REGIONAL ASSOCIATION OF
OIL, GAS AND BIOFUELS SECTOR COMPANIES
IN LATIN AMERICA AND THE CARIBBEAN

Systemic approach to improve the recovery factor of oil resources

Second edition

August 2019

ARPEL PUBLICATION N° WP02-2019

WHITE PAPER

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1. Introduction

Modern societies require increasing amounts of energy to meet their growth needs. In absolute terms, energy demand increases daily, regardless of improvements in energy efficiency.

Despite the incorporation of renewable energy in the energy matrix at a cost competitive with traditional sources, the share of oil and gas is estimated to account for 50 % of the world energy matrix by 2040.

> The global energy demand is expected to grow approximately 28% between 2015 and 2040. This means that by 2040 the world will require approximately 4,5 billion cubic meters per day of natural gas and 16 million barrels of oil per day, more than what was consumed in 2015.

Moreover, the existing oil and gas fields are being depleted at a rate of 6 % per year (1). Thus, the industry and states, owners of the hydrocarbon resources, have the challenge and the opportunity to work together to make the necessary investments and meet this growing energy demand in a manner consistent with sustainable development.

Most of the production comes from mature fields, i.e., fields that reached long ago their production peak and whose facilities are close to the end of their useful life. Depending on the permeability and the flow regime of the reservoir, a field can reach the stage of maturation in just 3 to 6 months or up to several years.

In 2017, mature fields accounted for approximately 70 % of the global oil production so there is a huge potential to increase the recovery from existing producing fields. At the global level, it is estimated that for every 1 % increase in oil recovery from currently operating mature fields, two years could be added to the global supply of oil, and help meet future energy demand. However, the percentage of global oil production through enhanced oil recovery has remained stable at 2-3 % (2, 3).

The average recovery factor in oil reservoirs is approximately 30 %; this percentage can be increased up to 40-60 %. To achieve this in an economically viable way, there must be a combination of factors, such as the use of modern technology, regulations that favor the improvement of recovery factors and optimization of corporate performance through the improvement of operational aspects and business strategies.

In this context, and considering that, in traditional basins, most of the major reservoirs have already been discovered, improving the recovery factor of mature fields is of vital importance to global energy security.

> This document aims to share with different stakeholders options to improve the recovery factors of mature oil reservoirs in a systemic way. In particular, an evaluation was made of the various policy and regulatory options in several producing countries that promote the increase in the recovery factor in mature fields.

2. Reactivating Mature Fields A Strategic Approach

Among other **BENEFITS**, rejuvenation of mature reservoirs will allow:

- adding significant volumes to the reserve stock without exploratory risk
- using existing treatment and transportation infrastructure in the area
- reactivating the economy of countries where the E&P activity is one of the main sources of employment
- postponing the disbursement of abandonment costs
- incorporating multiple technologies not available at the time of the development of reservoirs, which can make this opportunity possible

The maximization of the expected net value of economically recoverable oil and gas from depleting reservoirs is an issue of interest to both governments and operators. In this regard, it is important for them to consider the **NEED** for:

- Operators to focus on maximizing economic recovery as well as pursuing their individual commercial objectives
- Fiscal stability to be consistent with the challenges of maturity
- A proactive regulator
- Significantly improved asset stewardship
- Greater constructive collaboration between operators
- Better implementation of industry strategies

When it comes to evaluate the decision to rejuvenate mature fields, the strategic thinking of some companies include–among other- the following factors (4):

