



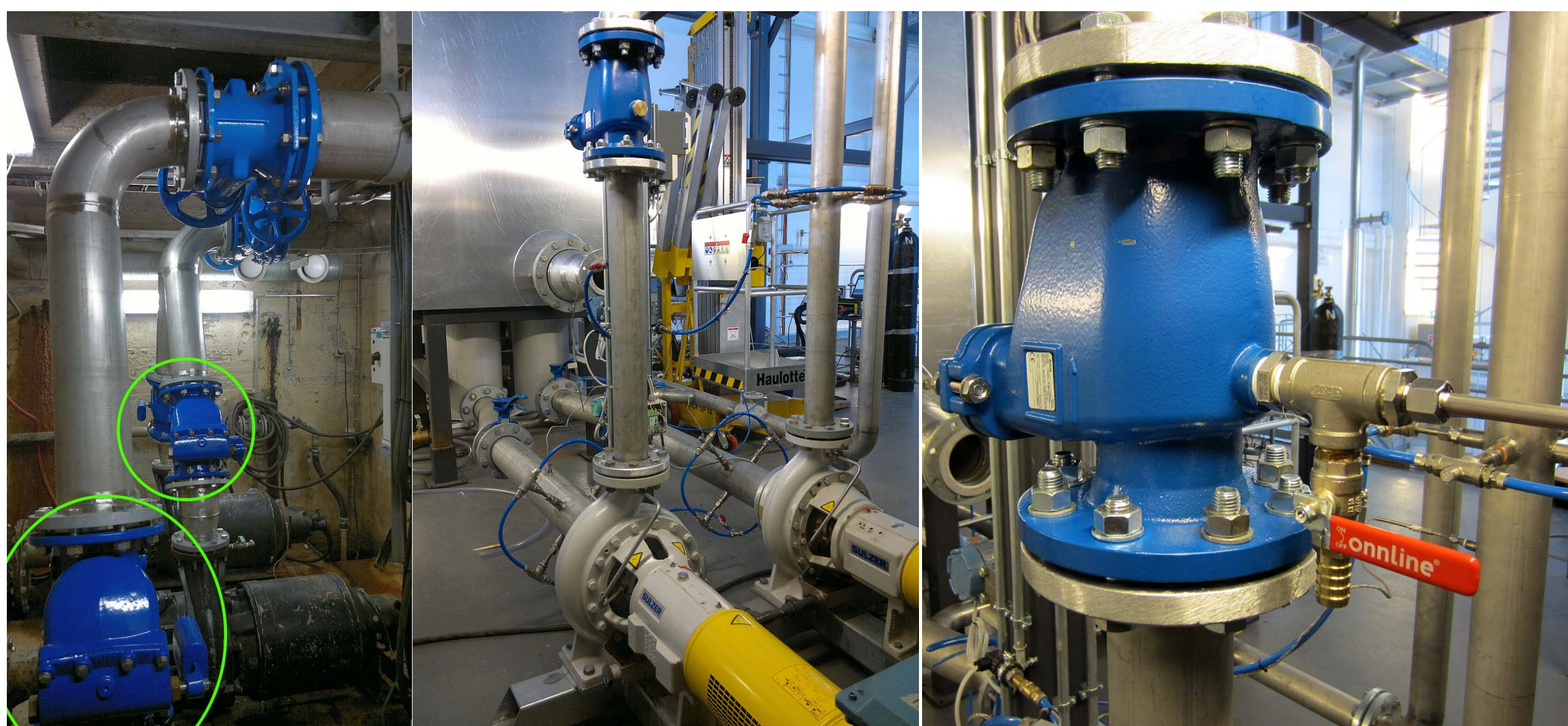
# efeu

Efficient Energy Use

## Monitoring of non-return valve operation with a variable-speed drive

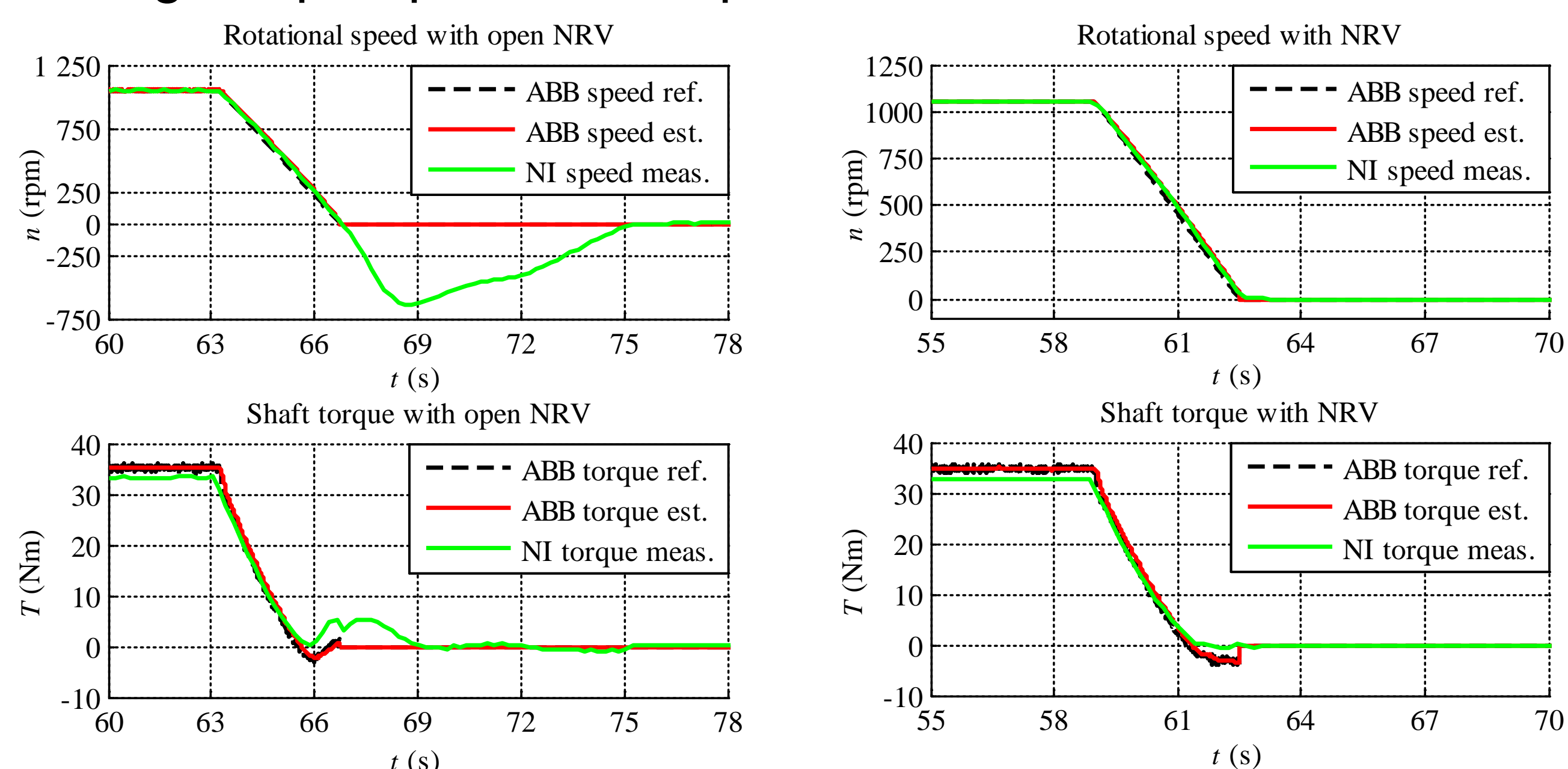
Pumps are often installed to systems, where the fluid flow is allowed only to a single direction. If the non-return valve fails, consequences due to flooding may be severe. Fortunately this can be immediately detected with a variable-speed drive.

The return flow in wastewater stations must be prevented with the use of non-return valves (NRVs). When the pump is started, the resulting pressure will open the NRV. Correspondingly, the pump shutdown will lead to the NRV closure. If the NRV doesn't close, it may lead to water flooding in the pumping station with severe consequences.



