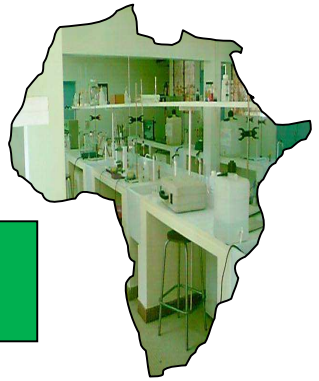
Institut International d'Ingénierie de l'Eau et de l'Environnement
International Institute for Water and Environmental Engineering

Efficacité exergétique appliquée à l'optimisation de performances d'un moteur Diesel fonctionnant aux biocarburants

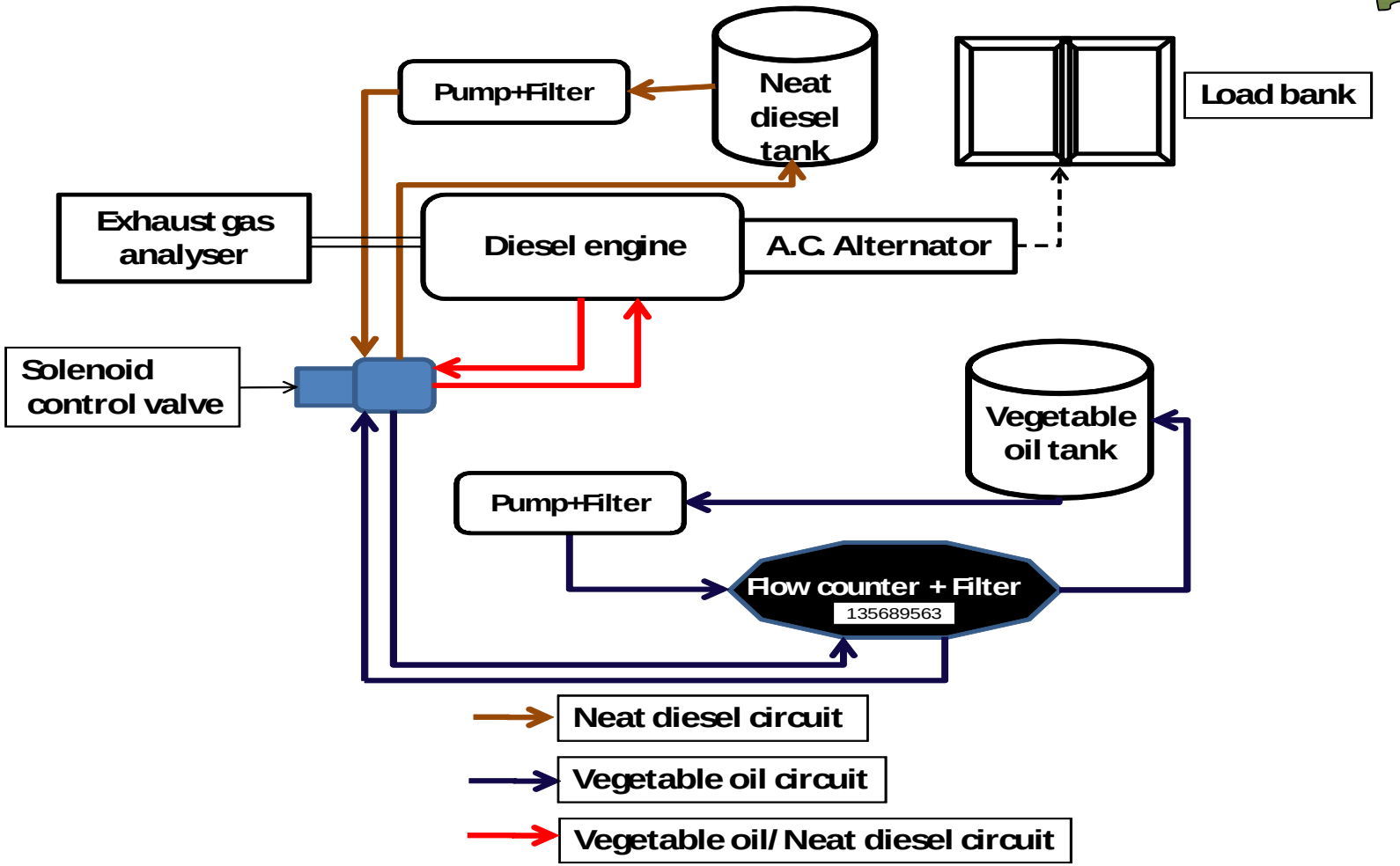
Enjeux

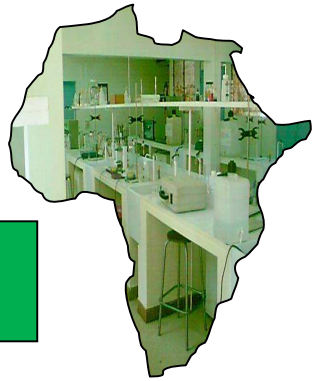
- **Adaptation d'un moteur diesel aux Huiles Végétales (HV) pour des fins d'électrification et de pompage en zones rurales.**

- **Efficacité exergétique & émission de gaz : critères d'optimisation des performances des moteurs?**

