



Economic and Social Council

Distr.: General
15 February 2019

Original: English

Economic Commission for Europe Committee on Sustainable Energy Expert Group on Resource Management

Tenth session

Geneva, 29 April–3 May 2019

Item 9 (d) of the provisional agenda

Development, maintenance and implementation of the United Nations

Framework Classification for Resources and the United Nations Resource Management System: Petroleum

Pilot project for the classification of Mexico's petroleum resources and reserves based on the United Nations Framework Classification for Resources (UNFC)

**Prepared by the Petroleum Working Group of the Expert Group on
Resource Management**

Summary

This document outlines the implementation of the pilot project for the classification of petroleum resources and reserves of Mexico according to the United Nations Framework Classification for Resources (UNFC).

The overall intent of this paper is to show the planning and execution of the pilot project, the results, and conclusions obtained from it, as well as the evaluation of UNFC as an adding value tool to the classification and management of oil and gas resources in Mexico. The methodology outlined in this document may be used in other countries, adapted and adopted as necessary to the local conditions, for relatively quick classification according to UNFC.

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I. Introduction

1. This document presents the results of a large-scale project (pilot project) to apply the United Nations Framework Classification for Resources (UNFC) to projects in nineteen hydrocarbon exploration and extraction blocks in Mexico. The pilot project was led by the National Hydrocarbons Commission (CNH) of Mexico in collaboration with the Ministry of Energy (SENER) and the Safety, Energy and Environment Agency (ASEA).
2. According to the proposal included in document ECE/ENERGY/GE.3/2018/9¹, Mexico implemented a pilot project under the auspices of a regulator (CNH).
3. The primary purpose of the pilot project was the implementation of UNFC to evaluate the value and applicability in Mexico, with particular regard to describing the social and environmental project risks.
4. The collaboration between the institutions involved allowed the holistic identification and visualization of all aspects involved in the evaluation of oil and gas projects.
5. Mexico has large discovered hydrocarbon volumes and significant undiscovered hydrocarbon potential; as of 1 January 2018, the estimated 2P² reserves were approximately 16.2³ Billion barrels of oil equivalent (BBOE) and 112.8⁴ BBOE for the prospective resources (risked mean values) in conventional and unconventional resources.
6. Currently, hydrocarbon volumes in Mexico are classified according to the Society of Petroleum Engineers (SPE) Petroleum Resources Management System (PRMS)⁵. PRMS (briefly) notes environmental and social aspects among other considerations for the classification of hydrocarbon projects. UNFC uses similar principles to PRMS but explicitly differentiates social and environmental risks, with some granularity, to better describe the level of project maturity.
7. The pilot project involved evaluating hydrocarbon projects with different levels of commercial maturity, legal and contractual terms, development risks and technical uncertainty, trying to obtain a representative sample of the different types of hydrocarbon projects in Mexico.
8. The key social risks identified in the pilot project include the approval and acceptance (often referred to as ‘social license’) of the projects by local communities, agrarian cores, indigenous people, among others; negotiation of the use, affectation or acquisition of land, property or rights to carry out activities, and for the specific case of unconventional resources, social acceptance of hydraulic fracturing.
9. The key environmental risks identified in the pilot project include the loss of natural protected areas, water use, and reduction in biodiversity due to deforestation.

¹ Petroleum Working Group of the Expert Group on Resource Management (formerly known as the Expert Group on Resource Classification), 2018, ECE/ENERGY/GE.3/2018/9, United Nations Economic Commission for Europe

² 2P is a term in the Society of Petroleum Engineers (SPE) Petroleum Resources Management System (PRMS) and denotes the best estimate of reserves (sum of proved plus probable). In UNFC, this is equivalent to G1 + G2 for commercial projects

³ https://portal.cnih.cnh.gob.mx/downloads/es_MX/estadisticas/Reservas%20por%20campo%202018.pdf

⁴ https://portal.cnih.cnh.gob.mx/downloads/es_MX/estadisticas/Recursos%20Prospectivos.pdf

⁵ SPE, 2007, Petroleum Resources Management System and 2011, Guidelines for application of PRMS

