

$$\min_{N_{y,m,\sigma}, P_{m,i}, R_{m,\sigma} \in \mathbb{Z}^*} \frac{1}{|S|} \cdot \sum_{\sigma \in S} \left( \sum_{m \in M} \left[ \sum_{y \in Y} (N_{y,m,\sigma} \cdot c_{y,m}) + \sum_{i \in I^P} (P_{m,i} \cdot d_P \cdot e_m^H) + \sum_{i \in I^R} \left[ \sum_{m'=0}^m (f_{m',i,\sigma} - R_{m',i,\sigma}) \right] \cdot e_m^H \cdot H_m \right] \right) \quad (1)$$

subject to:

$$L_y \cdot N_{y,m,\sigma} + L_{y,m}^{Inst} \geq \sum_{i \in I^P} (P_{m,i} \cdot d_y^P) + \sum_{i \in I^R} (R_{m,i,\sigma} \cdot d_{y,i}^R) \quad \forall \sigma \in S, \forall m \in M, \forall y \in Y \quad (2)$$

$$\sum_{m'=0}^{m-1} f_{m',i,\sigma} \geq \sum_{m'=0}^m R_{m',i,\sigma} \quad \forall \sigma \in S, \forall m \in M, \forall i \in I^R \quad (3)$$

$$P_{m,i} \leq \sum_{m'=0}^{m-G^{MIN}} P_{m',(i-1)} - \sum_{m'=0}^{m-1} P_{m',i} \quad \forall m \in M, \forall i \in I^P \quad (4)$$

$$P_{m,i} \geq \sum_{m'=0}^{m-G^{MAX}} P_{m',(i-1)} - \sum_{m'=0}^{m-1} P_{m',i} \quad \forall m \in M, \forall i \in I^P \quad (5)$$

$$N_{y,m,\sigma} \leq A_{y,m} - N_{y,m}^{Inst} \quad \forall \sigma \in S, \forall m \in M, \forall y \in Y \quad (6)$$

# Model Explanation

- (1) The objective takes an average cost of all scenarios by counting up the cost per month. Each month has a cost for vessels chartered (by type), the energy lost due to planned maintenance, and the energy lost due to unrepaired failures
- (2) For each vessel type the available time (based on charters and spare time from installation) needs to surpass the estimated total time all tasks take
- (3) For any type of reactive task, the amount of tasks performed cannot exceed the amount of failures of that type (with a 1 month delay before a failure can be solved)
- (4) Ensures planned tasks are not scheduled too close together by counting up the turbines that were last visited  $G^{MIN}$  or more months ago and subtracting all that were revisited later
- (5) Ensures planned tasks are not scheduled too far apart, in similar manner as the previous constraint
- (6) Limits the maximum amount of vessels chartered based on normal availability and vessels used for installation

# Notation overview