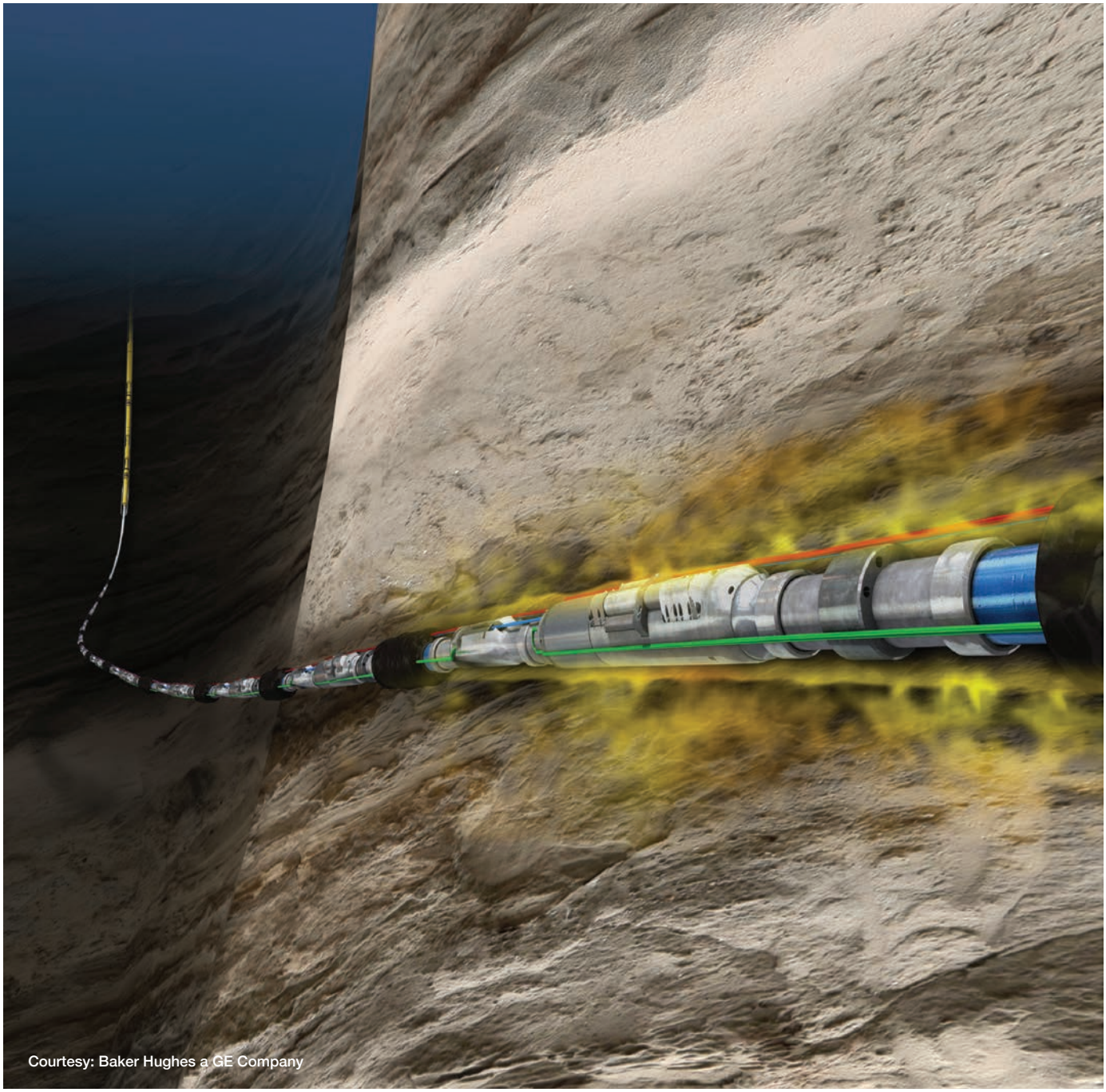
- The incentive to pursue increased recovery is often highest when and where there are concerns over resource scarcity.
- The preference for projects that can generate fast returns. Projects to rejuvenate mature fields require time to plan, test and implement, and generate incremental production only in the latter stages of a field's lifetime.
- The rejuvenation of mature fields has become a niche business among oil and service companies, and the requisite skills, technologies and expertise are not widely available.
- Costs for reactivating mature fields have come down since 2014, but the costs of other projects – including shale and offshore developments – have come down more quickly so production reactivation projects will have to compete with other investment opportunities.

3. Technology Options

Mature fields represent important challenges to oil and gas companies worldwide. Costs increase along the field lifecycle, with an incremental amount of produced water associated with increasingly stricter regulations on their disposal, even requiring 100% reinjection. Then, technology is required to enhance the extraction, stimulate the reservoirs and optimize production costs.

As fields becomes older (i.e., more mature) oil production comes with an increased amount of produced water. Being able to deal with the high water/oil ratios with aging and often undersized facilities (underestimation of water) is a major challenge.

An even bigger challenge in mature field is to find and extract the remaining oil, which occurs due to inefficient displacement (residual oil in the pores of the swept zones) or poor sweep (by-passed oil). Following a continuous reinterpretation of the reservoir, another major challenge is to get the additional oil out by applying technologies that improve the recovery factor.



Courtesy: Baker Hughes a GE Company

3.1. TERMS COMMONLY UTILIZED WHEN SPEAKING ABOUT ENHANCED OIL RECOVERY

During the life cycle of oil production, the SPE (Society of Petroleum Engineers) defines three stages of recovery (5):

Primary recovery (up to 20% recovery factor) - The initial production stage results from the displacement energy naturally existing in the reservoir.

Secondary recovery (additional 20-30% recovery factor) - The second stage of operations is implemented after the decline of primary production, targets mobile oil with secondary recovery processes such as waterflooding, pressure maintenance and gas injection.

Tertiary recovery (additional 10-20% recovery factor) - Targets immobile oil based on thermal energy, gas and chemical injection and other technologies in combination with water flooding and pressure maintenance.

