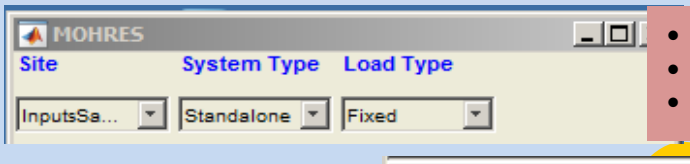
Case Study 2- Design of a Standalone HRES based on End-User Requirements

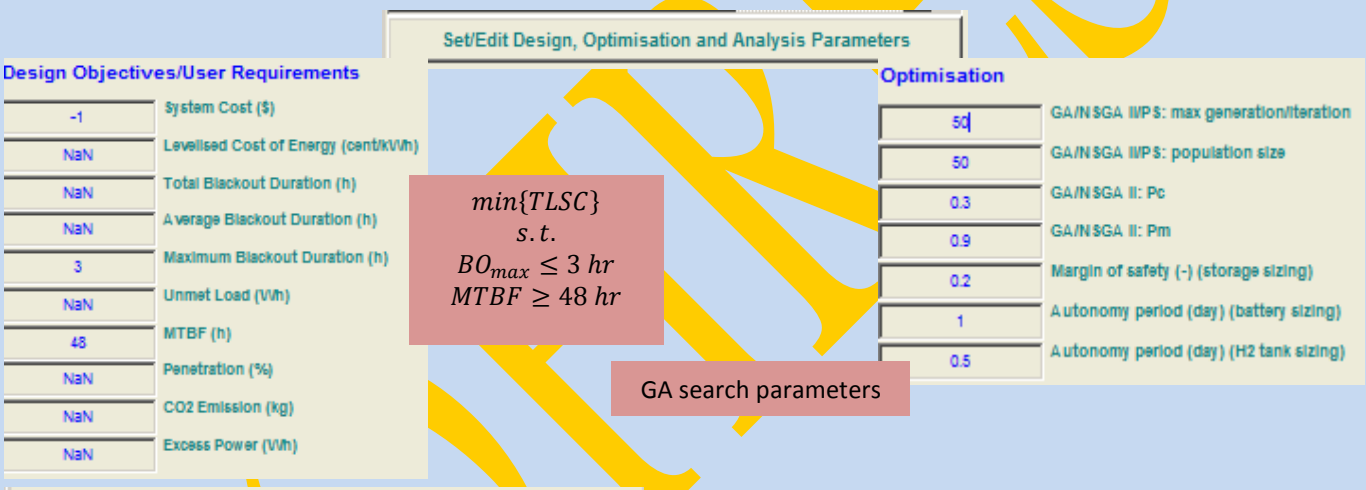
The end-user looks for the cheapest system possible. They can tolerate the **power cuts of up to three hours** as long as the **average time between two consecutive power cuts is more than two days**.

Background Theory:

- **Integrated Configuration-Size Optimisation**
- **Implementation of User Requirements using BO distribution and MTBF**
- **Deterministic Design**
- **Dispatch Strategy as Design Variable**
- **Single Objective Optimisation**
- **Genetic Algorithm**

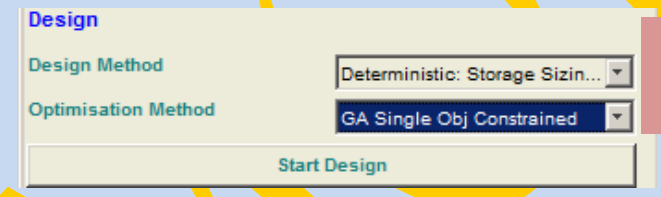


- InputsSample.xlsx
- Standalone
- Fixed

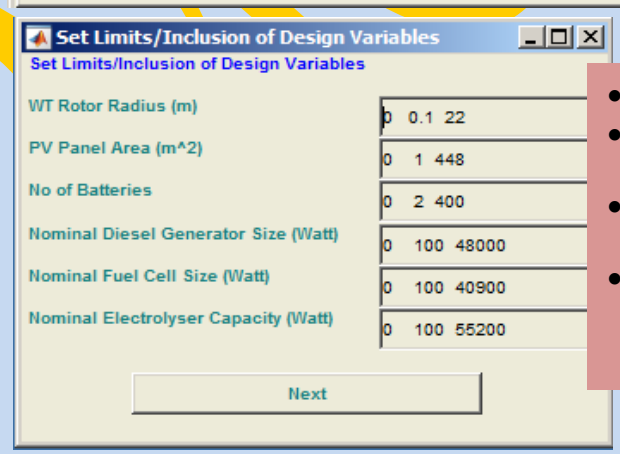


$$min\{TLSC\}$$
$$s.t.$$
$$BO_{max} \leq 3\ hr$$
$$MTBF \geq 48\ hr$$

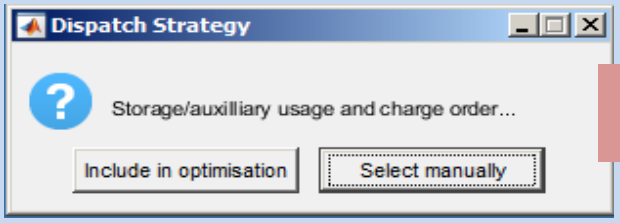
GA search parameters



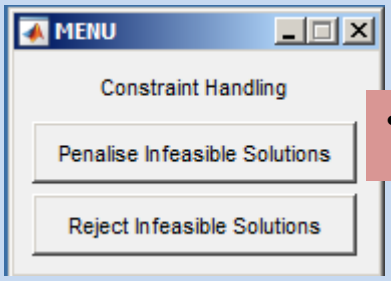
- Deterministic: Storage sizing along with other components
- Genetic Algorithm



