



INERGE



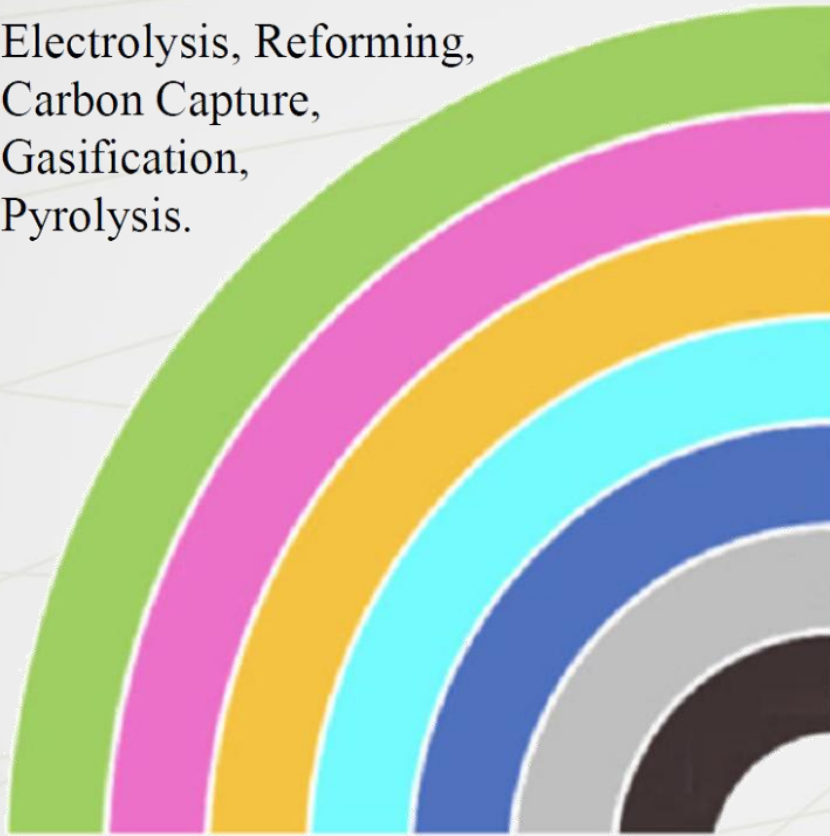
Lecture

Off-grid low-carbon hydrogen generation system with photovoltaic source and battery

Edson da Costa Bortoni
Professor at UNIFEI



Electrolysis, Reforming,
Carbon Capture,
Gasification,
Pyrolysis.



Green

Pink

Yellow

Turquoise

Blue

Gray

Brown / Black

White

$< 2 \text{ kg CO}_2\text{e} / \text{kg H}_2$

$< 3 \text{ kg CO}_2\text{e} / \text{kg H}_2$

$\sim 11 \text{ kg CO}_2\text{e} / \text{kg H}_2$

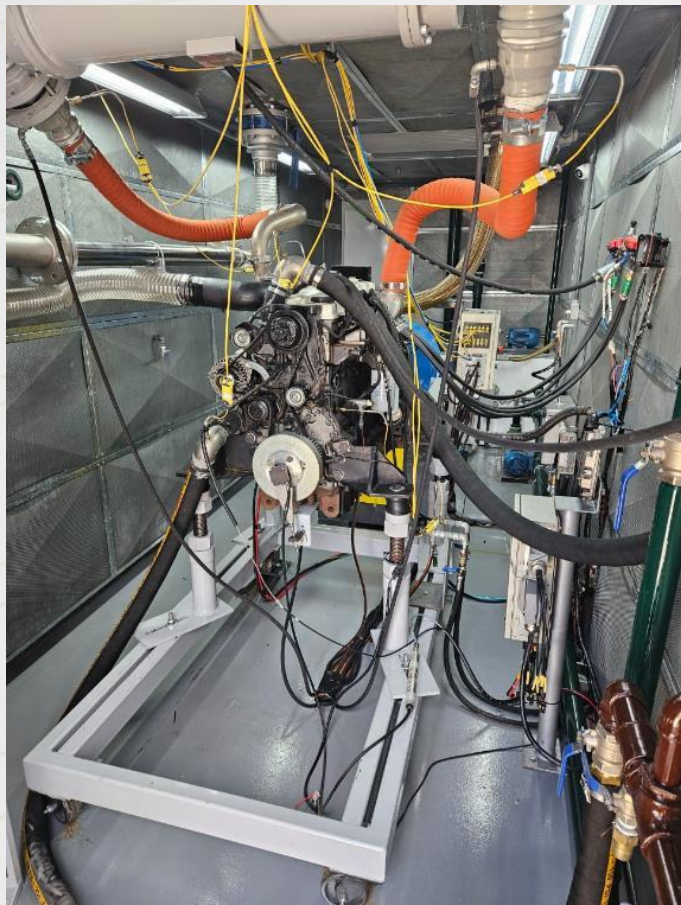
$> 20 \text{ kg CO}_2\text{e} / \text{kg H}_2$

