#3. Sugar Evaporation Plant Optimization

Objective: Minimize capital cost and avoid steam losses during syrup evaporation.

Plant Details:

- Capacity: 9500 TCD sugar juice (syrup) evaporation
- Clear juice: 492.61 TPH, 13.16% DS, 82.40% purity
- Target syrup: 69.0% DS via five-stage evaporator
- Steam supply: Stages 1–4 from live steam; Stage 5 uses MVR to optimize steam economy

5th Effect Evaporator Operation

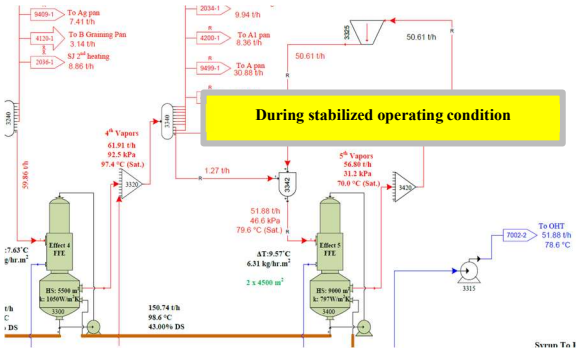
Supplier Philosophy:

Startup:

- Bypass MVR system
- Connect fourth-effect vapor to fifth effect through control valve
- Vent fifth-effect vapor to atmosphere (condenser use uneconomical at startup)

Stabilized Operation:

- Bring MVR online; divert fourth-effect vapor to other heating needs
- Feed fifth-effect vapor to MVR, recompress, and recycle to fifth effect
- Supply makeup steam as needed
- Control excess vapor via a condenser and pressure control valve (PCV)

Recommended Philosophy:

- Fourth-effect vapor is not required for startup
- Pressure difference between fourth (105.9 kPa abs) and fifth effect (31.2 kPa abs) causes syrup flashing, providing initial vapor for MVR
- MVR should start at low speed; vapor quantity increases as recycled to fifth effect until target conditions are reached
- Makeup steam can supplement flash vapor if necessary
- Eliminates need for a fourth-effect vapor line and associated control valve, reducing complexity and cost