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A Bottom up Cost Assessment of Alkaline & PEM Stack

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Introduction

We present a bottom up assessment of AE and PEM **state of the art** and **advanced** stack direct cost with an aim to assess their feasibility for a GW/year production by 2030

Methods

The direct cost encompasses *materials, labor, manufacturing cost, overhead* and *profit margin*.
The *materials* prices are based on spot prices + a processing fee. The *manufacturing* and *labor* cost are based on the accounting method employed by Mayyas et al.(2019)[1] where *manufacturing* cost accounts for capital, building fee, operation and energy cost . The *labor* cost is based on the number of laborers per production line with a fixed hourly rate working for 1600 hours/year.
Overhead and *profit margin* are based on cost structures reported in annual financial statement of PV and electrolyser manufacturers
Price sensitivities:
Materials: based on ten year historical prices where the peak and trough are choses as the high and low prices respectively. *Manufacturing and labor*: results for the bottom up assessment were compared to PV manufacturers at a GW scale, cost structures reported in annual financial statements of electrolyser manufacturers and public statement for ITM's GW factory

Results:

Materials

The main cost drivers for materials cost is moving to advanced "larger" stacks with higher capacity coupled with reducing the loading of PGMs and replacing expensive materials like sintered porous titanium and gold with stainless steel powder and niobium respectively (Fig 1 a & b)

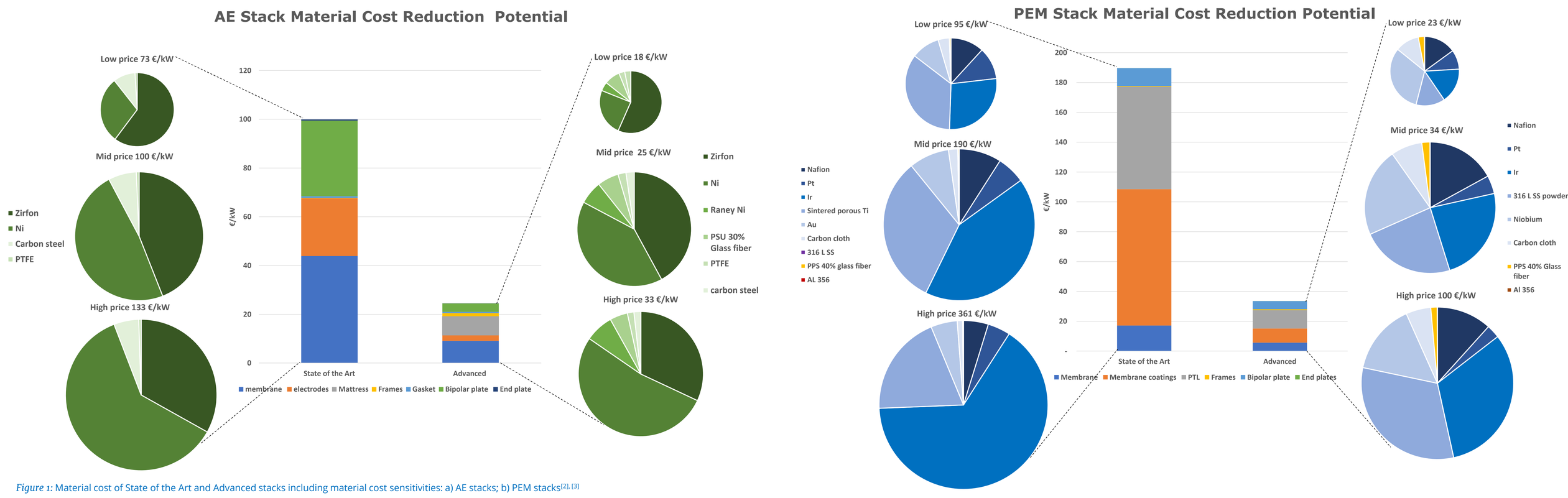

Figure 1: Material cost of State of the Art and Advanced stacks including material cost sensitivities: a) AE stacks; b) PEM stacks[2], [3]

Manufacturing and Labor

Figure 2 a & b illustrates a schematic of the processes and production line required to produce AE and PEM stacks[4]. The methodology employed my Mayaas et al. (2019) results in highly underestimated manufacturing and labor cost (~**5% of stack cost)** when compared to cost ratios seen in PV industry and electrolyser manufacturers (**materials: labor : manufacturing – 4:2:1**; **8:4:1** respectively)[5], [6]