$0 \text{ kg CO}_2\text{e} / \text{kg H}_2$













Área de expansão da Universidade
Campus Unifei



CH2V



MINISTÉRIO DE MINAS E ENERGIA

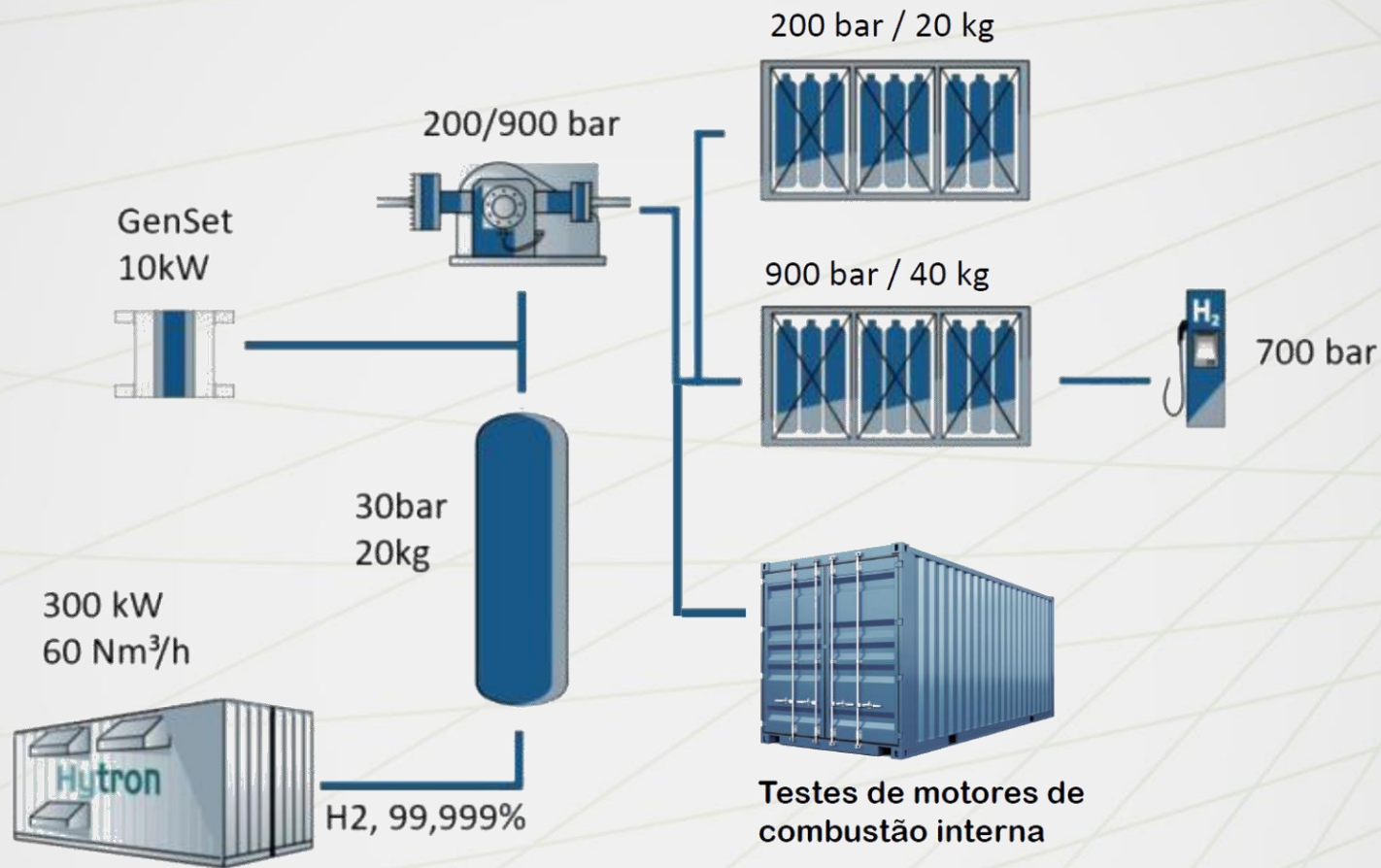
giz

H2BRASIL
Expansão do Hidrogênio Verde



CEMIG







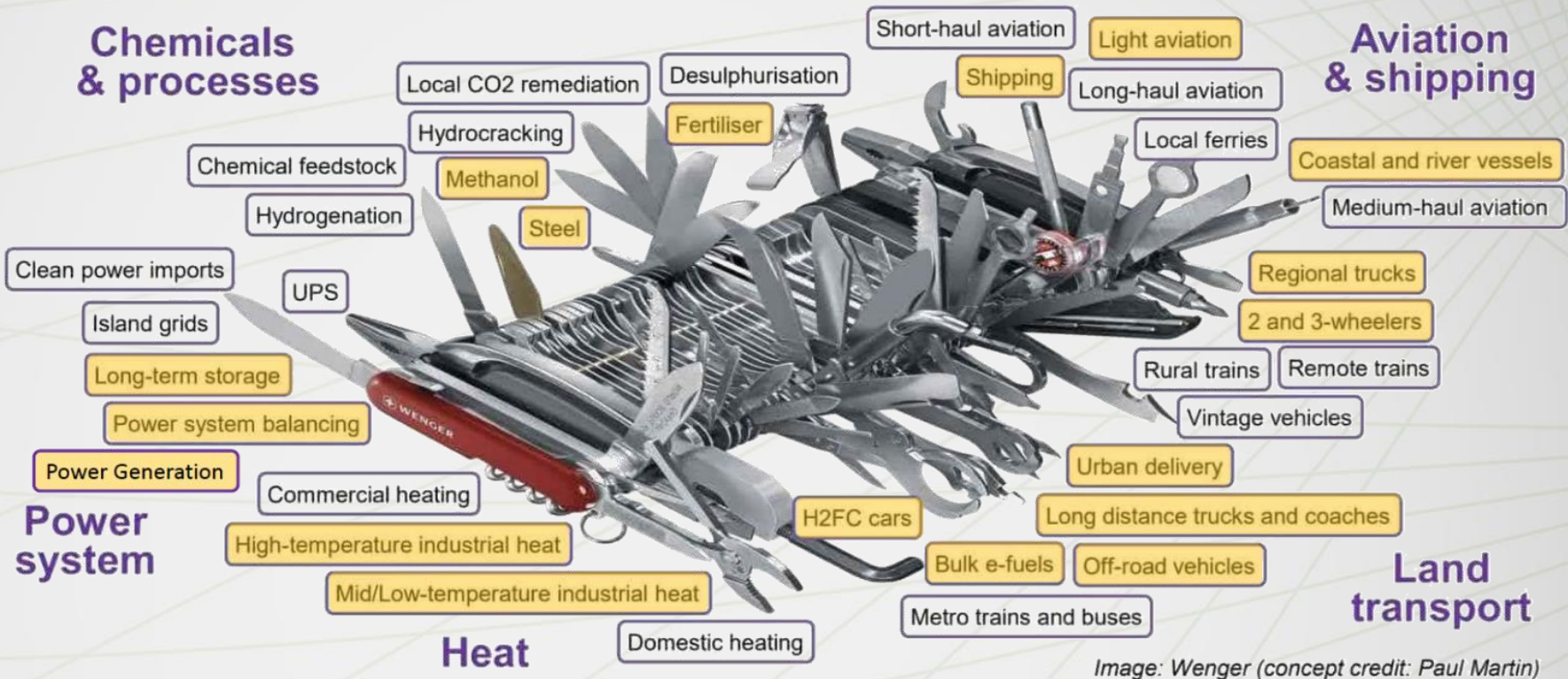