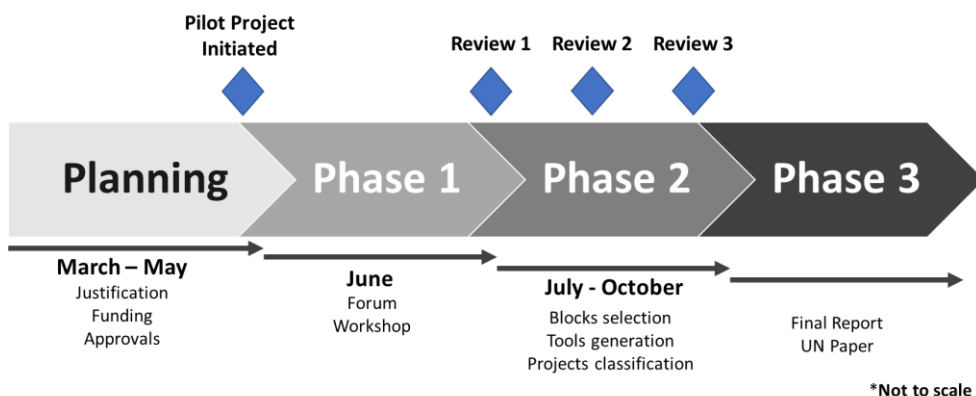
10. This document summarizes all the experiences, lessons learned, tools and considerations made in the implementation of the pilot project, including classification of all the projects using UNFC.

II. Description of the Pilot Project

11. The pilot project comprised four main stages (see **Figure I**):

- (a) Planning: Justification and Funding;
- (b) Phase 1: Forum and workshop on UNFC;
- (c) Phase 2: Project selection, tools generation and classification using UNFC;
- (d) Phase 3: Final Report.

Figure I
Pilot Project Phases



12. A detailed project schedule including all the activities and the specific dates is shown in the Annex.

A. Planning

13. An agreement with the United Nations Development Programme (UNDP) was established for Mexican institutions to conduct the UNFC pilot project with the support of experts in the field. All necessary internal procedures were followed to obtain the funds and the corresponding approvals.

B. Phase 1

14. A forum and a workshop were conducted to outline the scope and objectives of the pilot project, including the benefits of applying UNFC within the context of the Sustainable Development Goals (SDGs). Multiple stakeholders within the oil industry including oil and gas exploration and production entities, regulators and government, and relevant non-governmental organizations participated in the forum.

15. During the workshop, a team was formed comprised of representatives from CNH, SENER, ASEA, and members of the Expert Group on Resource Management (Expert

Group). The purpose of this workshop was to understand the technical, economic, social, environmental, and regulatory conditions to classify the projects using UNFC.

16. During Phase 1, UNFC was better understood, and a selection of new blocks was needed, given that those initially selected (before the workshop), did not have committed associated projects. The definition of the project was re-assessed as well, to ensure agreement with UNFC.

C. Phase 2

17. The selection of blocks was made taking into account certain criteria in order to meet the goal of having a representative sample of hydrocarbon projects to analyze.

18. The blocks selection criteria included the existence of an operator exploration, appraisal or development plan, different project maturity, fluid type, resource type, location, social, environmental, technical and legal risks. This resulted in a set of nineteen blocks to evaluate.

19. Subsequently, the team identified the projects in each of the selected blocks, resulting in a total of seventy-five projects.

20. All the variables to be considered in the E and F axes of UNFC were outlined and assessed in the classification of the projects with a specific focus on the local social and environmental risks.

21. As part of this process, two tools were created to assist in mapping to UNFC categories. For the evaluation of the E axis, a matrix that identifies the key social, environmental and legal risks, as well as the main economic assumptions for each project. Likewise, for the F axis case, a project feasibility evaluation tool was created based on the existing regulatory processes of oil and gas projects approvals.

22. For the G-axis evaluation, as no volumes were estimated by the team, the team instead used values provided by existing estimates that were made according to the regulatory framework^{6,7} and validated by CNH.