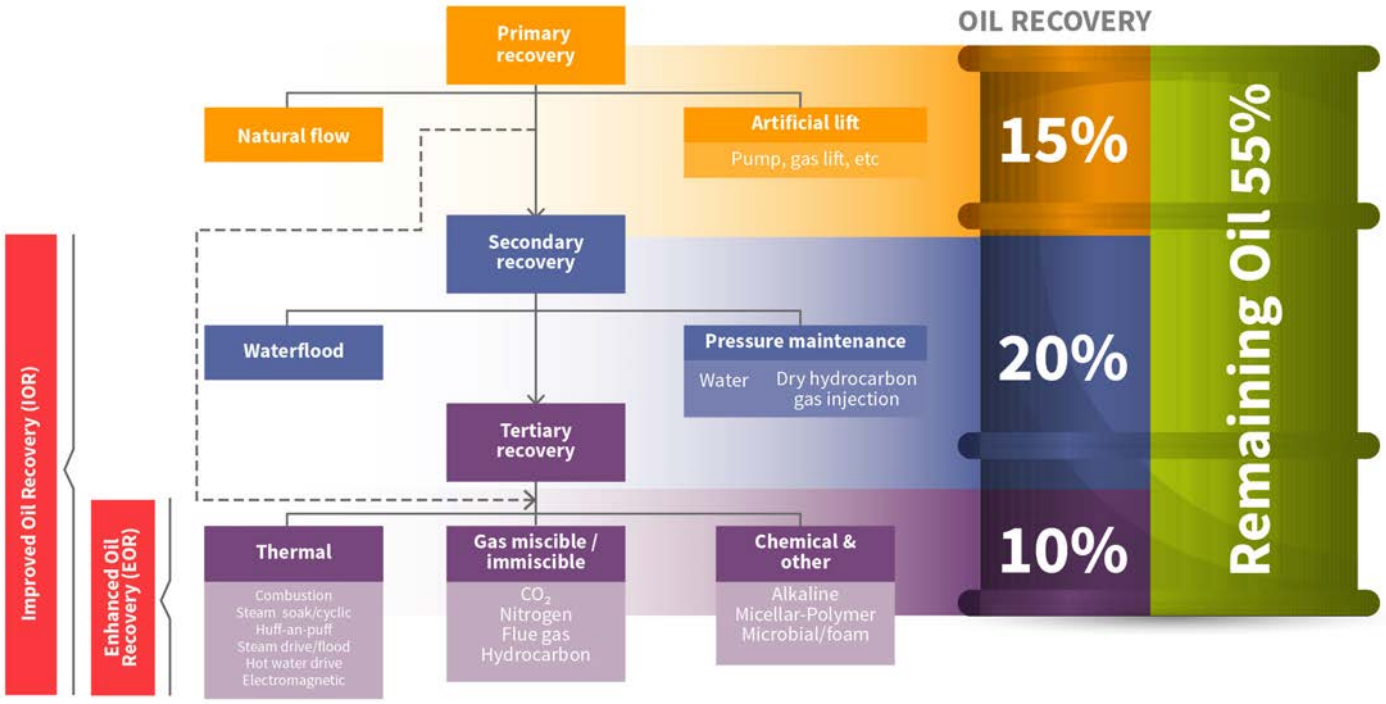


Figure 3.1: Schematic illustration of the IOR/EOR concurrent definition/approach with primary, secondary and tertiary recovery and associated technologies (Modified from 6)

Resulting performance of the oil field is also captured in Figure 3.1 in terms of recovery factors by production stage and remaining oil at the end of the life cycle. Then, more than of 50% of the oil in situ is remaining oil which can be extracted and produced improving costs, operations, commercial models, and the incorporation of new technology.

These three stages may not be conducted in a sequence. For heavy oils the primary production is generally negligible and waterflooding is not feasible, so that the thermal energy is the only way to recover oil from the beginning. Then, the term "tertiary recovery" has been replaced by Enhanced Oil Recovery (EOR). EOR results principally from the injection of gases or liquid chemicals and/or the use of thermal energy.

Enhanced Oil Recovery (EOR) is oil recovery by injection of fluids not normally present in the reservoir but excluding conventional pressure maintenance and immiscible displacement processes. EOR processes involve injection of a fluid or fluids that alter the original properties of the reservoir and create favorable conditions for oil recovery.

Improved Oil Recovery (IOR) refers to any practice used to increase oil recovery and includes EOR. Figure 3.1 better explains these definitions and highlights some of the most common –at present- associated technologies.

The economic limit of the well or the asset is very important for the economics approach of the field in every stage of the primary-secondary-tertiary production, where different capital and operating expenditures are needed to obtain positive economics results according with current oil price and existing regulations of each country.