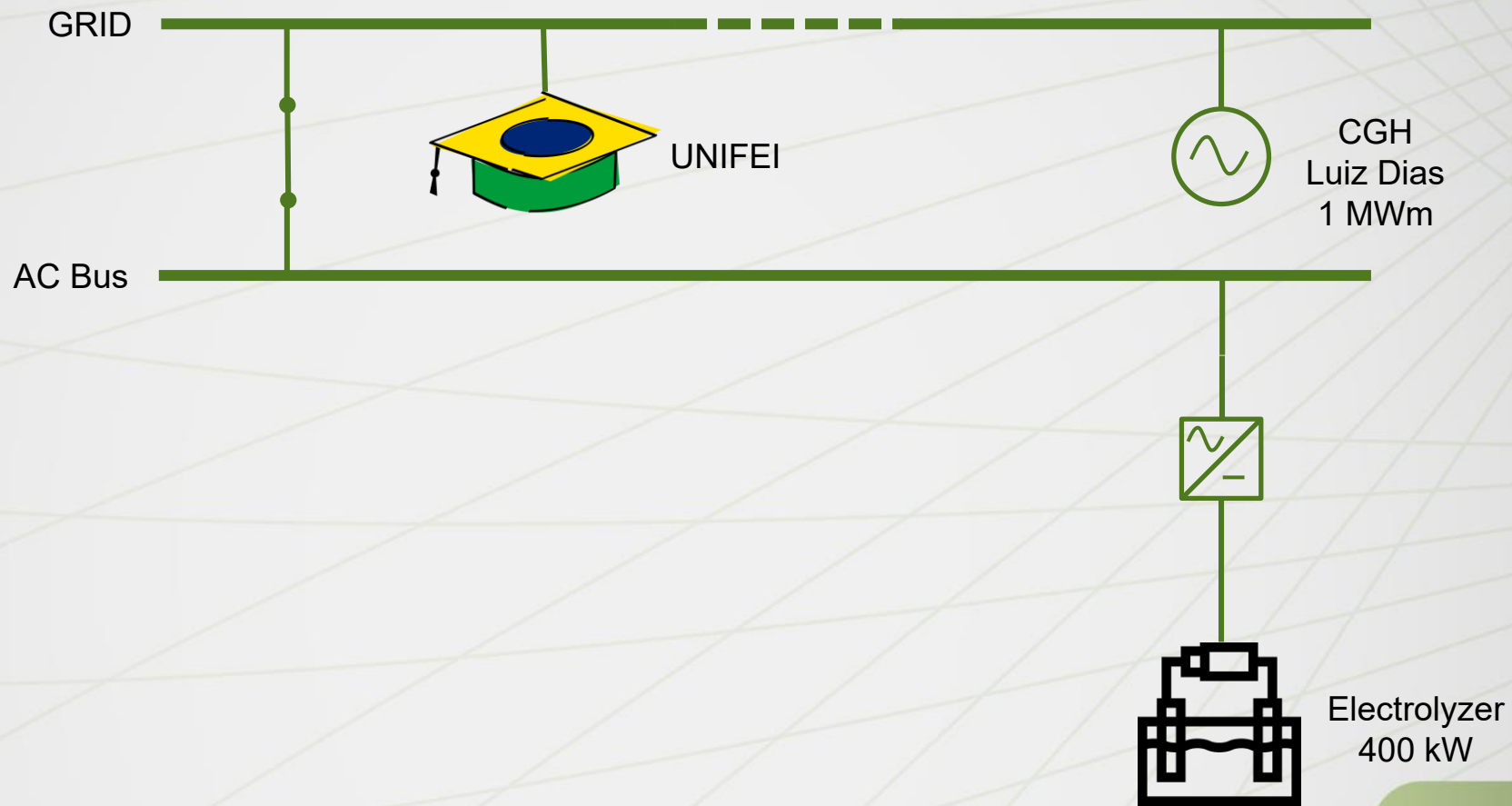
The hydrogen Swiss Army Knife

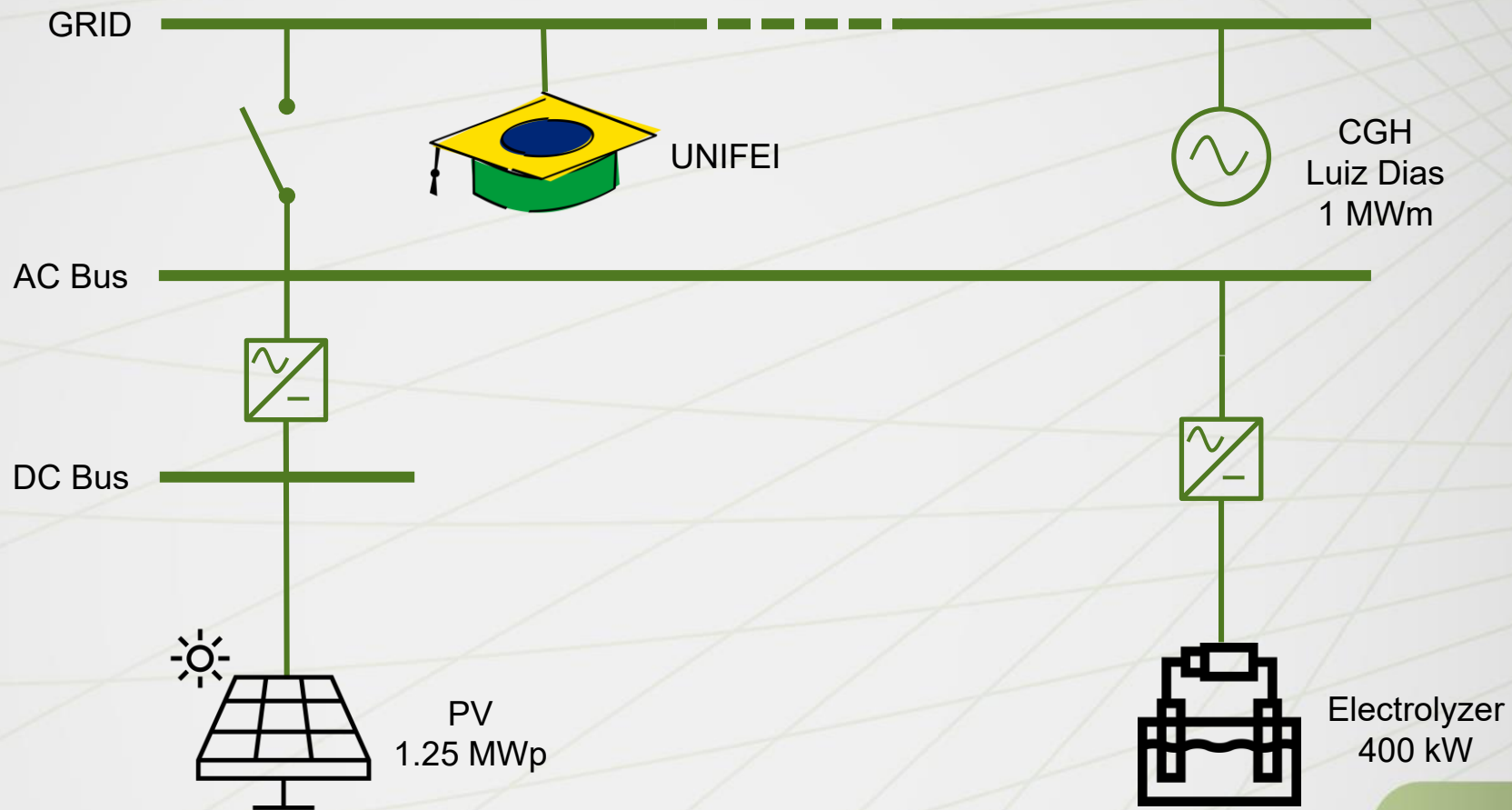


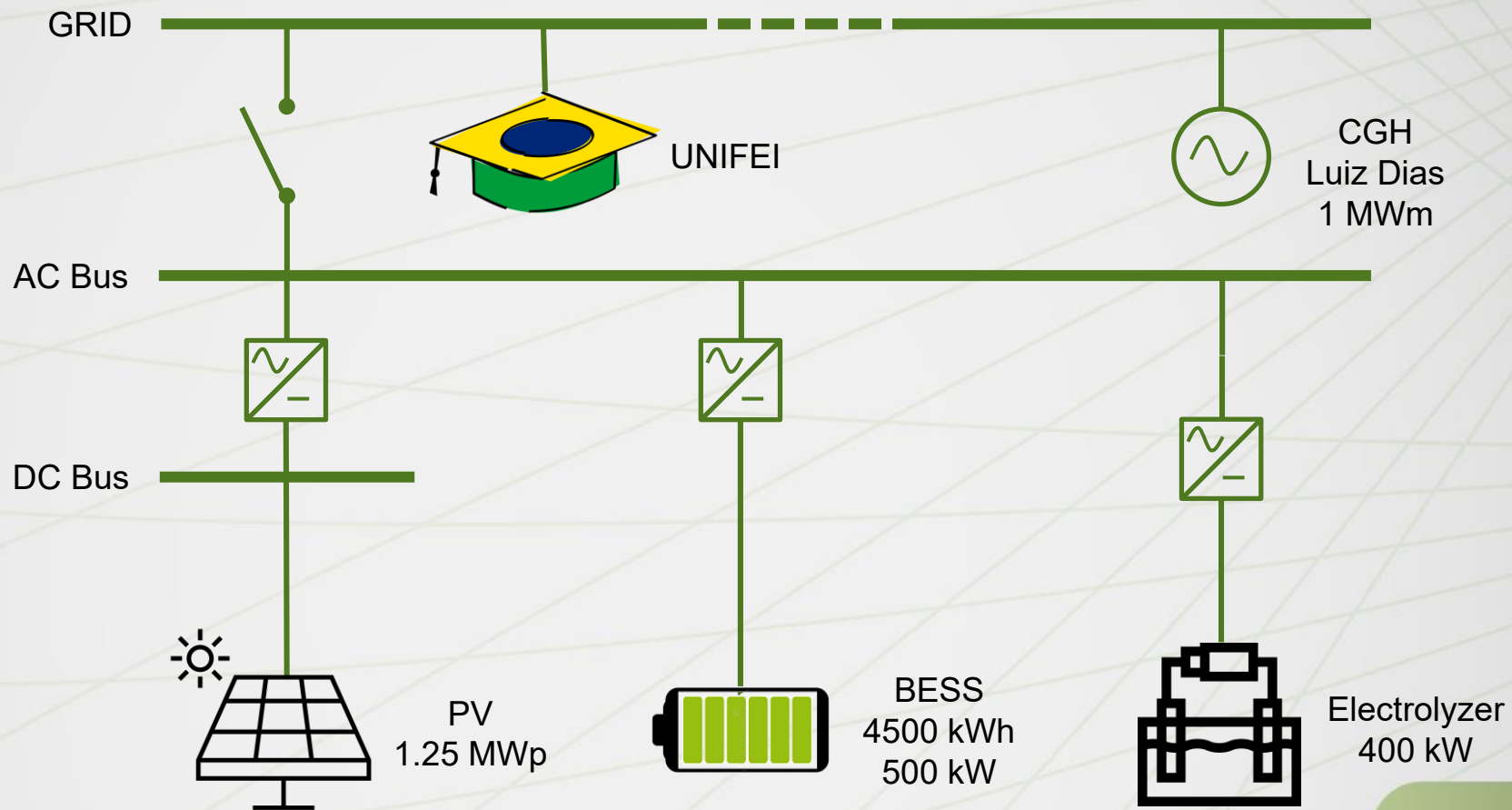
