$$variables = \begin{array}{cccccccc} \textbf{Bid} & P_H & P_G & P_P & E & d & T & P_{DL} \\ [\ \ x0 & x1 & x2 & x3 & x4 & x5 & x6 & x7\ \ ] \end{array}$$

$$\begin{array}{c|cc|c} Bid_i & 0 & & x_0 \\ P_{Hs} & 1 & s & x_1 \\ P_{Gs} & s{+}1 & 2s & x_2 \\ P_{Ps} & 2s{+}1 & 3s & x_3 \\ E_s & 3s{+}1 & 4s & x_4 \\ d_s & 4s{+}1 & 5s & x_5 \\ T_s & 5s{+}1 & 6s & x_6 \\ P_{DLs} & 6s{+}1 & 7s & x_7 \end{array}$$

Equations:

Eq. 0: Market Bid for period i $\Rightarrow [0 : s-1]$

$Bid_i = P_{Hs,i} + P_{Gs,i}$

$$
Eq.\,0 = \begin{array}{cccccccc} Bid_i & P_{Hs,i} & P_{Gs,i} & P_{Ps,i} & E_{s,i} & d_s,i & T_{s,i} & P_{DLs,i} \\ \left[\begin{array}{cccccccc} 1 & -1 & -1 & 0 & 0 & 0 & 0 & 0 \end{array}\right] \end{array}
$$

$b = \begin{bmatrix} 0 \end{bmatrix}$

Eq. 1: Initial Reservoir Level $\Rightarrow [s : 2s-1]$

$\hookrightarrow$ 1st hour

$E_{s,1} = past\_reservoir\_level$

$$
Eq.\,1 = \begin{array}{cccccccc} Bid_i & P_{Hs,i} & P_{Gs,i} & P_{Ps,i} & E_{s,i} & d_s,i & T_{s,i} & P_{DLs,i} \\ \left[\begin{array}{cccccccc} 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{array}\right] \end{array}
$$

$b = \begin{bmatrix} e\_begin \end{bmatrix}$

Eq. 2: Reservoir level $\Rightarrow [2s : 3s-1]$

$\hookrightarrow$ remaining hours

$$E_{s,i} = E_{s,i-1} + t \cdot \left[\eta_P \cdot P_{Ps,i-1} - \frac{P_{Hs,i-1}}{\eta_H} \right]$$

$$
Eq.\,2 = \begin{array}{cccccccc} Bid_i & P_{Hs,i} & P_{Gs,i} & P_{Ps,i} & E_{s,i} & d_s,i & T_{s,i} & P_{DLs,i} \\ \left[\begin{array}{cccccccc} 0 & 1_{t-1} \cdot \frac{t}{\eta_H} & 0 & -1_{t-1} \cdot \eta_P \cdot t & -1_{t-1} & 0 & 0 & 0 \end{array}\right] \end{array}
$$

$b = \begin{bmatrix} 0 \end{bmatrix}$

Eq. 3: Imbalance for every scenario $\Rightarrow [3s : 4s-1]$

$d_{s,i} = P_{Gs,i} - P_{Ws,i} + P_{Ps,i} + P_{DL_{s,i}}$

$$
Eq.\,4 = \begin{array}{cccccccc} Bid_i & P_{Hs,i} & P_{Gs,i} & P_{Ps,i} & E_{s,i} & d_s,i & T_{s,i} & P_{DLs,i} \\ \left[\begin{array}{cccccccc} 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1 \end{array}\right] \end{array}
$$

$b = \begin{bmatrix} P_{Ws,i} \end{bmatrix}$

Inequalities:

Ine. 0: Hydro Generation $\Rightarrow [0 : s-1]$

$$P_{Hs,i} \leq \eta_H \cdot \left[\frac{E_{s,i}}{t} + \eta_P \cdot P_{Ps,i} \right]$$

	Bid_i	$P_{Hs,i}$	$P_{Gs,i}$	$P_{Ps,i}$	$E_{s,i}$	d_s, i	$T_{s,i}$	$P_{DLs,i}$
$Ad.\ 0 =$ [	0	1	0	$-t \cdot \eta_H \cdot \eta_P$	$-\frac{\eta_H}{t}$	0	0	0]

$bd = \begin{bmatrix} 0 \end{bmatrix}$

Ine. 1: Epigraph Form (1) $\Rightarrow [s : 2s-1]$

$$d_{s,i} \cdot (p_i - p_i^+) \leqslant T_{s,i}$$

	Bid_i	$P_{Hs,i}$	$P_{Gs,i}$	$P_{Ps,i}$	$E_{s,i}$	d_s, i	$T_{s,i}$	$P_{DLs,i}$
$Ad.\ 1 =$ [	0	0	0	0	0	$p - p\_plus$	-1	0]

$bd = \begin{bmatrix} 0 \end{bmatrix}$

Ine. 2: Epigraph Form (2) $\Rightarrow [2s : 3s-1]$

$$-d_{s,i} \cdot (p_i^- - p_i) \leqslant T_{s,i}$$

	Bid_i	$P_{Hs,i}$	$P_{Gs,i}$	$P_{Ps,i}$	$E_{s,i}$	d_s, i	$T_{s,i}$	$P_{DLs,i}$
$Ad.\ 2 =$ [	0	0	0	0	0	$p\_minus - p$	-1	0]

$bd = \begin{bmatrix} 0 \end{bmatrix}$

Ine. 3: Hydro + Pump Constraint $\Rightarrow [3s : 4s-1]$

$$P_{Hs,i} + P_{Ps,i} \leq P_H^M$$

	Bid_i	$P_{Hs,i}$	$P_{Gs,i}$	$P_{Ps,i}$	$E_{s,i}$	d_s, i	$T_{s,i}$	$P_{DLs,i}$
$Ad.\ 3 =$ [	0	1	0	1	0	0	0	0]

$bd = \begin{bmatrix} P_H^M \end{bmatrix}$