23. The projects were then evaluated and classified based on UNFC.

D. Phase 3

24. Phase 3 consisted of the documentation of the pilot project, including:

(a) a report provided to the participating institutions for internal usage. This report included a detailed analysis of each of the seventy-five projects, the evaluation undertaken and their classification under UNFC;

(b) a summary report (herein) for wider distribution.

⁶ http://dof.gob.mx/nota_detalle.php?codigo=5508418&fecha=20/12/2017

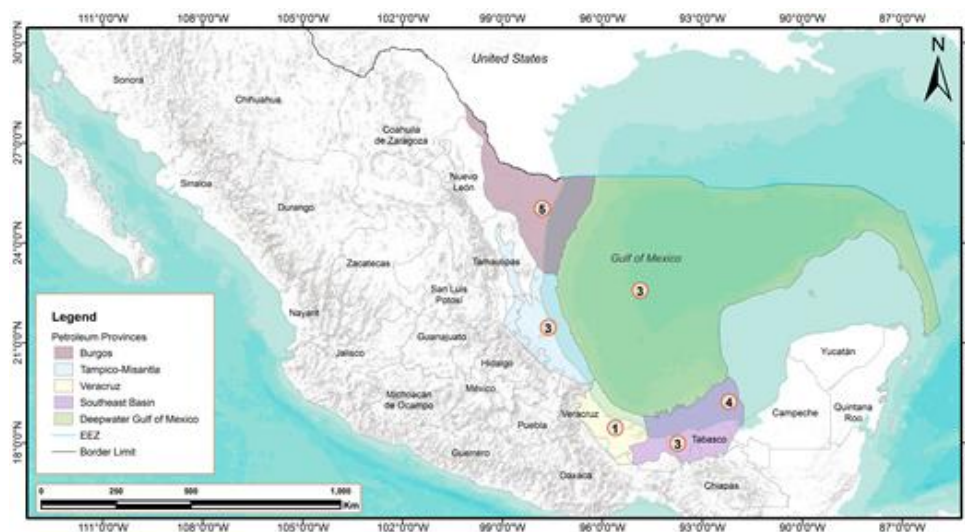
⁷ http://dof.gob.mx/nota_detalle.php?codigo=5324529&fecha=05/12/2013

III. Pilot project execution

A. Project definition and considerations

25. A map showing the location of the nineteen blocks evaluated during the pilot project is shown in **Figure II**, located in the five most important petroleum provinces of Mexico, which include five blocks in Burgos, three in Tampico-Misantla, one in Veracruz, three onshore and four offshore in the Southeast basins, and three in Deepwater Gulf of Mexico.

Figure II
Pilot project blocks location map



26. The operator exploration, appraisal or development plans for each block were assessed to define the individual projects based on project maturity. This included a review of the committed activities (base scenario) and incremental activities (incremental scenario) within each plan.

27. The assessment identified the conventional and unconventional resources potential. Potential volumes come from the estimates included in the National Leads Database (managed by CNH), as well as from a regional study carried out by the state-owned petroleum company (Petróleos Mexicanos (PEMEX)). These volumes are not committed to be developed by any current block operator, otherwise they would be included in an exploration plan. The decision of considering these volumes was made to evaluate the full potential of the whole geological column of the blocks.

28. The status of regulatory approvals was undertaken and considered in the classification.

29. Based on the above considerations, it was possible to identify seventy-five projects (see **Figure III**) and catalogue them into nine different project groupings with similar project attributes in each (see **Figure IV**). The project groupings included:

- (a) Unconventional Prospective Resources (UPR);
- (b) Conventional Prospective Resources (CPR);
- (c) Exploration Plans (Incremental Scenario) (EPI);
- (d) Exploration Plans (Base Scenario) (EPB);

- (e) Appraisal Plans (Base and Incremental Scenarios) (AP);
- (f) Migration Proposal (MP);
- (g) Provisional Field Development Plan (PFDP);
- (h) Field Development Plans (FDP);
- (i) Current Production (CP).

30. Each project (project groupings) included in the 19 blocks (Blocks A to S), is displayed in **Figure III**. For example, in Block A, one project of Current Production type (CP), two projects of Field Development Plan type (FDP), and one project of Unconventional Prospective Resources type (UPR) are included, adding four projects in total for that specific block.