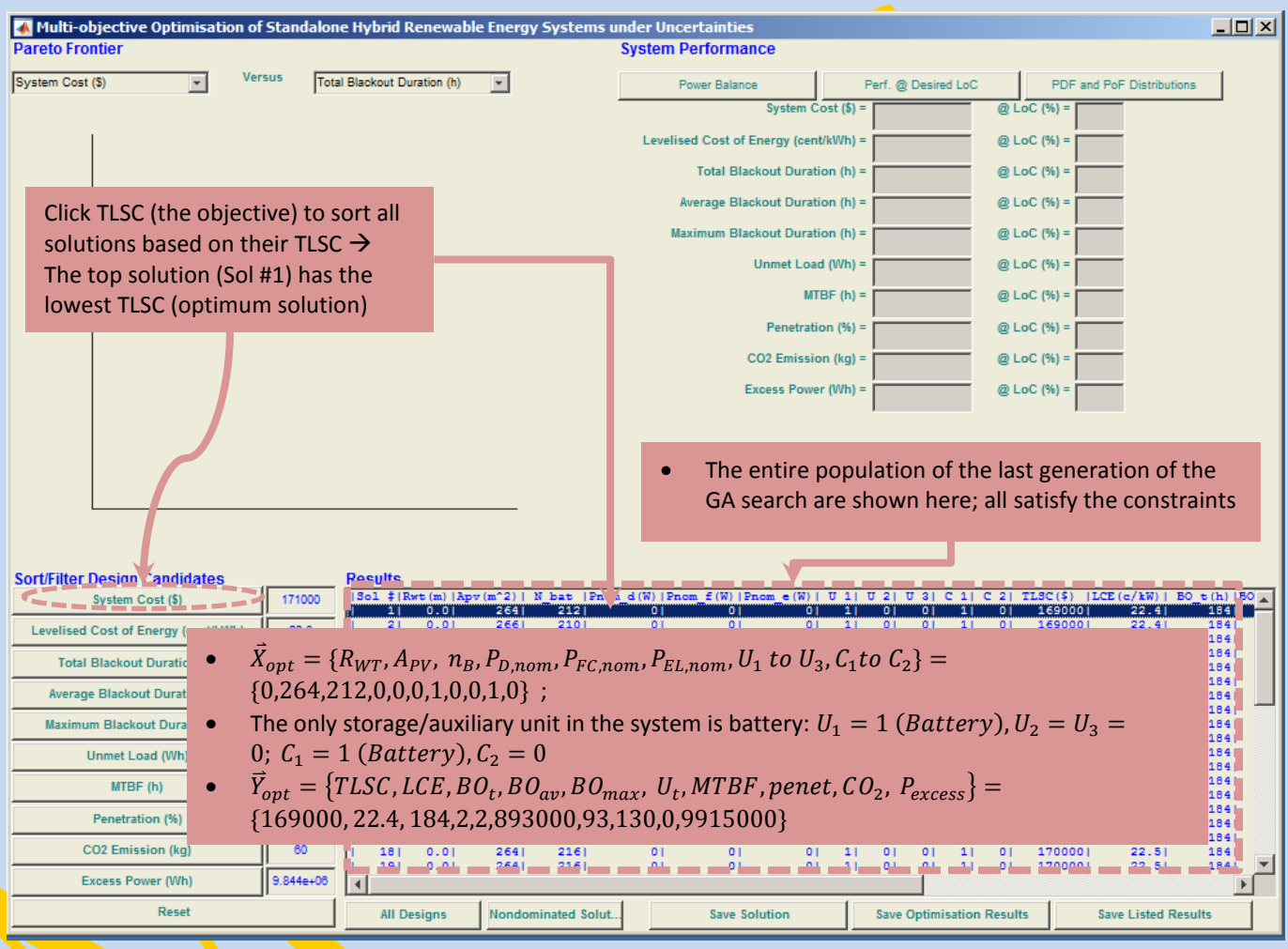
- Lower and upper limits populated automatically
- Upper limits are calculated based on worst case scenarios (editable)
- Steps, also populated automatically, do not apply to genetic algorithm (MOHRES ignores them here)
- All lower limits are set to zero to allow reducing the configuration from a full generic Wind-PV-Battery-Diesel-Fuel cell/Electrolyser to any other potential configuration



- Include in optimisation: Add dispatch strategy to the set of design variables



- Reject Infeasible Solutions (this optimisation problem is not too constrained/design space is not too rigid)



Click TLSC (the objective) to sort all solutions based on their TLSC → The top solution (Sol #1) has the lowest TLSC (optimum solution)

- The entire population of the last generation of the GA search are shown here; all satisfy the constraints

- $\vec{X}_{opt} = \{R_{WT}, A_{PV}, n_B, P_{D,nom}, P_{FC,nom}, P_{EL,nom}, U_1 \text{ to } U_3, C_1 \text{to } C_2\} = \{0,264,212,0,0,0,1,0,0,1,0\}$;
- The only storage/auxiliary unit in the system is battery: $U_1 = 1\ (Battery), U_2 = U_3 = 0;\ C_1 = 1\ (Battery), C_2 = 0$
- $\vec{Y}_{opt} = \{TLSC, LCE, BO_t, BO_{av}, BO_{max}, U_t, MTBF, penet, CO_2, P_{excess}\} = \{169000, 22.4, 184, 2, 2, 893000, 93, 130, 0, 9915000\}$