### Effect of NRV failure on the pump speed and torque

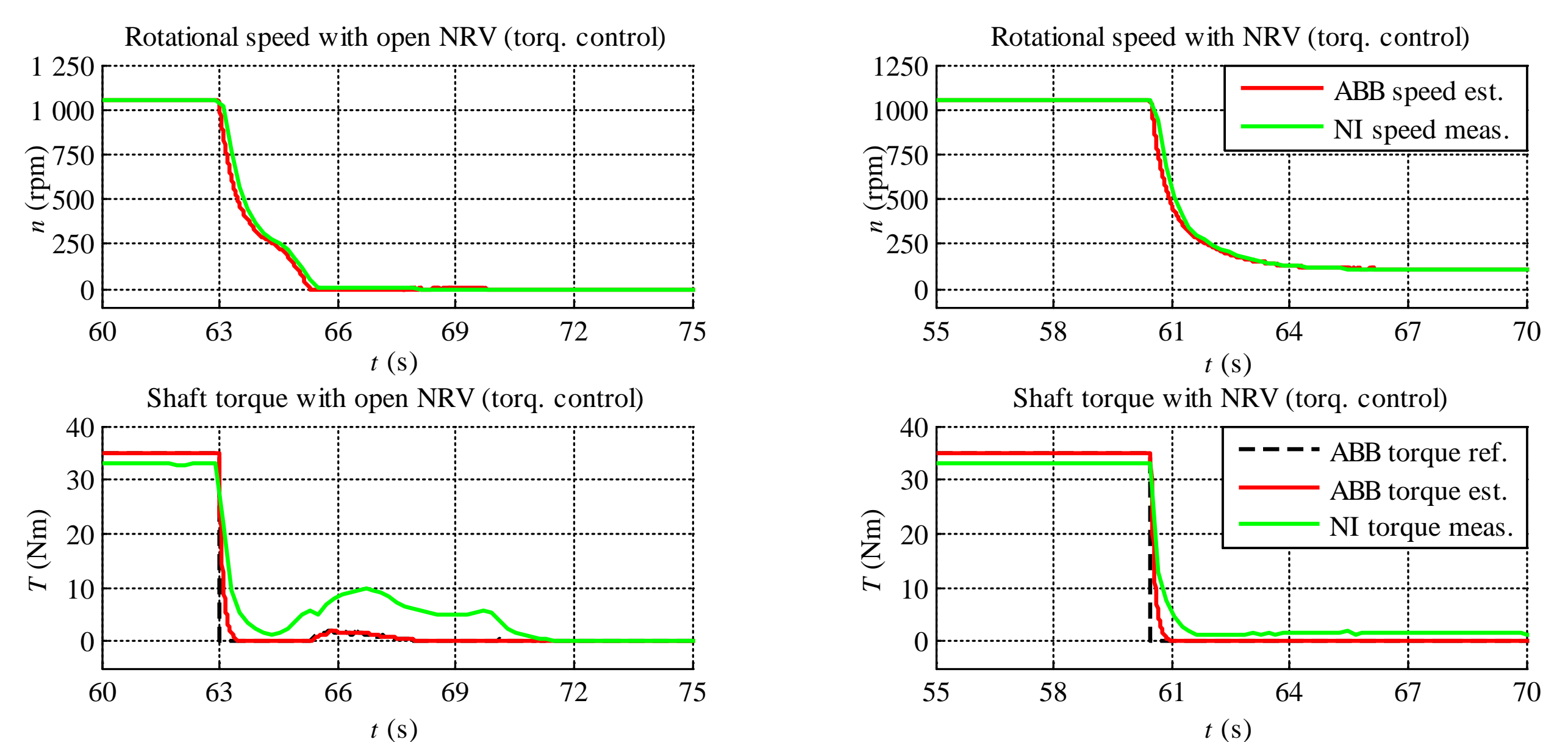
NRV failure and return flow in the piping leads to reversed pump rotation (see left-side figure). The return flow can also be seen in the VSD estimates as additional torque usage for realising certain speed ramp, if the drive is operating during the pump shutdown process.



Detection of NRV failure with a variable-speed drive is possible either **1) by monitoring the shaft torque behaviour during the shutdown** and comparing it with the known reference behaviour; or **2) by applying torque control mode for shutting down the pump** with zero torque reference. The first method is directly applicable to existing systems, while the second method allows accurate monitoring of the rotational speed behaviour and also prevention of reversed pump operation.

### Test results with jammed non-return valve

- Test runs shown left were applied to demonstrate the first detection method:  $\Sigma T_{est,ref} = -217.61$  Nm and  $\Sigma T_{est,inst} = -37.40$  Nm in the speed range of 0–500 rpm.
- The second detection method was evaluated by shutting down the pump with zero torque reference. In addition, 0 rpm was set as the minimum speed limit for the pump. Results below show how instantaneous torque boost is needed to prevent the reversed pump rotation.



- Automatic monitoring of NRV condition is possible with a modern variable-speed drive. If needed, torque-control-based approach can be used for instantaneous NRV failure detection and reversed flow prevention.



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