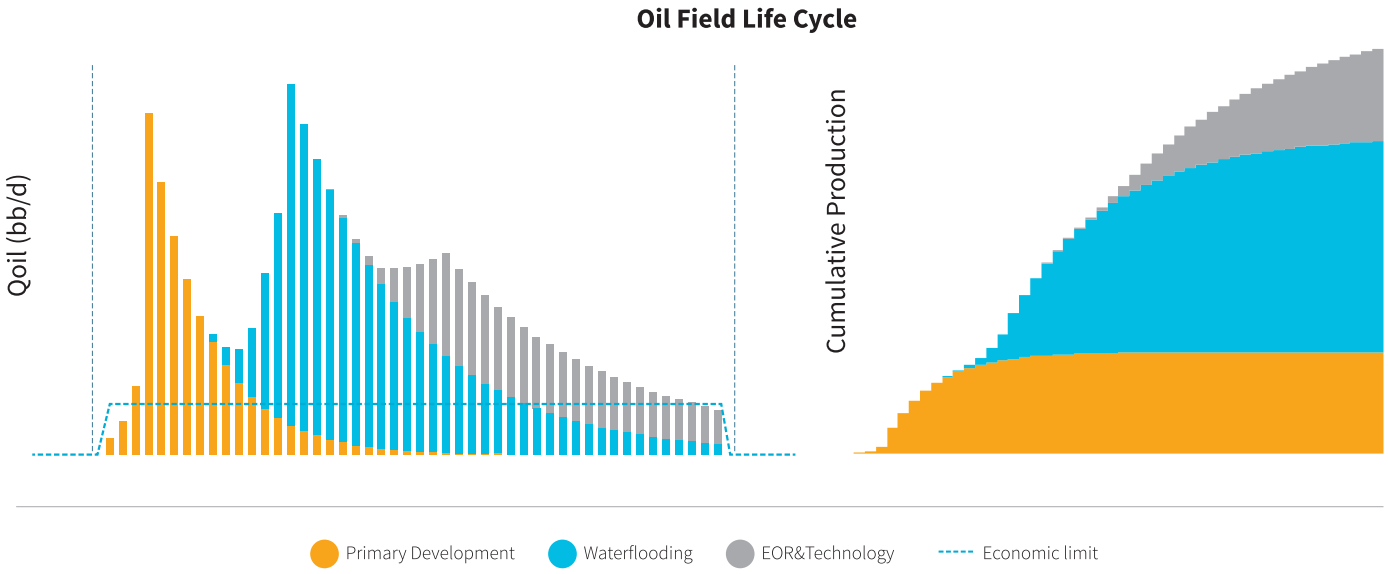


Figure 3.2: Typical oil production life cycle from a reservoir and the impact of enhanced oil recovery technologies (Courtesy of Schlumberger)

Improved Oil Recovery (IOR) and Enhanced Oil Recovery (EOR) may actually be used at any point in the life of a field, even from the beginning of its development. The IOR and EOR technologies are highly complementary. Ultimately, it is all about optimizing recovery and about energizing the oil in the reservoir to drive more of it to the surface.

Ideally, EOR strategy is already included in the field development phase; it is also needed for well integrity purposes in the basis of design. The most suitable EOR/IOR technology will depend on the specific reservoir and its actual condition. However, the decision on when to implement EOR is highly dependent on:

- internal project economics
- external market conditions, such as oil price (as an example of this dependency, most of the EOR processes used today were first introduced in the early 1970s at a time of relatively high oil prices)
- available reservoir / production data which indicates where and how much remaining oil is left, and
- the strategy of the operator (e.g., the main driver of the implementation of large scale polymer flooding for one company may be obtaining more oil recovered and this may not necessarily be the strategy for other companies)

3.2. THE IMPORTANCE OF EOR IN MATURE FIELDS

In order to address the increased worldwide demand for oil in a scenario where new oilfields are harder to find, the current expectation is that the number of EOR projects is going to increase worldwide in the future, despite concerns about greenhouse gas emissions and related environmental issues,.

It is relevant to mention from the very beginning that traditionally EOR processes/technologies have been closely intertwined to the industry's economic environment (i.e. oil and gas prices) and the expected supply/demand market prevailing at the time of their potential application.

The current belief is that our industry has not achieved yet the technological limit in terms of Recovery Factor.

Nowadays, as previously discussed, EOR deployment is controlled by economic factors and operational constraints. However, is fair to say that research continues to try to optimize these processes, to move them faster from the lab to the fields, and -of course-to make them more environmentally friendly.

Figure 3.3 describes the technical maturity of EOR processes. The red squares are mature technologies that can be implemented in many situations without significant adaptation. The yellow squares are those technologies that require optimization and field trials to get the correct full field design. The gray squares are technologies at the R&D (laboratory) level and require further field trials (7).