The new project involving H2V, PV, BESS

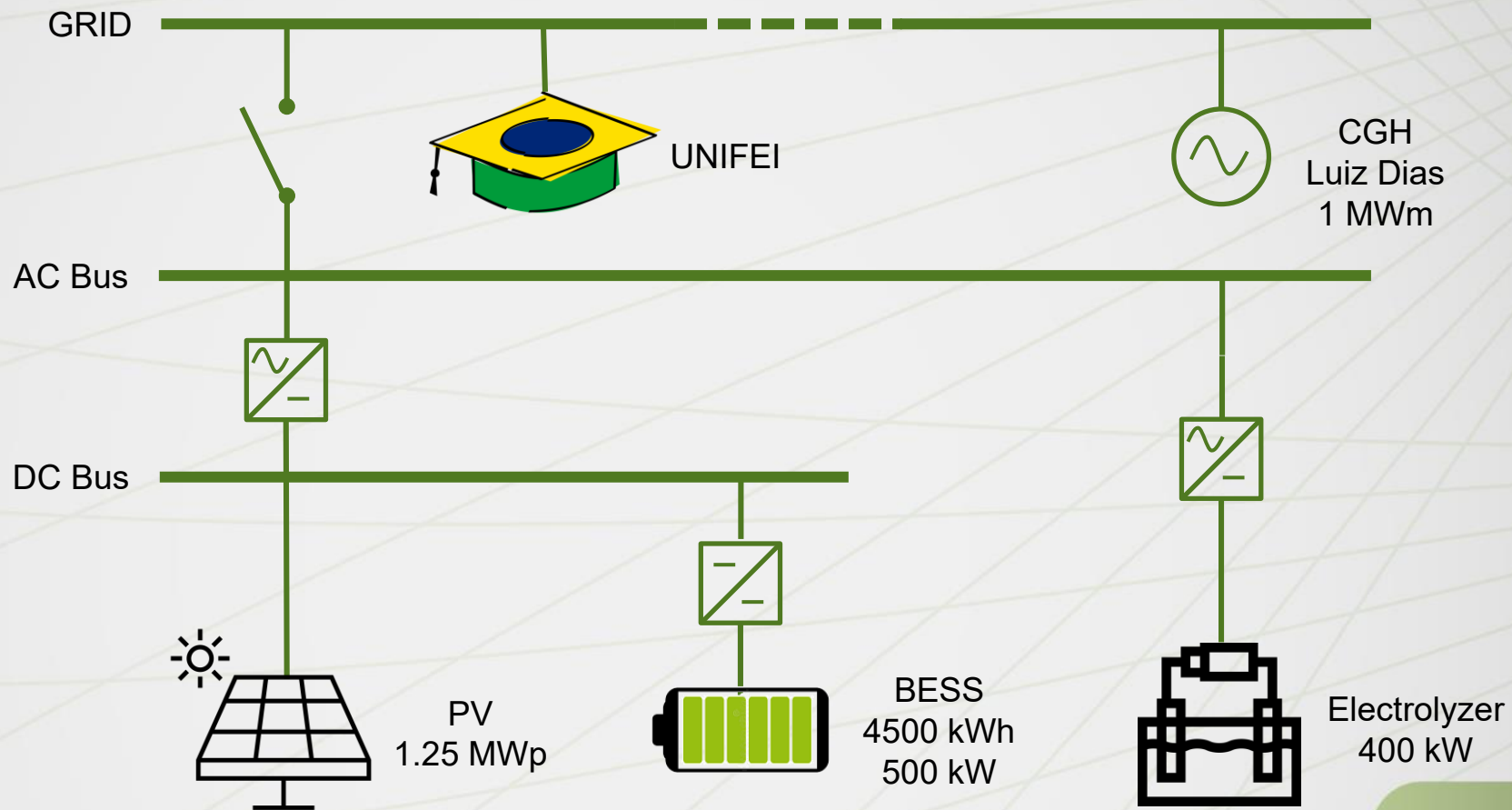
Concept and Design

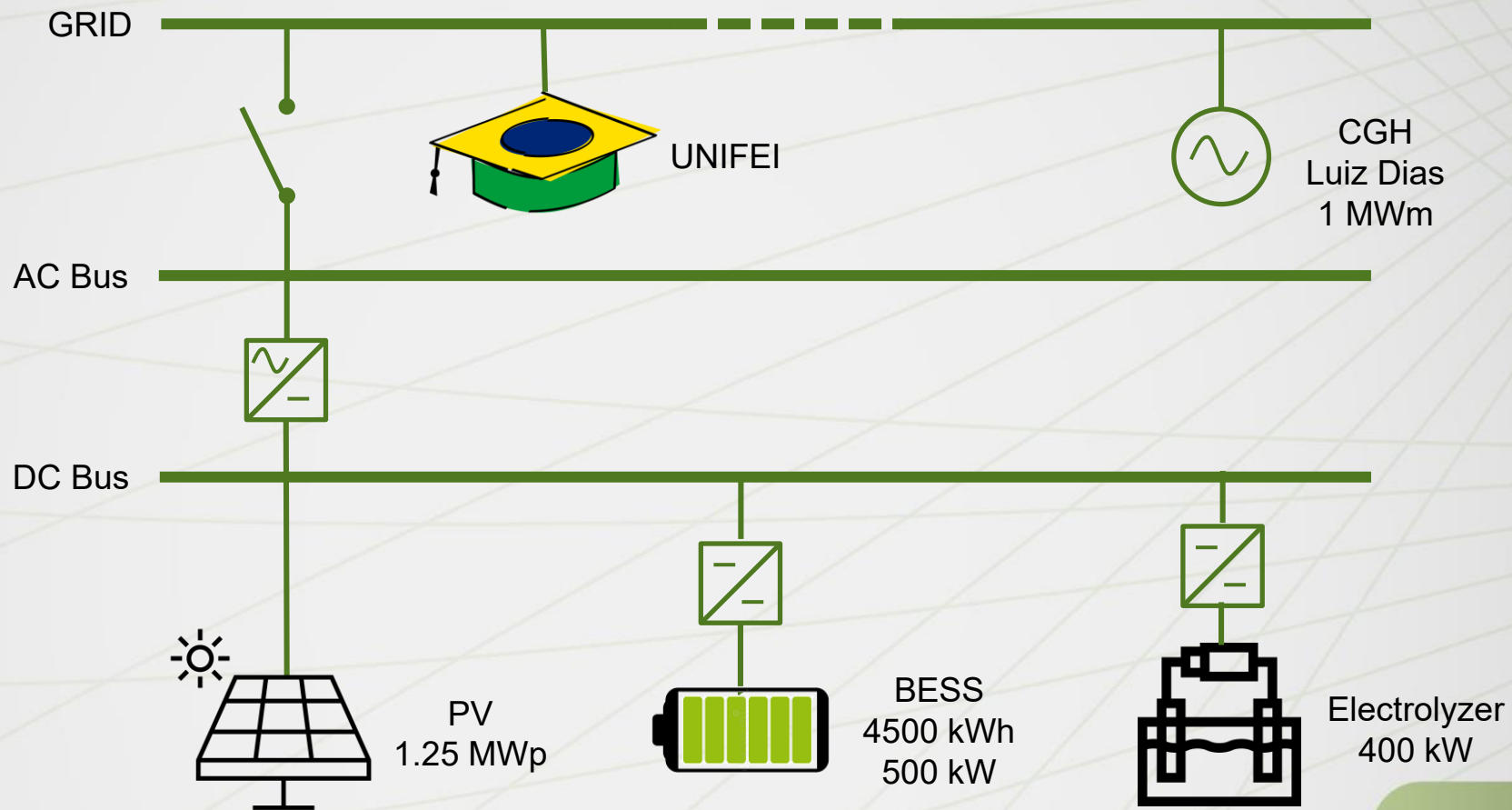


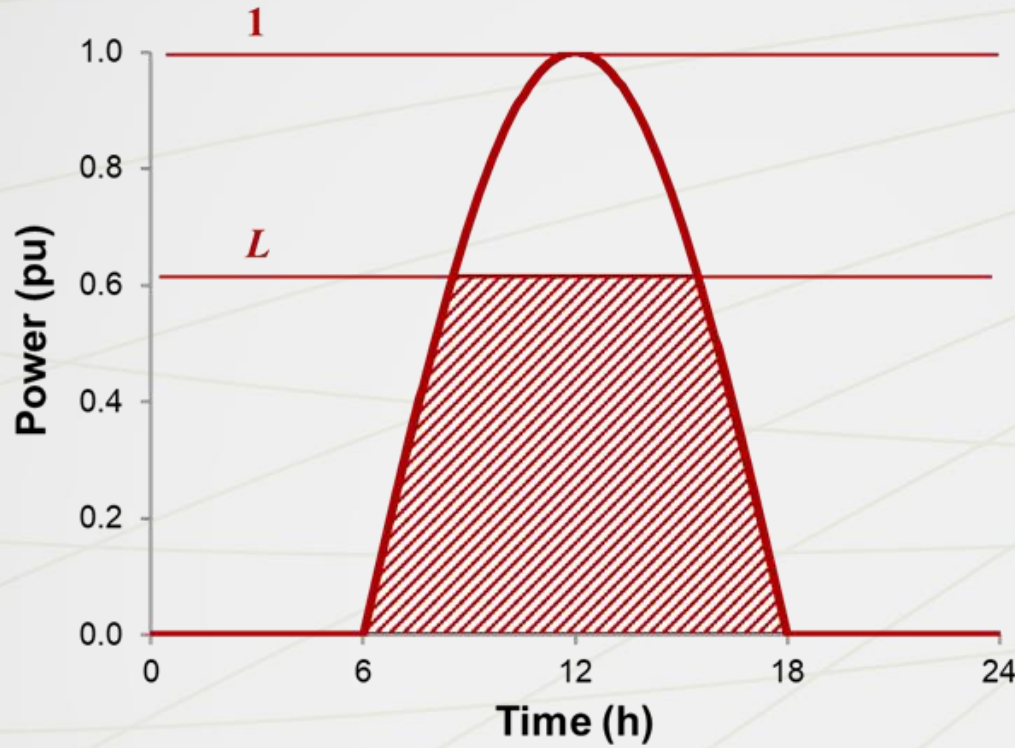




