities for cotton

To irrigate the field the pump network must deliver a total dynamic head of 400 ft. requiring 335 kW of power. Figure 1 shows the 2018 irrigation schedule for the field in question, a total of 490 hours of pumping. Dates of curtailment requests during the 2018 season are also shown as green markers along the date line.

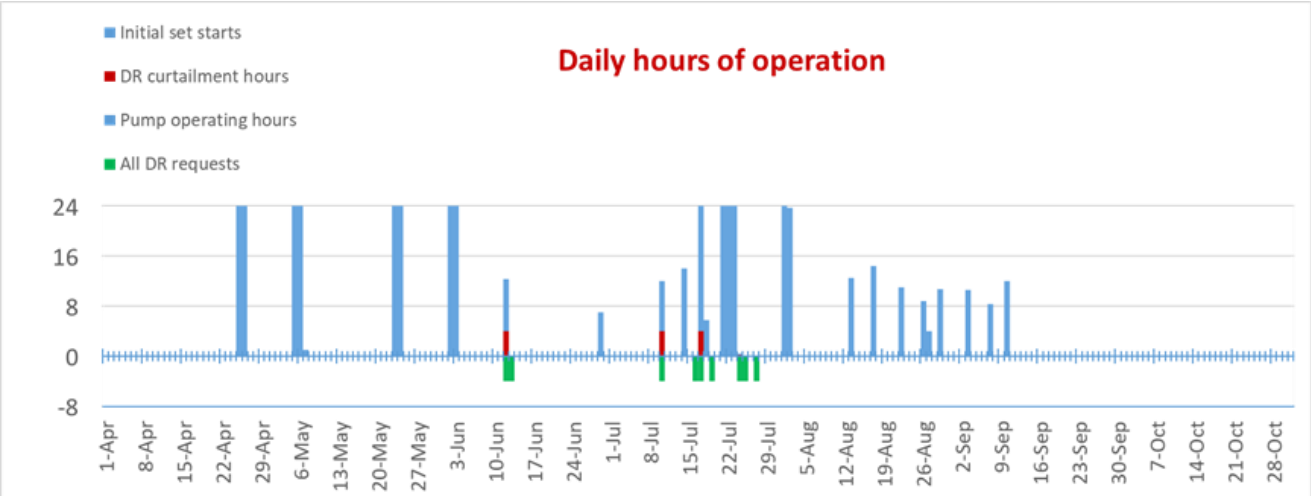

Figure 1: the irrigation schedule and timing of 2018 DR requests

DR requests occurred on nine dates, but because there were relatively few irrigation events and long intervals between the irrigations only three of those DR events coincided with irrigation events for that

field, once in June and twice in July. Those three curtailments, marked in red in Figure 1, would not appear to significantly disrupt the overall seasonal irrigation plan for the farm.

Estimated incentive payments

If the farm had participated in the three curtailment requests the potential incentive payments would have been $1590 for the event in June and $2875 for each of the events in July, a total of $7,348. If we assume that same pumping capacity was used to irrigate other similar fields when not irrigating the example field, enabling the farm to participate in the other six DR events, the farm would have earned another $13,090. Additionally, during the months when no DR events occurred the farm would still have qualified for an additional $13,428 as payments for its readiness to participate. The total benefit to the farm would then have been **$33,866**.

Caveat

The $33,866 figure is an estimate of the maximum potential incentive payments offered by a utility. However, these payments can also be reduced in two ways. First, they may be offset by penalties if the participating farm often declines curtailment requests. Second, participating farms commonly contract with an 'aggregator', a company that assembles portfolios of participating farms and then contracts separately with the utility. In that case the incentive payments will be reduced by the contract arrangement with the aggregator. However, if the farm contracts directly with the utility it would receive the full payments.

Alternative approaches

Revising the irrigation schedule

The farm can deal with curtailments by revising the seasonal irrigation schedule to compensate for the lost time. The simplest option would be to extend an interrupted irrigation or increase the duration of a subsequent irrigation. In this example case, with the primary pumping network already running 24/7, some supplemental ground water pumping capacity would be needed to maintain the planned irrigation schedule.

Another alternative would be to build a re-regulating reservoir with sufficient storage capacity for four hours of supplemental irrigation (2 acre feet in this case), which would enable the farm to continue irrigating with a low power booster pump while curtailing the substantially higher power demand for pumping well water. That would simplify the rescheduling of later irrigations and enable the farm to maintain pressure in the irrigation system. The 335 kW reduction in ground water pumping load would be partially offset by a 63 kW increase for the booster pump, leaving a net reduction of 272 kW. The resulting incentive payments would be reduced to $27,500.

Deficit irrigation

A third option is to simply accept the reduced irrigation time and the resulting deficit in applied water. The incentive payment would be the full $33,866 but there would be a potential yield impact. In the present case the 12 hours of curtailed irrigation would reduce the total applied water by about 3%. Based on the simple FAO#33 yield model we estimated that the yield would be reduced by a corresponding 3%. The potential cotton fiber quality impacts of this deficit are more difficult to quantify, but generally the crop is more vulnerable to irrigation deficits the week preceding and following each bloom.