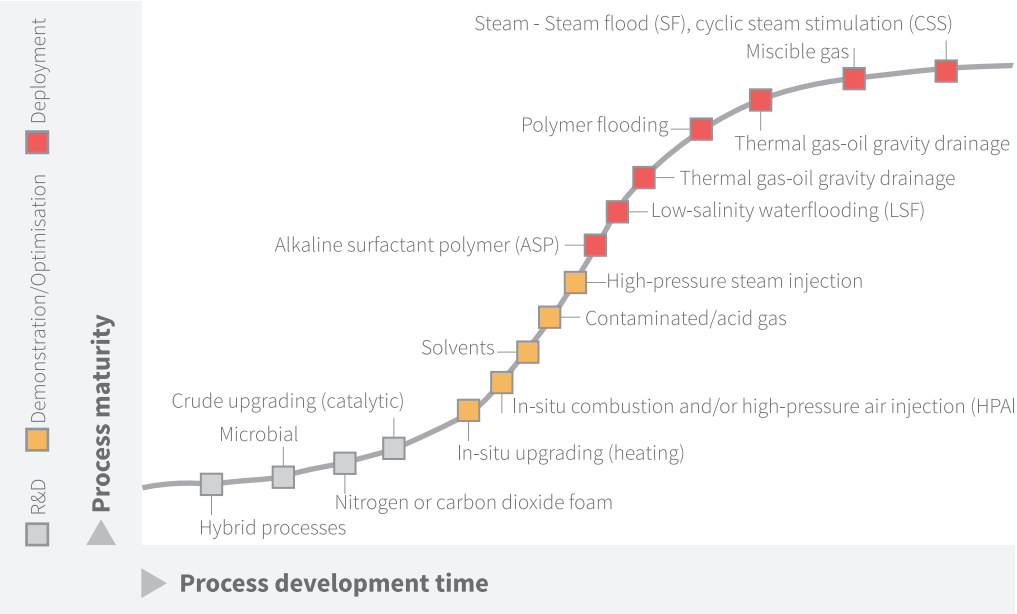


Figure 3.3: Main EOR Processes and their Level and Road to Maturity (7)

Despite the undeniable progress in the area of IOR/EOR processes, it is in general important to consider the following aspects:

1. New EOR technologies have to be easier to design, require less specialized equipment and staff for their field applications, and should produce a quicker response in terms of oil rate.
2. Companies should be planning the deployment of both new and existing EOR technologies at the beginning of their field development planning to ensure that there will be facilities and space to implement EOR in due course (this is particularly critical in offshore developments).
3. A major challenge remains on the time delay between the deployment of a given EOR process in a field, which often involves considerable extra capital and operational costs, and the response in terms of additional oil production.
4. Where the geology is suitable, CO2 injection for EOR and geological sequestration of the CO2 is one of the ways in which companies can reduce the emissions intensity of the oil delivered to market and therefore reduce its environmental footprint.

4. Regulatory Alternatives

In addition to the reservoir management techniques and technologies applied, a comprehensive approach to foster mature fields development also includes the strategies, laws and regulations established by governments for such purpose. Different countries have taken –and are taking- several innovative regulatory approaches to maximize the expected net value of economically recoverable petroleum from relevant and depleting reservoirs.

> "Today over 80% of global EOR production benefits from some sort of government incentive or is prioritized by national oil companies as part of their efforts to maximize the return from national resources." (8).

The implementation of these regulations are expected to provide additional output derived from increased exploration activity, better stewardship, more efficient production, improved recovery and delayed decommissioning.

USA provides a good example of how policy incentives affect the growth of EOR projects. In the 1980s, faced with the prospect of declining domestic oil production, the Crude Oil Windfall Profit Tax 1980 kick-started the US EOR industry by significantly reducing its tax burden. More recently, the US section 45Q tax credit has been amended to provide a tax reduction of $35/tCO2 for 12 years for CO2 stored in EOR operations (8).

This section describes some incentives models as well as some effective regulatory practices utilized by different countries in Latin America and the Caribbean as well as other regions of the world to assist existing and new operators to cost/effectively enhance the recovery of oil from mature fields. It is worth noting that, the intent of the strategies/regulations described in this chapter indistinctly refers to the promotion of the development of mature fields, resources and marginal reserves.

The models described in this section may be proven regulatory approaches as well as preliminary governmental attempts to gauge their effectiveness over time. These models are –generally- country specific since each country has unique approaches to the development policies of its hydrocarbon resources and sustainable development. This means that although governments would find the options presented here useful to be considered in their own context, they are not necessarily unfailing recipes that governments have to follow as a silver bullet to ensure a successful outcome in their countries.

It is worth pointing out that these regulatory approaches are typically developed by governments under the premise that all stakeholders should be obliged to maximize the expected net value of economically recoverable petroleum from depleting reservoirs in each country.

REGULATORY/STRATEGIC APPROACH

If the operator presents a Development Plan to request the extension of the term of the contract, including the realization of pilot or massive projects of improved recovery according to the maturity of the reservoirs, a lower royalty or higher remuneration may be granted to the incremental production. Volumes within the planned production curve will be subject to the same royalties agreed in the concession contract. For this, the government determines - for each contract - the basic production curve, considered as the one that would be obtained from the wells that on the date of the agreement are in productive situation or that have produced in a sustained manner in the last three months.