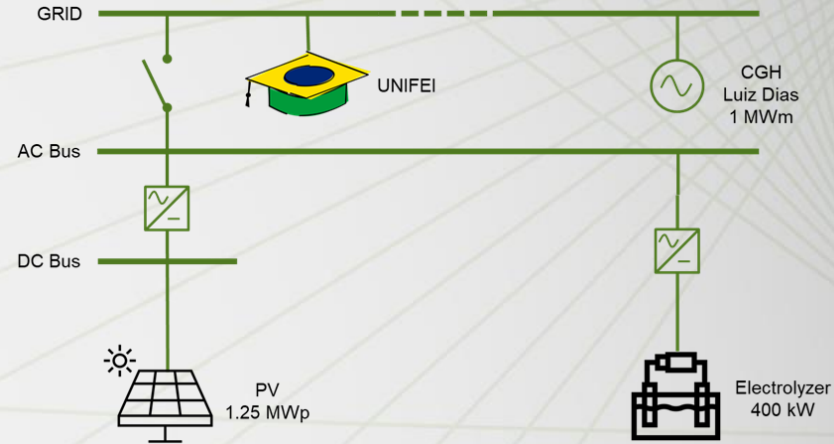








$$E = 2 \left\{ 1 - \cos[\sin^{-1}(L)] + L \left[\frac{\pi}{2} - \sin^{-1}(L) \right] \right\}$$