Figure III
Projects identified

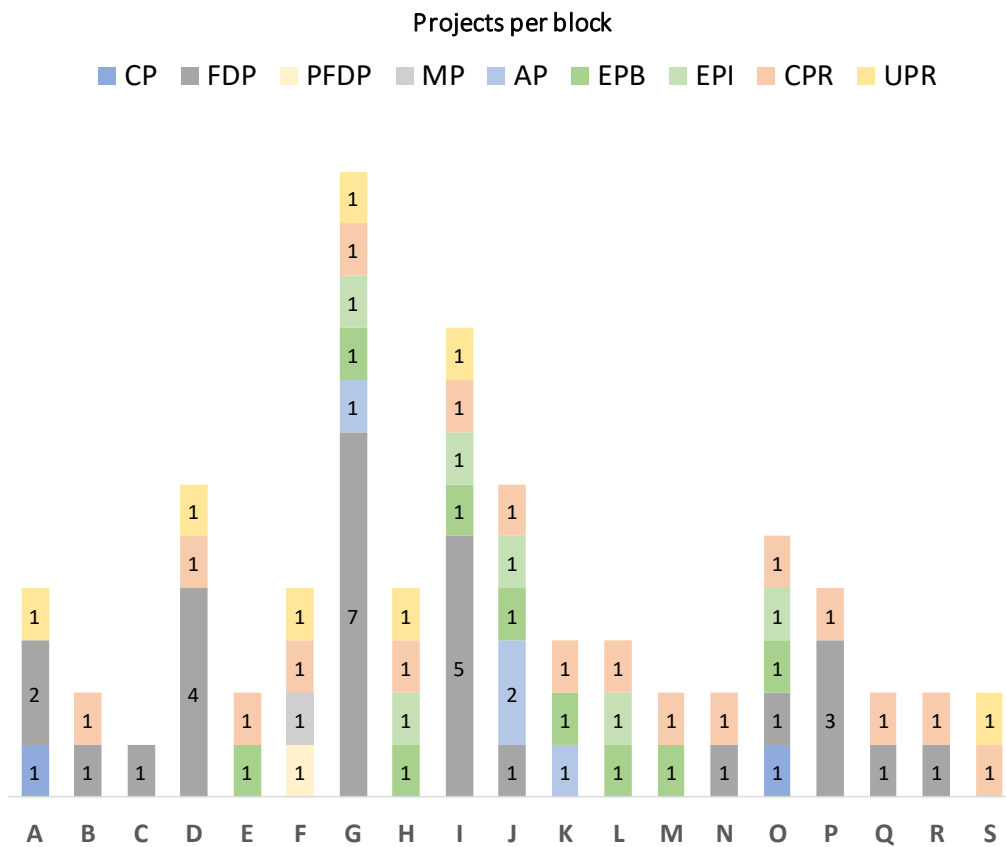
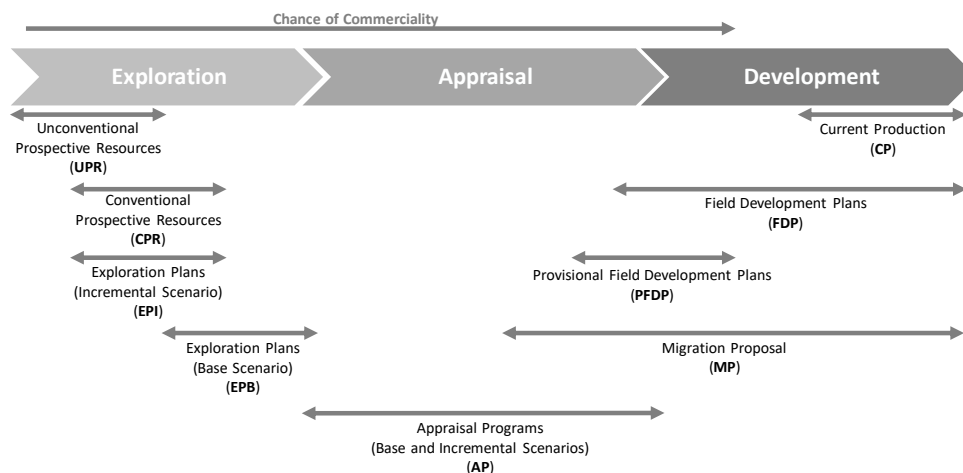


Figure IV
Types of projects



B. Mapping tools

31. In evaluating the socio-economic viability of the E axis, a matrix was created to better describe the project specific risks. For the case of the F axis, a flow diagram (gate process) was generated.