Companies that wish to access the benefit will need to present - within the term determined by the regulation- new development plans (including budgets of investments and expenses), proving there are additional economically feasible volumes to extend a field's life. For such reduction of the royalty or increase of the remuneration, the Operator has to develop and implement a Minimum Work Program and an additional one, according to a budget of investments and expenses, and within the term determined by the regulation.

This benefit granted by the government may vary, depending on the quality of the crude oil extracted.

EXPECTED OUTCOME

- Boost of production by bringing in new short-term investments.
- Increase interest from operators by providing incentives improving the economics of the investments.
- Indirectly, it is expected that new technologies be implemented.
- The State obtains a higher income tax that the operator would pay for the basic production, as it has a lower cost for the reduced royalty, or more income for the increased remuneration, as the case may be. This adds to the increased income tax obtained from oilfield service providers because of the increased investments and expenses of the operators hiring their services.
- New jobs would be generated by the increase in production activities.
- There may be a greater benefit for local refineries when substituting imported crude for local crude.

REGULATORY/STRATEGIC APPROACH	EXPECTED OUTCOME
Concede the rights of fields where operators are no longer investing the resources necessary to maximize the recovery of existing reserves	A company operating at a recovery rate that does not align with the obligations imposed in the development plan under its license and with an unacceptable economic return is authorized to finish their contract and sell it to smaller, technologically focused companies.
Flexibilization of local content rules. This may include the reduction of national and local taxes on the production and availability by national companies of goods and materials required for oilfield activities, especially for the development and operation of EOR projects, including the creation of nearby dry ports to land production areas.	Potential for costs' reduction of operators in new technology. Due consideration to the fact that the investments required for the operation in these areas may be disproportionate to the requirements established for the other bidding modalities.
If companies are not able to ensure the recovery of the maximum value of economically recoverable petroleum from their licenses or infrastructure for financial reasons, or because recovery generates returns that are unsatisfactory to them, they must seek to secure investment from other companies/means. If after a reasonable period the companies are unable to secure alternative funding or to divest themselves of the asset then, if the recovery of maximum value of economically recoverable petroleum would achieve a satisfactory expected commercial return, they shall relinquish the related licenses.	Companies are allowed to seek others to maximize the value of economically recoverable petroleum from their licenses or infrastructure including by divesting themselves of such licenses or assets to other financially and technologically competent companies. By doing so, increased production is accomplished together with the oil industry activity with the associated benefits for the State
Authorize the extension of concession contracts of producing fields as a means to extend their life	Allows companies more time to define alternatives (strategic, operational and technological) to extend the lifecycle of the field and maximize value for the benefit of the companies and the State.
The national hydrocarbon agency must take an integrated view of the production licenses and ensure that the licensees seek agreement in cases where coordination of reservoirs is clearly the rational approach. Considering that the interest of the companies in coordinating their activities and/or sharing inform may differ, it is important that the agency ensures that decisions are based on the right information	Coordination can help to cut costs and improve recovery. Coordination and area solutions can contribute to achieving profitability for several reservoirs that are not commercial on their own.

REGULATORY/STRATEGIC APPROACH	EXPECTED OUTCOME
The national hydrocarbon agency works to encourage research and development. As part of these efforts, it coordinates innovation work which cuts across companies and production licenses	Companies will be willing to exploit the opportunities provided by technological advances to create value through improved recovery or cost reduction.
The national hydrocarbon agency helps ensure that improved recovery projects are implemented before their window of opportunity closes.	In some areas, new developments of mature fields are usually tied back to existing facilities. As such infrastructure ages, the timing is a significant issue since improved recovery could face a critical window of opportunity that could mean that the value of a project declines –and at worst disappears

A NOTE ON THE ENVIRONMENTAL PERMITTING OF EOR PROJECTS

EOR projects generally require the construction/ adaptation of existing on-site facilities; they also utilize chemicals and/or energy not considered at the beginning of the field development. This means that after the –oil and gas- regulatory agency approves the EOR project the approval of environmental authorities will also be required.

In this regard, it is important that the term of the government response be balanced with the time limits of the EOR projects to ensure their economic viability within the window of opportunity defined (9).

If the increased production from EOR is a national strategic matter, it is important that these issues be resolved through a constructive dialogue among the corresponding governmental institutions and the local industry.

5. Operating Aspects

FEASIBILITY OPTIONS FOR EOR PROJECTS IN LATIN AMERICA AND THE CARIBBEAN

In 2018, approximately 65% of oil production in Latin America and the Caribbean came from mature fields*. This represents a great opportunity to increase production through EOR techniques in the Region.

Enhanced oil recovery projects are expensive and their true value takes a long time to be visible. Having to face the challenge of being cost-effective, private and state sector operators throughout the world are having a hard time earning the confidence of investors.

This challenge is great in regions or countries where industry does not have very mature and advanced levels of development and, therefore, industrial and research infrastructure, as well as existing professional skills for this kind of projects, are precarious or nonexistent.

Another element that plays an important role in the feasibility of enhanced recovery projects are funding programs for research and technological development projects focused on enhanced recovery and related areas.

(*) Calculation estimated by ARPEL

In most Latin American and Caribbean countries, there are top universities with high capabilities to train competent professionals and do basic and applied research in the areas/courses related to the hydrocarbon industry. In addition, in most countries in the region there is also a relatively developed industrial base in the areas of design and synthesis of chemical products, design and construction of industrial plants, transportation systems, etc. In general, these research and implementation capabilities are poorly utilized by operating companies that undertake pilot or massive projects of enhanced oil recovery. The most common practice of implementing enhanced oil recovery projects in the region is to delegate them to large contractors or specialized engineering firms in more advanced countries and develop "turn-key" projects, which is not always cost-effective. Therefore, companies should consider the combination University-Operator-Contractor.

Possible strategies to be considered by companies and governments

STRENGTHENING THE RESEARCH CAPACITY AND TRAINING OF PROFESSIONALS IN AREAS RELATED TO THE HYDROCARBON INDUSTRY AND ENHANCED RECOVERY

Enhanced oil recovery requires an important base of experience and knowledge of basic and applied science. In pre-implementation planning and evaluation stages, a huge amount of resources is required for the experimental evaluation and modeling at different scales of the process (or processes) to be implemented. This support may be provided by universities and local research centers to the extent that they have the resources and appropriate support of operating companies and the corresponding state organizations.

Research and development centers and universities in Latin America and the Caribbean require significant experience in the area of hydrocarbons and also financial support enabling them to have an important training and research infrastructure.

On the one hand, operating companies can work together with universities, provide them with additional resources, and give them appropriate support during the different stages of the project. On the other hand, governments could promote research projects and technological development (10, 11).

BETTER USE AND STRENGTHENING OF EXISTING INDUSTRIAL INFRASTRUCTURE IN DIFFERENT COUNTRIES

Chemical inputs, design engineering and industrial equipment/facilities are the more complex and expensive components for the implementation of enhanced oil recovery projects. Usually, these components are developed and executed in the most developed countries and then imported into countries where the project will be implemented. These processes are inherently expensive.

Operating companies could focus on maximizing existing capacities in the countries where they operate. Some of the countries where enhanced recovery projects are planned or under development have a long history in the industry, and there are local companies with the capacity to provide all or part of services and/or equipment required for the successful implementation of such projects (e.g., Argentina, Brazil, Colombia, Ecuador and Mexico, among others). The same is true in the areas of design engineering and construction of industrial plants.

This new strategy will not only allow the reduction of costs and implementation times of these projects, but would also help strengthen the industrial infrastructure, the use of more local labor, and the overall development of Latin American and Caribbean countries.

6. Commercial or Strategic Partnerships

In addition to considering technological, regulatory and operational aspects, companies can develop business strategies through synergies with other operators or service providers with the purpose of maximizing the recovery factors in mature fields with low operating costs.

6.1. SYNERGY AS A SHARED VALUE GENERATION APPROACH

The shared value comes from the generation of business economic value with direct benefit to the companies and the State as well as the important benefit to the communities of influence and to society at large.

This can be done in three different ways: reformulation of products and markets, redefinition of productivity in the value chain and creation of clusters of support for the sector around corporate facilities. All this with the vision of integrating people, processes, and information technology to carry out analysis and make high-impact decisions that transform and revitalize mature reservoirs.

The methods that should transform the workflow processes are based on the success and effectiveness of application of mature field operations integrated through operational synergy with the responsibility of improving the indicators that reflect the objectives to be achieved.

This transformation process based on synergy requires the following:

- gathering all project information and larger assets
- identifying, automating, standardizing and optimizing critical operations and technical work to ensure the reliability of wells and reservoirs in operation
- implementing solutions of high-impact operational synergy
- enabling collaboration between operators and service providers through access to experts and critical information

6.2. SYNERGY BETWEEN OPERATORS AND SERVICE PROVIDERS

In addition to the availability of services, which are their *raison d'être*, in a context of synergy between operators and service providers, the latter can bring innovation, new technology and technological support in the process of development and progression of hydrocarbons reserves.

In this regard, service providers could continuously warn about new improvements applicable in their field of action, for example:

- business mechanisms for implementation and development of applicable innovative solutions,
- optimization and management of existing resources under the framework of integrity of assets and
- design of integration between blocks

Different countries in Latin America and the Caribbean have implemented robust business models with the aim of improving the recovery factor of mature reservoirs through service contracts that have been integrated to the operation incorporating the concept of shared risk. This allows the study and the subsequent investments for the development of new wells, and the implementation of the latest technology available worldwide in processes of water injection and EOR.

The contribution of investment and technology by service companies, with alignment in asset risk management, is an excellent option for synergy with operators that ensures the transfer of knowledge and the optimization of operations.

6.3. SYNERGIES AMONG BLOCKS

The exploitation of oilfields continues to develop under various scenarios that over time have depleted primary reserves, leaving the remaining reserves and contingent resources to be developed that require suitable technological and operational resources with high implementation costs.

The ability to develop the remaining reserves and contingent resources of Latin America and the Caribbean -by deploying shared value generation schemes- will improve the economy of countries whose economies are based heavily on oil, generating well-being to society at large.

The proximity of blocks to existing infrastructure would create synergies in exploration and exploitation activities, as the geological characteristics and the type of reservoirs expected in those nearby blocks could be similar.

For the development of synergies among blocks, the following aspects should be considered:

01 IDENTIFICATION OF OPPORTUNITIES

It is important to validate the reserves and contingent and prospective resources of the operations involved, as well as to identify the assets available for designing and providing complementary assets.
The development scheme of each operation should be reviewed, as it is important to establish a certain level of synchronization so that no operation is impaired and no opportunity to mobilize the resources required is missed.

02 STRATEGIC ALIGNMENT

Individual development strategies must be aligned with a certain perspective and with joint collaboration goals. This will lead to a cultural change with a new vision focused on results, with greater productivity efficiency but without neglecting the individual objectives and internal processes of each company, which are the basis for success.

03 OPERATIONAL SYNERGIES

Whenever possible/beneficial for operators that wish to enter into an agreement, the existing facilities and processes as well as the possibilities of improvement to reduce operating costs or increase productivity should be shared.

04 ANALYSIS OF LEGAL, SOCIAL AND ENVIRONMENTAL FRAMEWORK

The development of joint exploitation agreements between operators must comply with the laws and regulations in force in each country, ensuring good environmental performance and the social well-being of the communities present and adjacent to the operations areas through the implementation of a socio-environmental management system adapted to the individual and joint realities.

05 MEMORANDUM OF UNDERSTANDING (MOU) BETWEEN OPERATORS

Once the previous steps have been successfully taken, the operators would sign a Memorandum of Understanding (MOU) to establish the mechanisms and scope of cooperation between companies that wish to develop mature fields in geographically close blocks. The MOU must include the economic and financial aspects in the light of the participation of each company

7. Conclusions

It is expected that EOR projects enhance their growth by 2020. By then, several oilfields have become mature enough to require efforts to maintain production or slow declines by supporting new EOR developments. IEA (4) expects that, between 2025 and 2040, total EOR production grow over 60% and account for around 4% of global production in 2040. Therefore, companies and governments should start thinking of the alternatives ahead now!

For EOR to projects to be actually implemented –and provide to the States the maximization of the expected net value of economically recoverable oil and gas from depleting reservoirs- several innovative measures would need to move fast soon.

Governments and industry need to commence simultaneous and concerted efforts to screen fields and determine EOR potential in resource-rich areas, testing EOR-projects in countries where it has not previously been used. They also need to be creative, defining regulatory approaches, including continued fiscal incentives and streamlined environmental permitting processes, identifying business strategies and taking full advantage of the technological advances and the potential for digitalization to generate a better understanding of the sub-surface strategies.

It is crucial for the production and creation of value of the mature fields that the different licensees are aware and manage their fields in an appropriate way. The authorities expect licensees to operate their fields as effectively as possible and to make all the investments and cost-effective measures for greater recovery. It also means that resources must be exploited before it is too late.

The technology, the regulatory framework and business strategies for the sustainable development of mature oil fields, periodically advance. ARPEL has developed a virtual collaborative tool known as Innov@arpel (www.innovarpel.org) that allows all users to share case studies, technologies and regulations related to the improvement of the recovery factors of mature fields (12, 13). Readers are invited to share their knowledge on the subject in this platform.

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Systemic approach to improve the recovery factor of oil resources

REGIONAL ASSOCIATION OF
OIL, GAS AND BIOFUELS SECTOR COMPANIES
IN LATIN AMERICA AND THE CARIBBEAN

ARPEL is a non-profit association gathering oil, gas and biofuels sector companies and institutions in Latin America and the Caribbean. Founded in 1965 as a vehicle of cooperation and reciprocal assistance among sector companies, its main purpose is to actively contribute to industry integration and competitive growth, and to sustainable energy development in the region. Its membership currently represents a high percentage of the upstream and downstream activities in Latin America and the Caribbean and includes national and international operating companies, providers of technology, goods and services for the value chain, and national and international sector institutions.

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