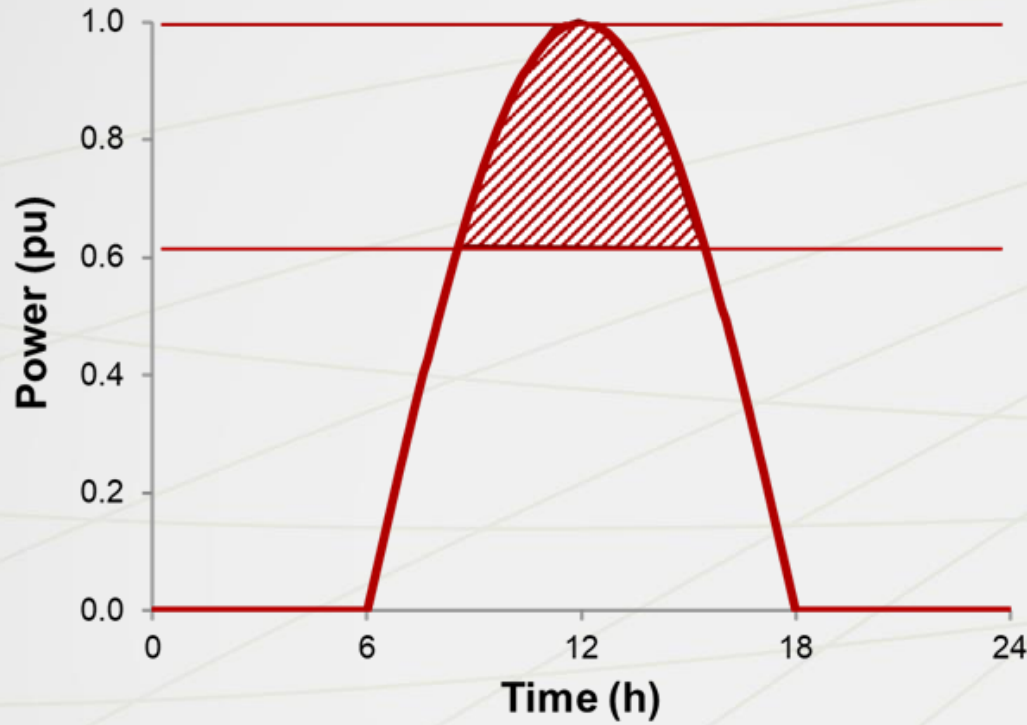


$$\theta = \sin^{-1}(L)$$

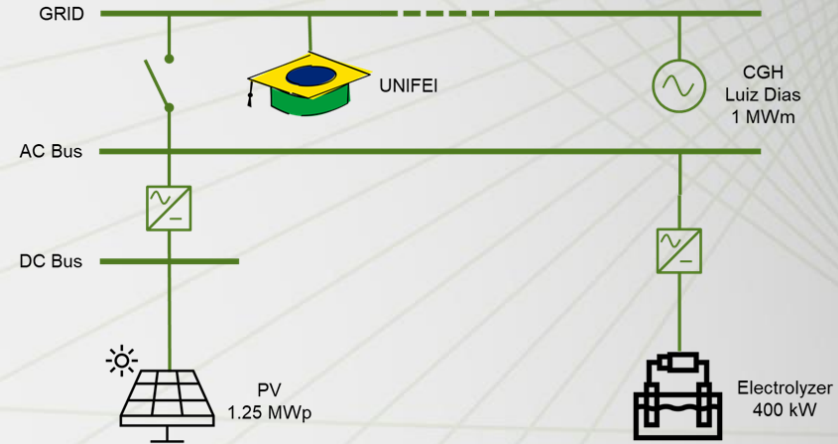
$$E = 2 \left[\int_0^{\theta} \sin(x) dx + \int_{\theta}^{\pi/2} L dx \right]$$

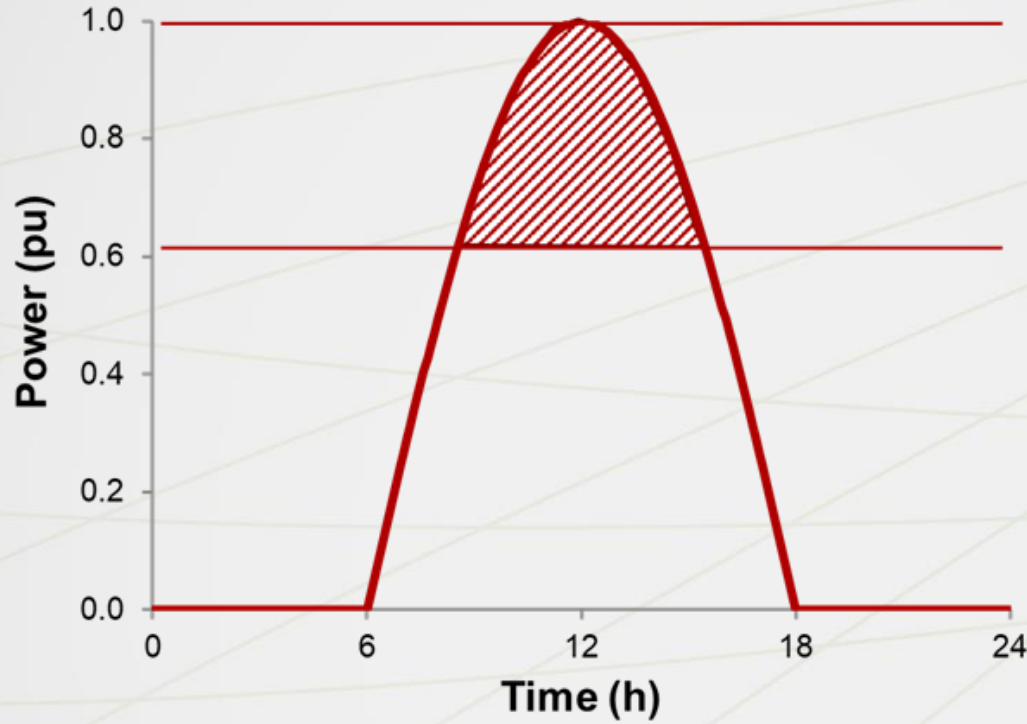
$$E = 2 \left[1 - \cos(\theta) + L \left(\frac{\pi}{2} - \theta \right) \right]$$



