In Pakistan Furnace units are consuming a max. of 50t/d Cl2 (g)
0.5Cl2 + 0.5H2 == HCl

so HCl produced

$$\frac{36.5}{35.5}\cdot 50\ \frac{ton}{day} = 51.408\ \frac{ton}{day}$$

HCl synthesis units with included steam generation. For units >60 t/d HCl we offer a membrane wall synthesis unit. For units <60 t/d HCl we propose our patented ECOSYN® option, using the water tube boiler concept. Nearly 40 % of the generated heat can be recovered as steam via a membrane wall unit, up to 60 % with the ECOSYN unit.

For SGL

The generated heat of combustion (approx. 0.7 kWh per kg of HCl (100 %)) and the heat of absorption in water (approx. 0.5 kWh per kg of HCl (100 %)) can be utilized to produce steam and hot water which can be used in other processes in the plant. Especially steam generation can be quite profitable.

Ecosyn disadvantage external absorber

$Heat\_Efficiency\_Transfer := 0.6$

$$Heat\_for\_Steam := \frac{0.5\ kW}{kg}\cdot 1\ hr$$

ton/day of HCl fluctuation

$$HCl\_Production := \left[\left(30\ \frac{ton}{day}\right), 35\ \frac{ton}{day}\,..\left(55\ \frac{ton}{day}\right)\right] = \begin{bmatrix}30\\35\\40\\45\\50\\55\end{bmatrix}\ \frac{ton}{day}$$

$$Heat\_HCl\_Production := Heat\_for\_Steam\cdot Heat\_Efficiency\_Transfer\cdot HCl\_Production = \begin{bmatrix}340.194\\396.893\\453.592\\510.291\\566.99\\623.69\end{bmatrix}\ kW$$

How much steam is produced per day @10barg

4.3 is the heat capacity, entering water temperature is 30, 2778 is steam enthalpy at 10barg

$$Steam\_Calc := m\cdot\left(\left(4.3\ \frac{kJ}{kg\ \Delta^{\circ}C}\cdot(100\ ^{\circ}C - 30\ ^{\circ}C)\right) + 2778\ \frac{kJ}{kg}\right)$$

$st\_mass(x) := maple(solve(Steam\_Calc = x, m))$ <--- Maple don't need units here.

This is for 10barg saturated steam. If the steam pressure is reduced so will be its enthalpy (2778 used in Steam_Calc eq.) & higher quantity we will achieve.

$$Steam\_Mass := \overrightarrow{st\_mass\left(Heat\_HCl\_Production\right)} = \begin{bmatrix}0.4385\\0.5115\\0.5846\\0.6577\\0.7308\\0.8038\end{bmatrix}\ \frac{ton}{hr}$$

production flow, such as boiler. In case of synthesis unit producing more than 40 metric tons 100% HCl per day, the heat recovery option is designed to generate around 1 000 kg/hour of saturated steam at 4.5 bara (147°C). The pressure can be increased up to 8 bara, depending on the process (check case by case).

Native smath roots, for this simple equation, don't need guess values. Notice that here we need to introduce the units, because roots don't handle them. Maple don't too, but preserve them as undefined variables, and returns the correct results doing that.

Units for roots: $u := \frac{kg}{s}$

$$Steam\_Mass := \overrightarrow{roots\left(Steam\_Calc = \frac{Heat\_HCl\_Production}{u}, m\right) \cdot u}$$

$$Steam\_Mass = \begin{bmatrix} 0.4385 \\ 0.5115 \\ 0.5846 \\ 0.6577 \\ 0.7308 \\ 0.8038 \end{bmatrix} \frac{ton}{hr}$$