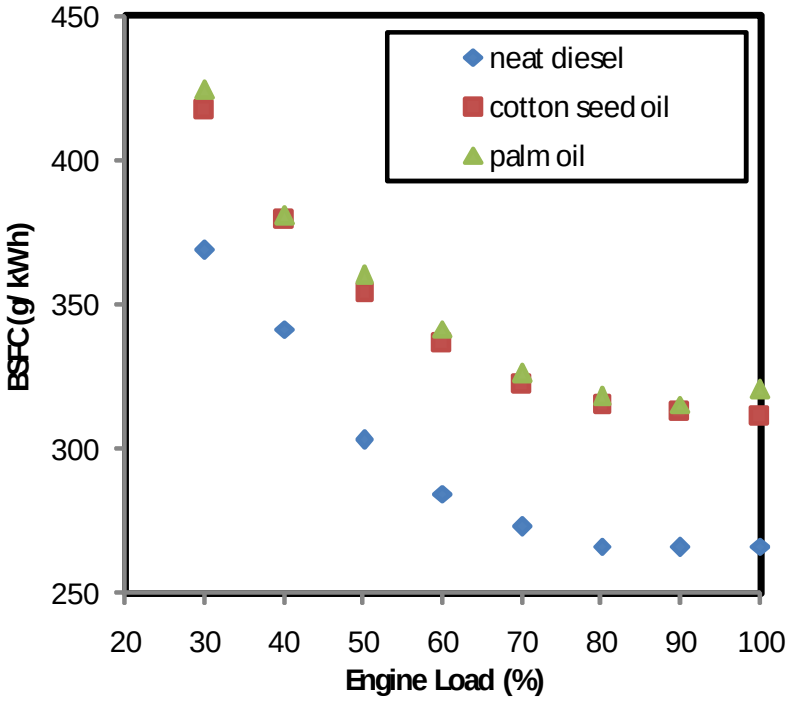


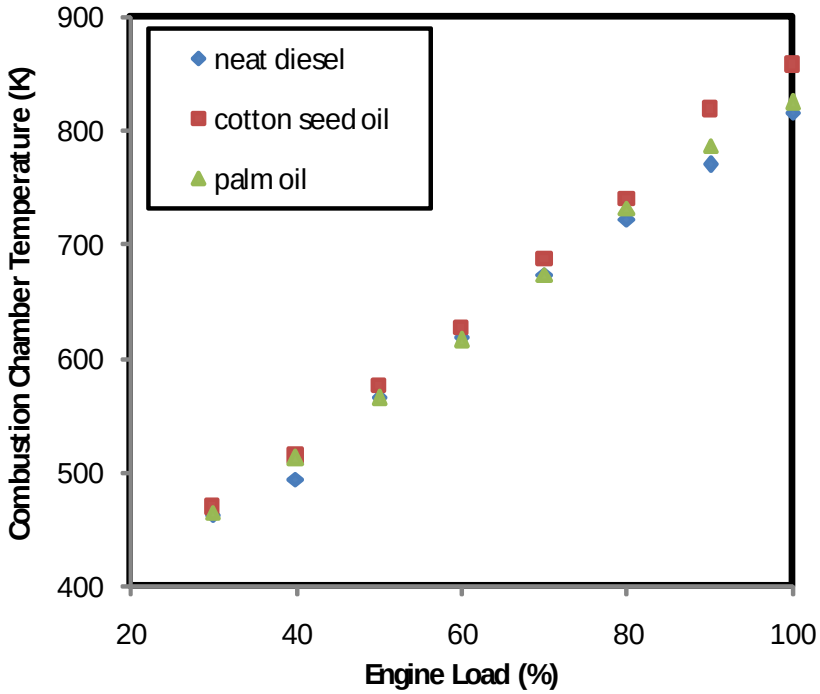
Dispositif Expérimental





Résultats expérimentaux





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