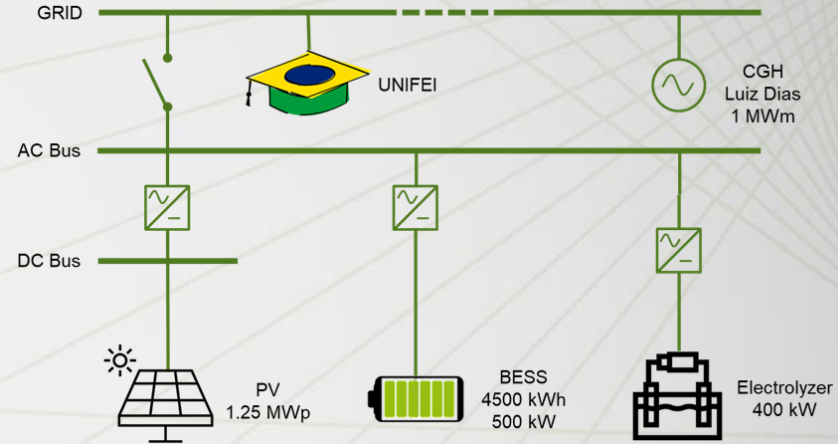


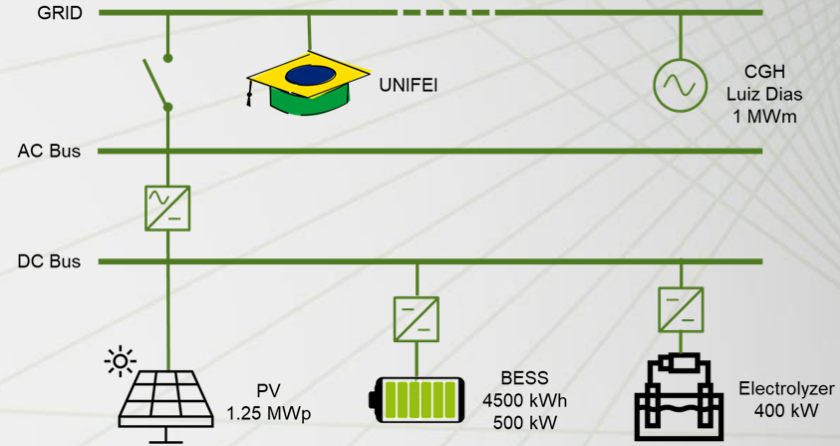
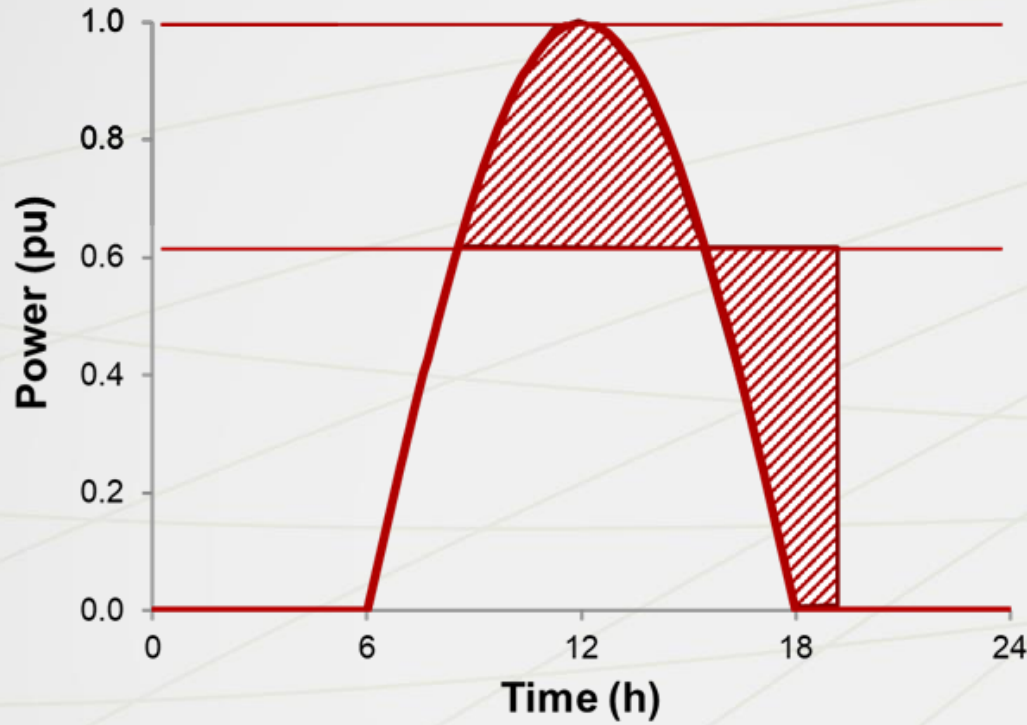
$$E = 2 \left\{ \cos[\sin^{-1}(L)] - L \left[\frac{\pi}{2} - \sin^{-1}(L) \right] \right\}$$





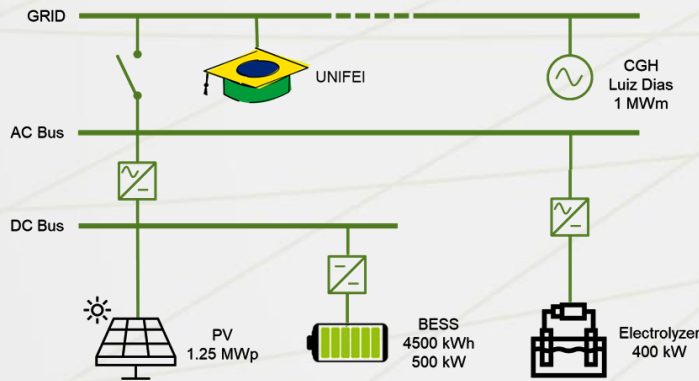
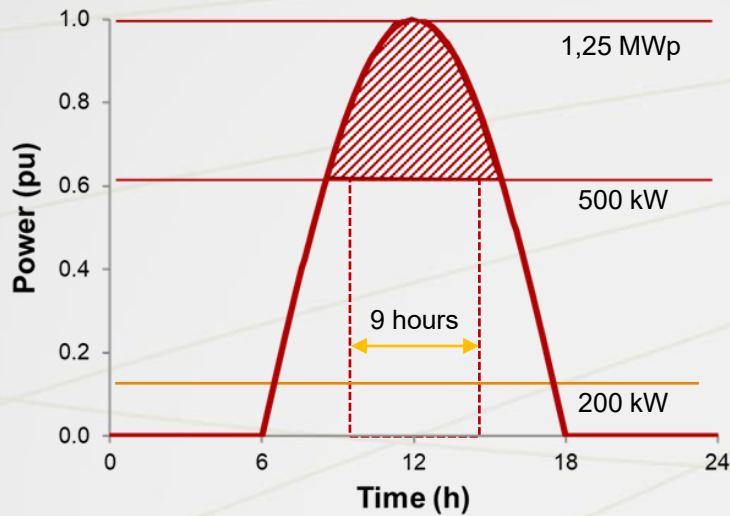
$$E = 2 \left\{ \cos[\sin^{-1}(L)] - L \left[\frac{\pi}{2} - \sin^{-1}(L) \right] \right\}$$





$$E = 2 \left\{ \cos[\sin^{-1}(L)] - L \left[\frac{\pi}{2} - \sin^{-1}(L) \right] \right\}$$





- In the region of Itajubá, South of Minas Gerais State, a PV system of 1,25 MWp generates something between 4800 kWh and 5200 kWh a day.
- Storing all the generated energy, the average power along a day is about 200 kW.
- For a load of 500 kW, and a storage of 4500 kWh, the system is capable to supply the load for about 9 hours, what is enough for a research purposes.
- The system will allow the testing of control techniques, synthetic inertia studies, grid forming power electronics such inverters, test of diverse DC/AC for the inverters, and so forth.





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