

## **Advanced Technologies in Heavy Oil Production**

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### **1. Introduction**

For many decades in the twentieth century, heavy oils were essentially produced by primary production just using pumping devices leading to low recovery factors of a few percents of Original Oil in Place (OOIP). In 1959, steam flooding was tested by Shell in the Venezuelan Mene Grande tar sand field that accidentally led to cyclic steam stimulation (steam soak process). This technique was therefore implemented in many heavy oil reservoirs of California in the United States, in Canada, Venezuela, .... After several cycles of steam stimulation, steamflood was generally applied. Both processes allowed to pursue the production of most of the heavy oil reservoirs, however the ultimate recovery factor was limited to 30 - 35 % of OOIP. In the last two decades, several technological advances allowed a new era in the production of heavy oils. This talk is aimed at showing these advances illustrated by results obtained in field applications and issues that are remaining to still improve heavy oil production or optimize existing EOR processes used for that purpose.

### **2. Key Features**

- Conventional production of heavy oils will be first reminded.
- Issues concerning steam injection will be outlined:
  - Need of huge amount of water
  - Need of huge amount of energy (gas or oil) for steam generation
  - Generation of huge amount of CO<sub>2</sub>
  - Problems of treatments (injected, produced)
- New advances will then be presented (concepts, implementation, results & issues):
  - Horizontal drilling technology
  - Foamy oil production
  - Better understanding and optimization of steam flood.
  - New processes : SAGD, VAPEX, THAI.

### **3. Conclusions**

The talk will be concluded by considerations about the need of improvements in :

- the understanding through adapted lab experiments of physical phenomena involved during the injection of various agents (steam, solvent, ...) for the production of heavy oils,
- the development of fast and accurate numerical models for the modeling of heavy oil production through the various available EOR processes,
- the optimization of the EOR processes themselves in order to reduce the amount of water or solvent to be injected, and the amount of CO<sub>2</sub> generated.

### **4. References and Bibliography**

#### **Speaker's Biography**

G rard Renard is a research engineer at Institut Franais du P trole (IFP) in Rueil Malmaison, France. His research interests are in reservoir engineering aspects of horizontal wells and EOR, essentially for heavy oils. He graduated from  cole Nationale Sup rieure d' lectronique, d' lectrotechnique, d'Informatique, et d'Hydraulique de Toulouse (ENSEEIH) in fluid mechanics and from  cole Nationale Sup rieure du P trole et des Moteurs (ENSPM) in petroleum engineering.