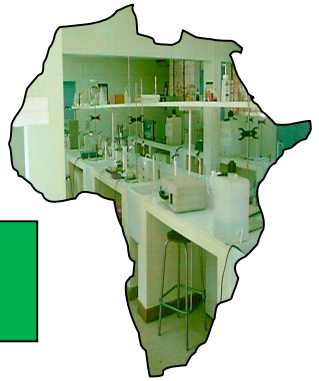
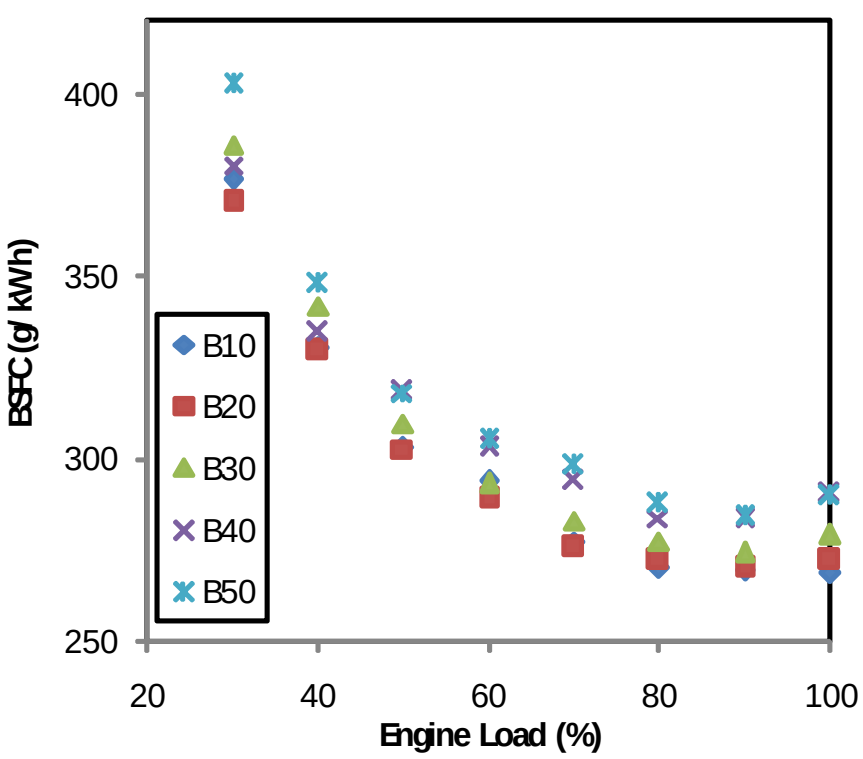
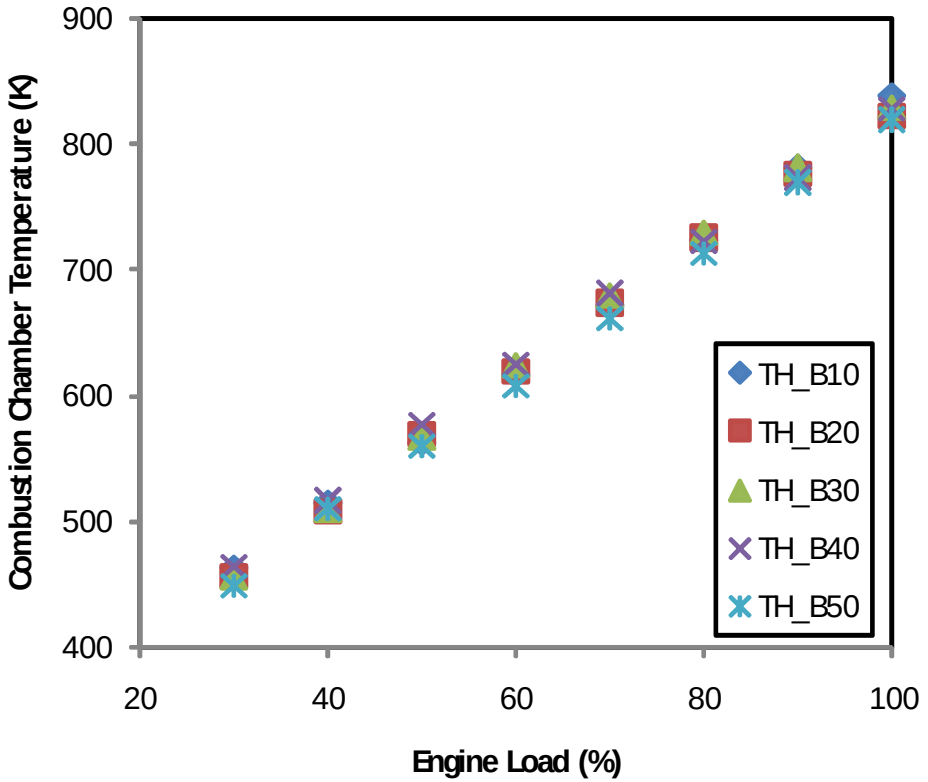
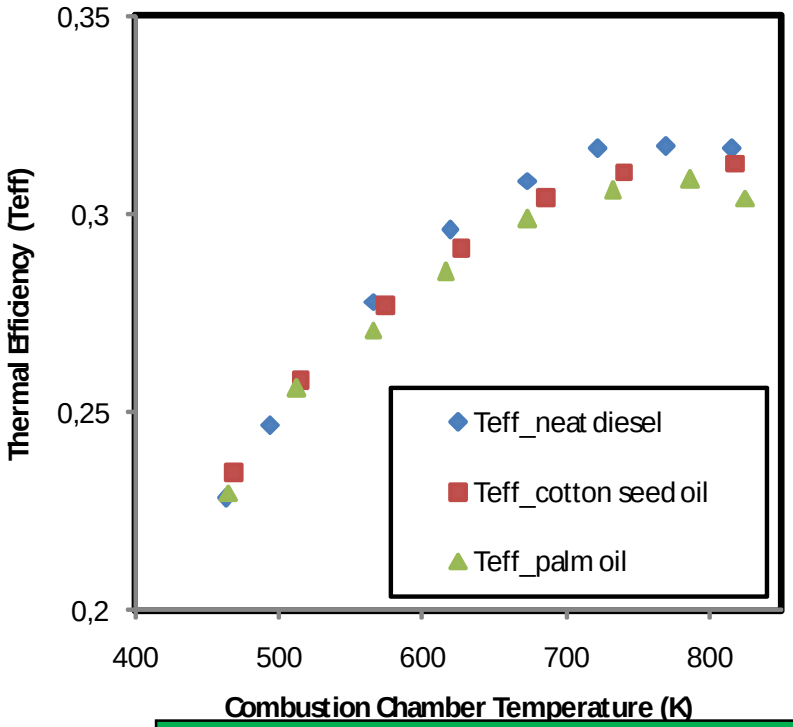