32. The matrix (for E-axis evaluation) considered the Mexican legislation regarding socio-organizational and environmental factors, required by the government in two documents: the “Social Impact Assessment”⁸ (MIA) and the “Environmental Impact Assessment”⁹ (EVIS). Thus, the matrix contains the relevant information required by the country’s legislation.

33. The socio-organizational factors included the presence of communities with indigenous people, urban and rural land use, the values of the marginalization index and the index of human development, the local economic activity and water use, among other variables.

34. The environmental factors included the existence of safeguard zones, protected natural areas, wetlands of international importance (called Ramsar¹⁰ sites), species of flora and fauna protected by legislation and the zoning of critical land use in the area.

35. The team used a multivariate geospatial analysis (map algebra¹¹) to identify and evaluate the socio-organizational and environmental factors. This tool allows the identification of the spatial distribution of the variables and interaction between variables within the blocks.

36. The map algebra considered both quantitative and qualitative variables. Each variable had different weights or values based on its importance considering the vulnerability, fragility, sensitivity or protection and conservation, as established in the respective legal

⁸ <https://www.semarnat.gob.mx/temas/gestion-ambiental/impacto-ambiental-y-tipos/contenido-de-una-mia>

⁹ <https://www.gob.mx/tramites/ficha/evaluacion-de-impacto-social/SENER2561>

¹⁰ <https://www.ramsar.org/>

¹¹ Tomlin, C. D. (1990). Geographic information systems and cartographic modeling (No. 526.0285 T659) Prentice Hall

framework related to the protection of property, environmental services, indigenous communities, archeological zones, safeguard zones, and protected natural areas, among other considerations.

37. Legal and regulatory conditions were also considered including those contained within the MIA and EVIS, in addition to the “Environmental Baseline” (LBA), “Change of Land Use in Forest Land”, “Safety and Environmental Management System” (SASISOPA), and the acquisition of insurance policies or guarantees to cover environmental contingencies.

38. For economic factors, the evaluation considered the economic indicators Net Present Value (NPV) and the Internal Rate of Return (IRR).

39. **Table 1** presents the proposed matrix which uses three levels of viability for the development of the projects, considering the environmental, social, legal and economic variables used to classify the projects on the E axis: (1) high or most likely, (2) best or likely, and (3) low or unlikely. This matrix can be used by experts, with extensive knowledge of the project area, as a qualitative tool and judgment should be used to identify key social, environmental, legal and economic risks in order to assess the likelihood of project execution.

40. The matrix presents the environmental and social factors separately for practical reasons. However, the final evaluation assumed that both factors are cross-linked and equally important to determine the economic viability of a project.

41. The F-axis flow diagram generated fits appropriately with the definitions of the categories and sub-categories of UNFC, in accordance with the regulations issued by CNH in terms of planning approvals.

42. Considering the above, it was concluded that the processes of submission and approval of plans are consistent with the definitions of the F axis, therefore the classification was considered “direct”.

43. The flow diagram (see **Figure V**) consists of binary responses (yes or no) and gate type which leads to a direct categorization on the F axis.

44. For the specific case of F1.2 classification, there are two ways possible to evaluate it. The first one is to consider that the Final Investment Decision (FID) of the operator is unknown by CNH, as it is not a legal requirement for FDP approval, and it is implied that the operators will meet the committed activities (once FDP is approved) as they have demonstrated previously their financial capacity. The second way is to consider FID disclosure by the operator. These two ways indicate that there are no impediments to the project proceeding and that the project is underway.

45. For other purposes or stakeholders, this process can be modified, improved and adjusted to adapt it to the specific regulatory conditions or to the processes established by governments, companies or general users of UNFC.

