**Figure 1** Mass flow rates ($F$), VOP, COP and economic margins ($\Delta e$) along with allocation factors ($\alpha$) of the streams in a Jatropha-based biorefinery.

**Figure 2** Generic EVEI profile of a product

**Figure 3** Biodiesel process simulation flowsheet in Aspen Plus®

**Figure 4** Mass flow rates ($F$), CVP, ICP, EI saving margin $\Delta i$ and allocation factors ($\alpha$) of the streams in a Jatropha-based biorefinery system.

**Figure 5** a) Economic and b) environmental profiles of biorefinery products.

**Figure 6** EVEI profile of a) biodiesel, b) glycerol, c) cake and d) husk featuring the costs composite curve (→), the limiting line (←) and the value line (─●─•). 1) feedstock, 2) auxiliary raw materials, 3) utilities, 4) process emissions and 5) fixed costs.

**Figure 7** EVEI profile of a) biodiesel, b) glycerol, c) cake and d) husk featuring the costs composite curve (●●●), the limiting line (→) and the value line (─●─•) after the improvements a-c along with the costs composite curve in the base case system (←). 

**Figure 8** Integrated flowsheet after modifications a to c showing the integration of steam generation from oily waste and husk.
Figure 1 Mass flow rates ($F$), VOP, COP and economic margins ($\Delta e$) along with allocation factors ($\alpha$) of the streams in a Jatropha-based biorefinery.
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Figure 4 Mass flow rates ($F$), CVP, ICP, EI saving margin $\Delta i$ and allocation factors ($\alpha$) of the streams in a Jatropha-based biorefinery system.
Economic value ($ t^{-1}$) vs. Mass flow rate (kt y$^{-1}$)

- VOP
- COP
- Husk
- Cake
- Glycerol
- Biodiesel

Total area = biorefinery economic margin = 7.02 M$ y$^{-1}$
Figure 5 a) Economic and b) environmental profiles of biorefinery products.
Environmental impact (kt y\(^{-1}\)) vs. Economic value (M$ y\(^{-1}\))

- Policy target: 147.2 kt y\(^{-1}\)
- Economic margin: 4.71 M$ y\(^{-1}\)
- EI saving: 94.9 kt y\(^{-1}\)
- EI saving margin: 52.3 kt y\(^{-1}\)

Legend:
- 1) Policy target
- 2) Economic margin
- 3) EI saving
- 4) EI saving margin
- 5) DEFICIT
Environmental impact (kt y\(^{-1}\))
Economic value (M$ y\(^{-1}\))

Policy target
27.3 kt y\(^{-1}\)

EI saving
17.2 kt y\(^{-1}\)

EI saving
DEFICIT
10.1 kt y\(^{-1}\)

Economic margin
1.28 M$ y\(^{-1}\)
Figure 6 EVEI profile of a) biodiesel, b) glycerol, c) cake and d) husk featuring the costs composite curve (−−−−), the limiting line (−→) and the value line (−−).
Environmental impact (kt y\(^{-1}\))

Economic value (M$ y\(^{-1}\))

Policy target met

Policy target 147.2 kt y\(^{-1}\)

Economic margin 5.32 M$ y\(^{-1}\)
b)
Environmental impact (kt y\(^{-1}\))

Economic value (M$ y\(^{-1}\))

Policy target
27.3 kt y\(^{-1}\)

SURPLUS
1.2 kt y\(^{-1}\)

Economic margin
1.42 M$ y\(^{-1}\)
Figure 7 EVEI profile of a) biodiesel, b) glycerol, c) cake and d) husk featuring the costs composite curve (●●●), the limiting line (→) and the value line (−−) after the modifications a-c along with the costs composite curve in the base case system (−−).
Figure 8 Integrated flowsheet after modifications a to c showing the integration of steam generation from oily waste and husk.