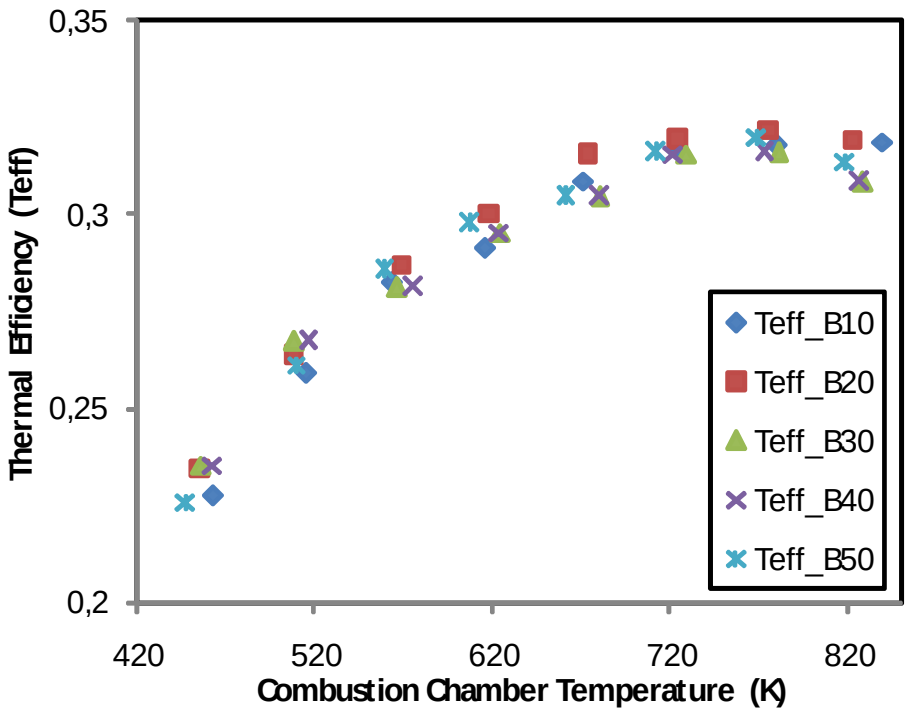
Résultats expérimentaux





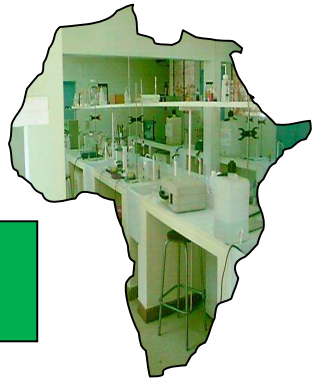
Résultats expérimentaux



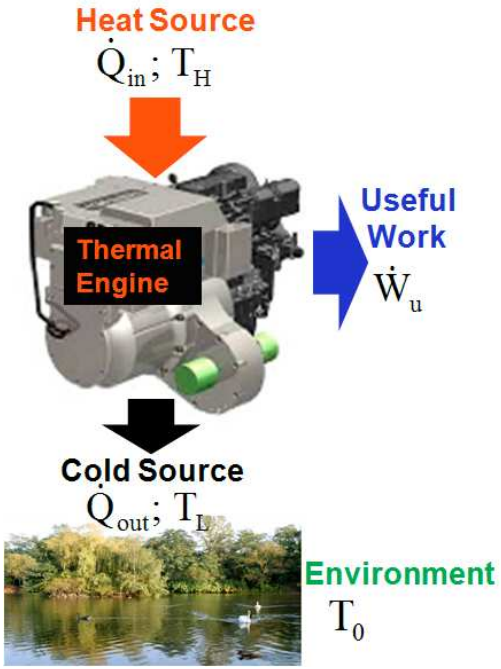


Remarque:

L'efficacité thermique diminue avec la température i.e. la qualité de l'efficacité thermique se dégrade quand la température diminue. Nécessité de prendre en compte cet aspect dans le choix de



Analyse exergétique



$$E_{x,in} = \dot{Q}_{in}\left(1 - \frac{T_0}{T_H}\right) = \dot{Q}_{in}\,\theta_H$$

$$E_{x,out} = \dot{Q}_{out}\left(1 - \frac{T_0}{T_L}\right) = \dot{Q}_{out}\,\theta_L$$