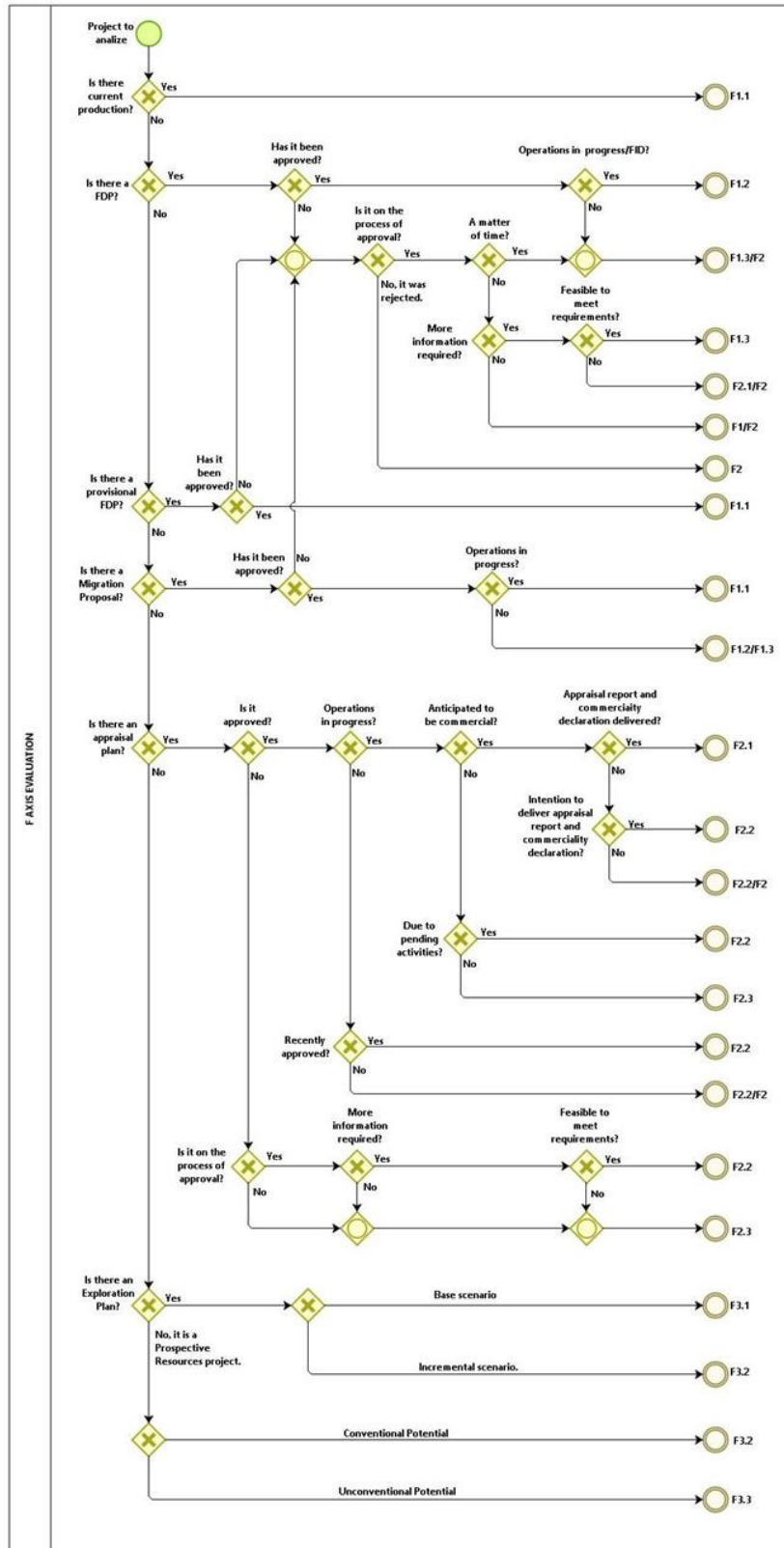
Table 1
E axis evaluation matrix

<i>Environmental variables</i>	<i>High (Most likely)</i>	<i>Best (Likely)</i>	<i>Low (Unlikely)</i>	<i>Spatial support</i>	<i>Legend</i>
Is the project located in a restricted area?	No	Partially	Yes		
<ul style="list-style-type: none"> • Natural protected area? • Ramsar Site? • Safeguard zone...? - Lacandon Jungle - Yucatan Platform and Mexican Caribbean - Coral reef: Gulf of Mexico and Mexican Caribbean. - Californian Gulf and Baja California Peninsula 	Comments:				
Is there flora and fauna listed in the NOM-059-SEMARNAT-2010?	No	Maybe	Yes		
<ul style="list-style-type: none"> • Species at risk (endangered, threatened, special) - Amphibians? - Birds? - Fungus? - Invertebrate? - Mammals? - Reptiles? - Fishes? 	Comments:				
Is there a critical ecological land-use planning?	No	Partially	Yes		
<ul style="list-style-type: none"> • General? • Regional? • Specific? • Local? 	Comments:				
Is there critical land use?	No	Partially	Yes		
<ul style="list-style-type: none"> • High Jungle? • Wetland? • Forest? • Other? consider the rest of existing categories 	Comments:				

<i>Socio-organizational variables</i>	<i>High (Most likely)</i>	<i>Best (Likely)</i>	<i>Low (Unlikely)</i>	<i>Spatial support</i>	<i>Legend</i>
Presence of indigenous communities? (Communities > 50 people)	No	Partially	Yes		
<ul style="list-style-type: none"> Communities with less than 40%? Communities with more than 40%? Communities of interest? 	Comments:				
Is there an indigenous region?	No	Partially	Yes		
<ul style="list-style-type: none"> Mayo-Yaqui? Tarahumara? Huicot o Fran Nayar? Purépecha? Huasteca? Sierra Norte de Puebla & Totonacapan? Otomí de Hidalgo & Querétaro? Mazahua-Otomí? Other? Consider 17 more existing regions 	Comments:				
Is there a social land ownership?	No	Partially	Yes		
<ul style="list-style-type: none"> Ejidal land (Ejido)? Communal Land? 	Comments:				
Is there marginalization? As measured by the marginalization index	No	Partially	Yes		
