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Interactive comment on "Pump schedules optimisation with pressure aspects in complex large-scale water distribution systems" *by* P. Skworcow et al.

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First of all the Authors would like to thank Tom Walski for providing a very interesting and relevant comments which shall be helpful in further work of the Authors. Our replies to each comment are addressed below.

- *The authors should mention that the price of energy is treated as a function of time which is good but they are neglecting some of the other complexities that exist in real energy tariffs. These would include peak demand charges and block rate pricing among others. They may want to look into Walski (2012).*

The method presented in the paper is oriented for the unit tariff in order to minimize energy consumption and energy cost. Inclusion of the peak demand charge requires longer horizon optimization, for instance one month and stochastic treatment as demonstrated in McCormick, G. and Powell, R. (2003). "Optimal Pump Scheduling in Water Supply Systems with Maximum Demand Charges." J. Water Resour. Plann. Manage., 129(5), 372–379. The block charges cause the objective function (energy consumption) to be non-smooth but only in isolated points. The nonlinear programming algorithm (CONOPT) should be able to cope with these isolated points.

- *It would have been very helpful to have provided a schematic map of the distribution.*

  A schematic of the network with fictitious names will be provided to the editor to be included in the final version of the paper. The schematic is also attached to this reply.

- *I am concerned about the use of Flow Control Valves (FCV) in models when these valves do not exist in the real system being modeled. These FCV's can produce flows in the model which cannot be achieve in the real system. Is there a real FCV in the system or are they being used to "trick" the model into producing flows? Are there real FCV's as shown in Figure 2? Valves like this tend to waste energy.*

  The optimization model has been created from a detailed EPAnet model provided by a water company. In the provided model there were components modelled in a unique EPAnet way e.g. pipes with assigned control rules. The EPAnet model was the only source of information and we did not have additional information about represented physical components. A pipe with the open-close control rule assigned was replaced with an equivalent valve (FCV) to ensure that only control elements are actually controlled in the model.

- *In mentioning commercial optimization packages, the authors should also have mentioned the Darwin Scheduler in WaterGEMS from Bentley Systems.*

  The reference to WaterGEMS will be provided to the editor be included in the text.

- *The authors list that 315 and 40 valve in their original and reduced models but they should indicate which are isolation valves, which are open-closed, and which are control valves, which can have a continuum of settings.*

  An additional table (see below) presenting function of each valve will be provided to the editor to be included in the text.

Table 1. Function of each valve in the original model and actions performed during the model reduction. (*) not classified as a valve in the total valves count in the original model.

Type	Status	# in original model	Action	# in reduced model
PRV	permanently closed	3	removed	0
	active	39	retained	39
FCV	active	1	retained	1
TCV	close-open control rule	1	converted to FCV	0 (1)
	isolation valve	51	removed	0
	constant opening	220	converted to pipe	0
Pipe*	close-open control rule	1	converted to FCV	0 (1)
Total		315		39 (42)

- *It was not completely clear which decision variables are solved for using equation (8) as the objective function. For pumps, was it on-off status or speed? For valves, was it open-closed or some indicator of relative opening?*

  The decision variables are pumps on-off status, normalised pumps speed and valve opening.

figure-1.pdf