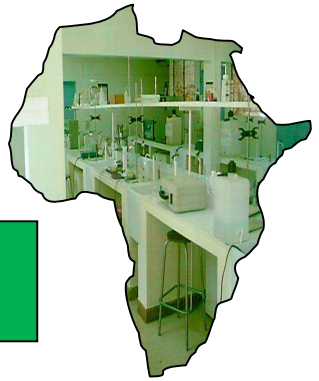
$$E_{x,useful} = \dot{W}_u$$

$$E_{x,destroyed} = T_0\dot{I}$$

$$\dot{Q}_{in} = \dot{m}\,PCI$$

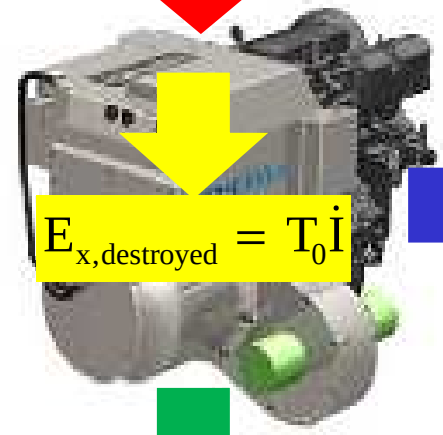
$$T_h = T_{chambre\ *\ combustion}$$

$$T_L = T_0 = T_{ambiante}$$



Efficacité exergétique

$$E_{x,in} = \dot{Q}_{in}\theta_H$$



$$E_{x,destroyed} = T_0\dot{I}$$

$$E_{x,useful} = \dot{W}_u$$

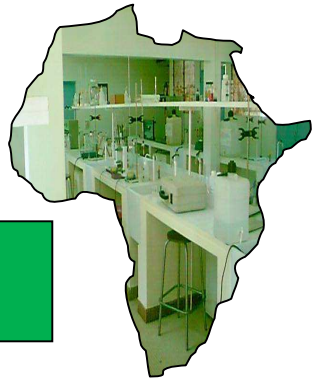
$$E_{x,out} = \dot{Q}_{out}\theta_L$$

Bilan exergétique

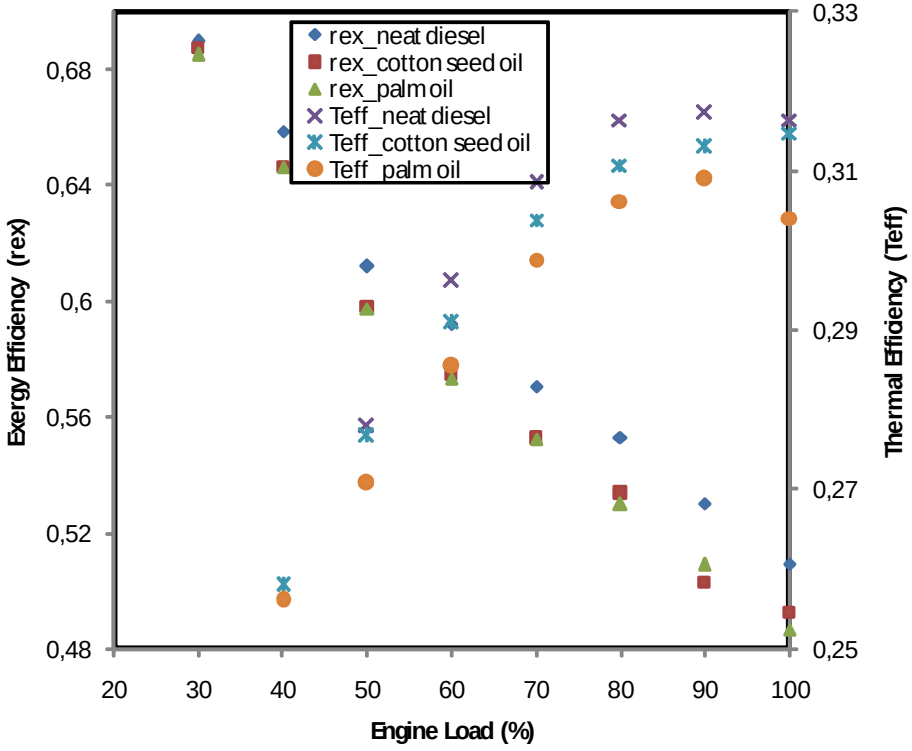
$$E_{x,in} = E_{x,out} + E_{x,useful} + E_{x,destroyed}$$

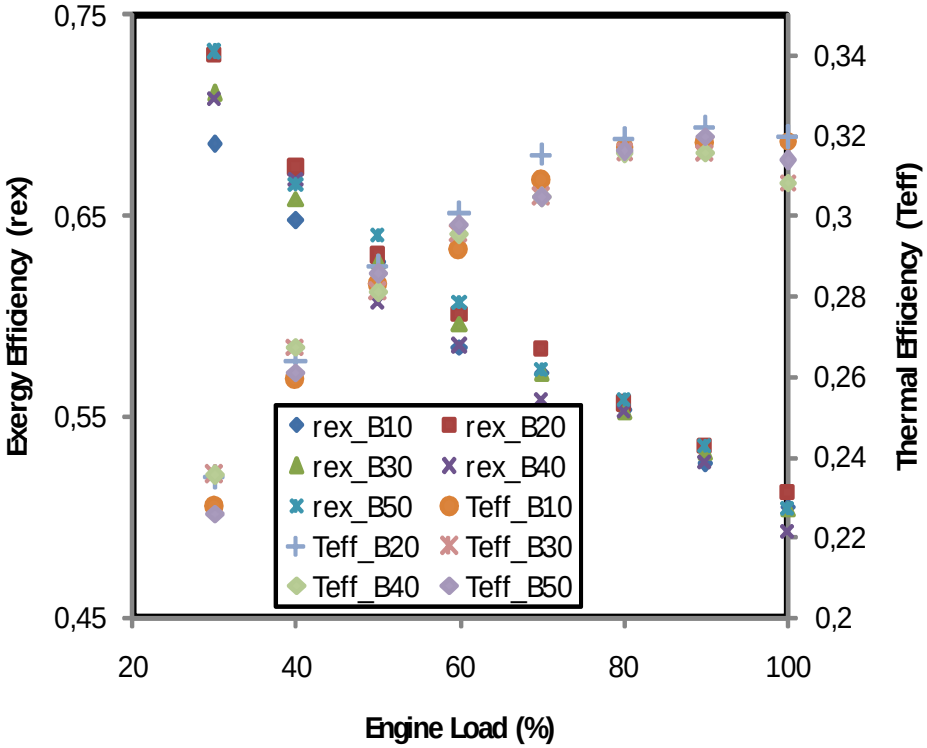
Efficacité exergétique

$$\eta_{ex} = \frac{E_{x,useful}}{E_{x,in} - E_{x,out}} = \frac{\dot{W}_u}{E_{x,consumption}}$$

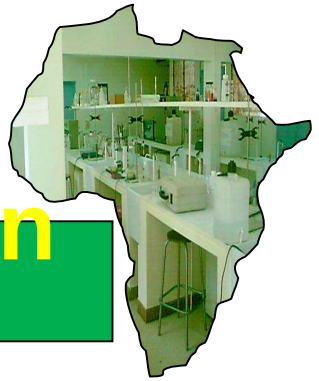


Comparaison des efficacités

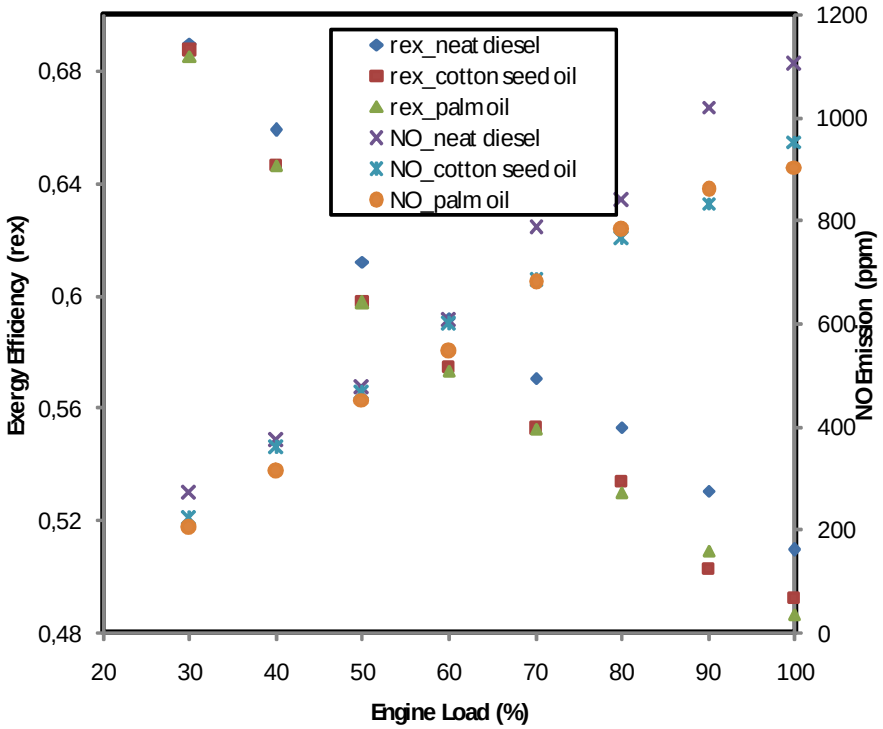


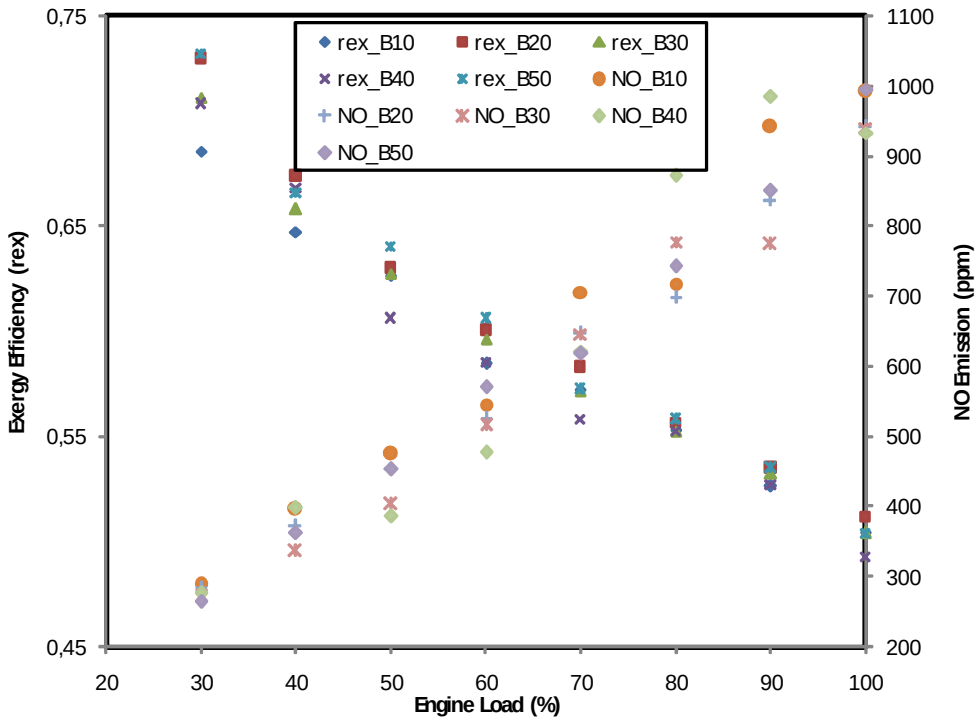


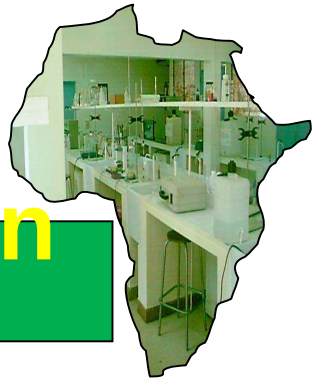
Grosse différence d'analyse selon les deux critères



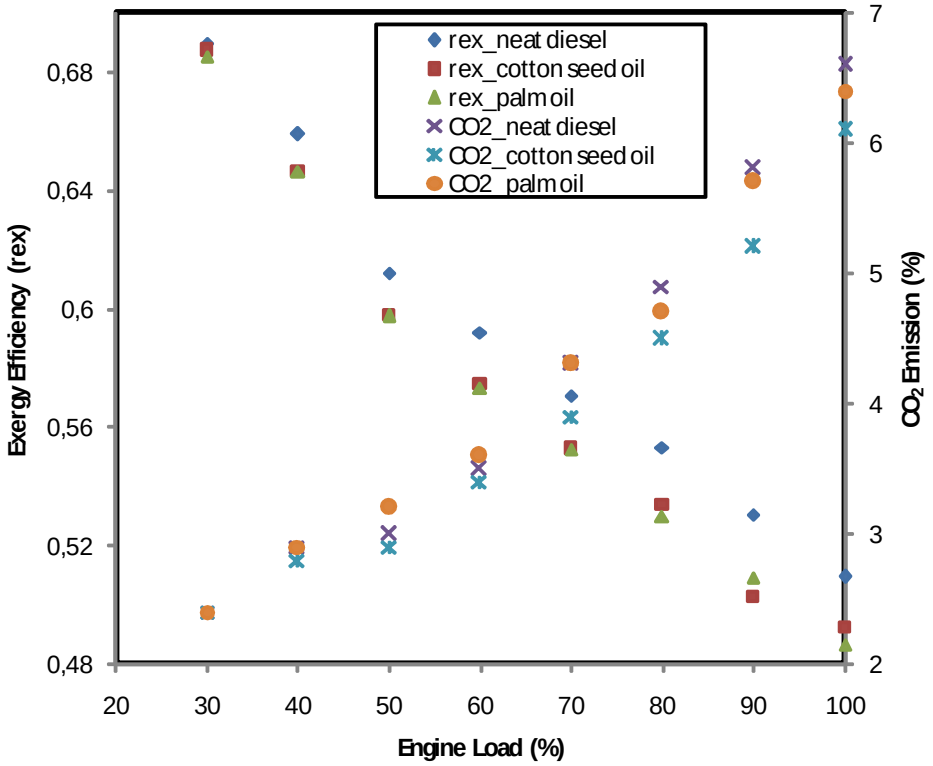
Efficacité exergétique vs émission de NO