<ul style="list-style-type: none"> Very high? High? Medium? Low? Very low? 	Comments:				
Is the project interfering with an economic activity?	No	Maybe	Yes		
<ul style="list-style-type: none"> Agriculture? Mining? Tourism? Other? 	Comments:				
Is there a concern with water?	No	Partially	Yes		
<ul style="list-style-type: none"> Hydrological basins? Aquifers? Water wells? Other? 	Comments:				

<i>Legal variables</i>	<i>High (Most likely)</i>	<i>Best (Likely)</i>	<i>Low (Unlikely)</i>	<i>Spatial support</i>	<i>Legend</i>
Is there any concern with the legal status of the project?	No	Partially	Yes		
<ul style="list-style-type: none"> • Contract? • Migration? • Entitlement? 	Comments:				
Are there environmental approvals and permits?	No	N/A	Yes		
<ul style="list-style-type: none"> • Environmental base line? • Environmental Impact Assessment? • Industrial, Operational, and Environmental Safety Administration System (SASISOPA)? • Insurance policy? • Any other applicable: • Change of land use in a forest area? 	Comments:				
Are there social assessments presented?	No	N/A	Yes		
<ul style="list-style-type: none"> • Social Impact Assessment? • Others? 	Comments:				
<i>“Pure” economic variables</i>	<i>High (Most likely)</i>	<i>Best (Likely)</i>	<i>Low (Unlikely)</i>	<i>Spatial support</i>	<i>Legend</i>
Is there an economic evaluation?	Yes	NA/ Maybe	No		
<ul style="list-style-type: none"> • Acceptable Net Present Value (NPV)? • Acceptable Internal Rate of Return (IRR)? 	Comments:				

Figure V
F axis evaluation process.



46. As mentioned previously, the estimates considered on the G axis were those made by the operators in accordance with the existing regulation regarding resources and hydrocarbon reserves, which is based on PRMS.

C. Block I Project Case Study

47. The project is located inside the “I” block (Entitlement) and it is an EPB. It considers the drilling of six exploratory wells targeting unconventional reservoirs. