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A WORLD-WIDE ECONOMIC ANALYSIS OF THE NON CONVENTIONAL CRUDE OIL SUPPLY BASED ON A MODELLING APPROACH

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Overview

The global energy trend forecasts point out an increasing demand over the next decades, especially for electricity and automotive fuel. Over the next 25 years, the growing activity of the transport sector will be based on internal combustion engines and therefore, it will involve increasing quantities of liquid fuels. On the supply side, the crude oil share in the total primary energy supply should remain to around 35% until 2030 according to the IEA forecasts. Thus, the non conventional crude oil supply (as well as gas to liquid or coal to liquid technologies) should give a significant and necessary contribution to the global crude oil availability. In this paper, we analyse the potential development of the non conventional crude oil in a world scale oil product model. In the first part of the study, we present a survey of the non conventional crude oil resources, production and transformation techniques. Then, this crude oil supply is introduced in a world-scale refining model. We point out the influence of economic factors (oil prices, carbon taxes) and energy policy decisions on this development. The next paragraph is dedicated to the methodology. The results and the main issues are given in the third and in the fourth paragraph.

Methods

Three categories of non conventional crude oil resources are distinguished : extra-heavy oils, tar sand and oil shale. From the geological surveys, the resources are evaluated. Then, the available reserves are estimated according to the production techniques. From the extra-heavy oil, synthetic crude oils are obtained through upgrading processing plants. Then, these synthetic crude oils are introduced in the refining processes. The aggregated refining model OURSE provides oil product marginal costs according to the crude oil price, the oil product demand and the refining processes.

The non conventional crude oil production and the upgrading processes are very costly and their development is strongly linked to the expected crude oil price over the production period. In the modeling approach, we test several price expectations (myopic and perfect foresight behavior) and energy policy decisions (supply security) which drive the investment decisions. Then, the production levels are derived from the available reserves and the production capacities.

Furthermore, carbon quotas are and carbon taxes are introduced in the modeling approach.

Results

The resources in extra-heavy oil and bitumen are estimated at 3 800 Gb which is in the order of magnitude to those of conventional crude oil discovered until now. They are mostly located in Canada and Venezuela and significant volumes are also present in Asia, Russia, Africa and USA. Projects aiming at developing those resources are today numerous but they represent a very small part of the discovered unconventional resources. Today, the oil supply coming from extra-heavy oil and bitumen is about 1,5 Mb/d. In 2015, taking into account the existing and planned projects, the production will represent about 3 Mb/d. This result has been obtai-

ned in a "business as usual" scenario on crude oil price and conventional crude oil availability. This represents twice as the current production. However, the contribution of the extra-heavy oil and bitumen to the world oil supply stays very limited especially in regard with the amount of the resources. Then we examinate the economic factors and the energy policy decisions which could influence the investment in field development and upgrading capacities.

Conclusions

Extra-heavy oils and bitumen represent a huge potential in terms of resources. They are either of a high strategic importance in term of diversification of oil supply and enhancement of supply security. In fact, the resources of extra-heavy oil and bitumen are more balanced over the 5 continents than the conventional crude oil. As their exploitation costs are higher than those for conventional oil, economic incentives from policy makers should always play a key role to encourage the development of new projects. Nevertheless, a lot of technical difficulties remain and environmental constraints (carbon emissions) could limit the use of these resources.

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