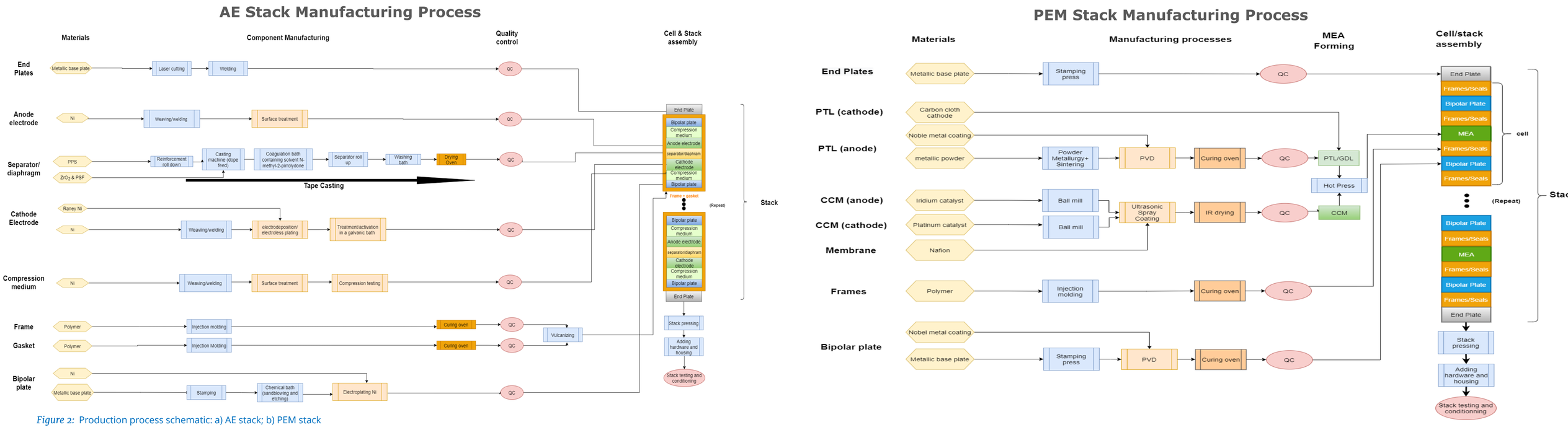

Figure 2: Production process schematic: a) AE stack; b) PEM stack

Total Direct Stack Cost (including overhead & profit margin)

The *manufacturing* and *labor* cost were adjusted in accordance with the cost ratios seen in electrolyser manufacturers' annual financial statements and the public statement from ITM's GW facility to arrive at a more realistic cost estimate for electrolyser stacks. Figure 3 illustrates the adjusted *manufacturing* and *labor* cost, coupled with *material* cost sensitivities and *overhead+profit margin (100% + (-50%) of stack cost for business in infancy; 25% + 10% for mature business)*[6]

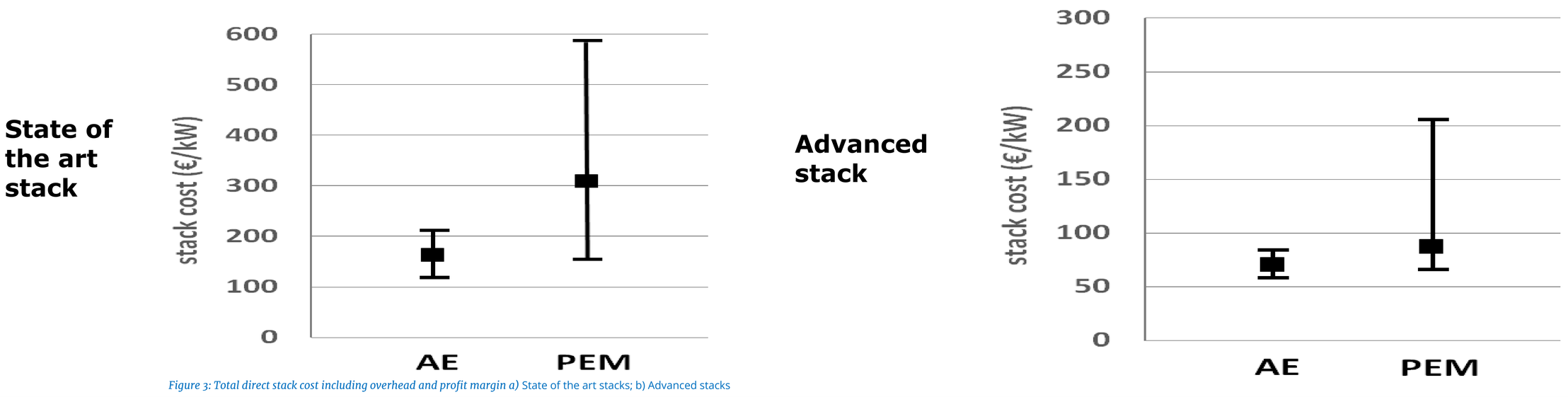

Figure 3: Total direct stack cost including overhead and profit margin a) State of the art stacks; b) Advanced stacks

References

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