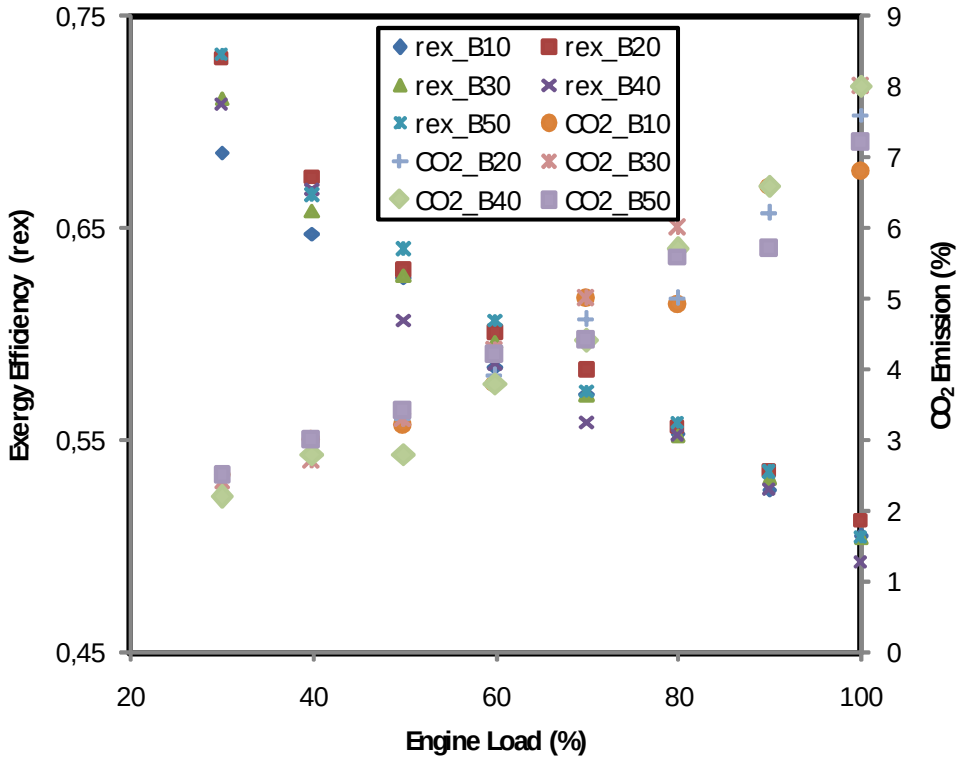




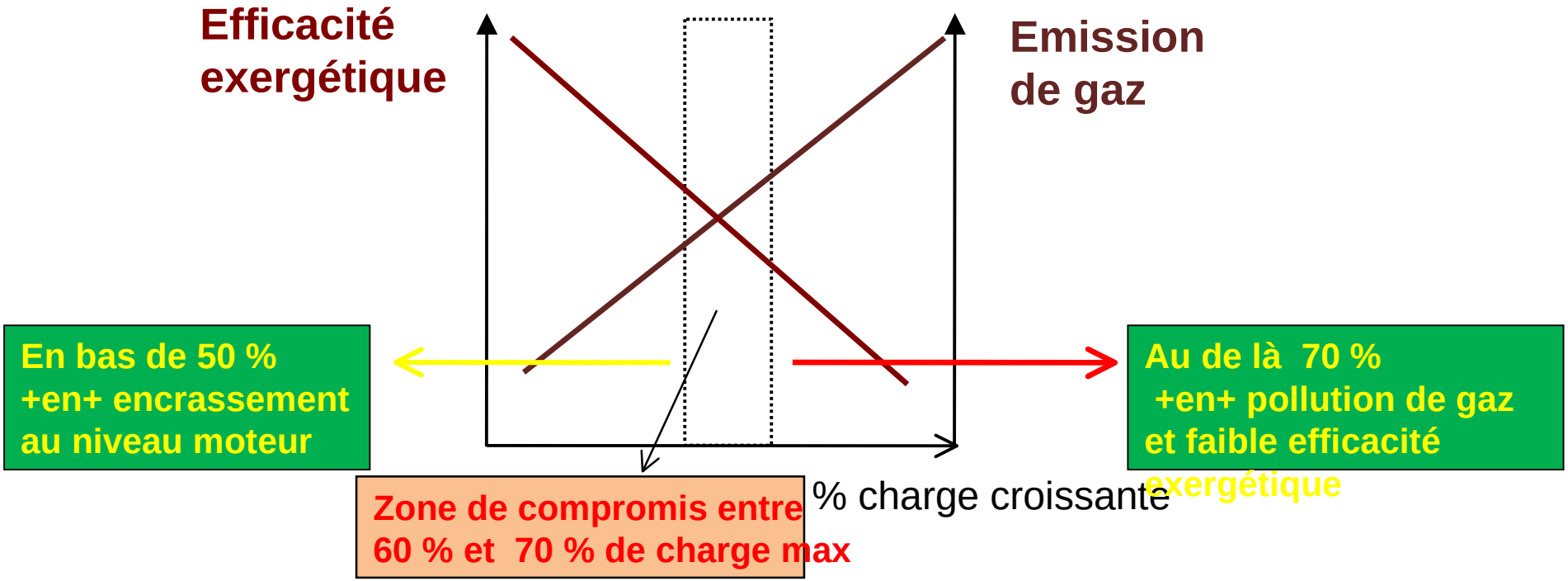


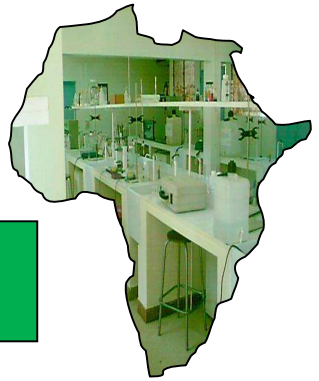
Efficacité exergétique vs émission de CO_2





Compromis: efficacité exergétique vs émissions de gaz





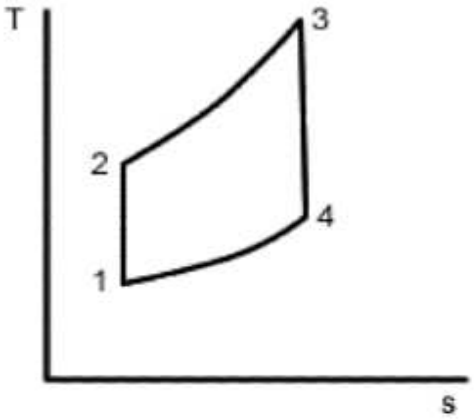
Conclusion

Combinaison efficacité énergétique & émission de gaz
outil efficace pour optimisation des performances des moteurs

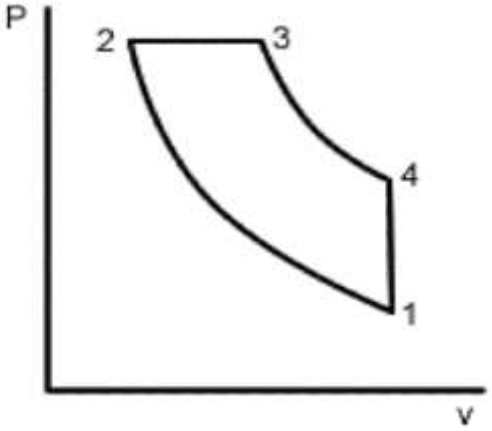
Application à un moteur Diesel fonctionnant aux biocarburants:
Etablissement d'une zone de compromis pour les charges, entre 60% et 70% de la charge max.

Merci de votre attention!!!

Détermination de la température de la chambre de combust



T-S diagram of ideal Diesel cycle



P-V diagram of ideal Diesel cycle

$$T_3 = T_4\left(\frac{r_c}{r_{of}}\right)^{\gamma-1}$$

$$r_c = \frac{V_1}{V_2} = 17.5$$

T4 = Temp_échappement

r_{of} =?????

$$\gamma = 1.4 = gaz\_parfait$$

$$T_{eff} = \eta_{en} = 1 + \frac{1 - r_{of}^{\gamma}}{r_c^{\gamma-1}\gamma\left(r_{of} - 1\right)} = connue$$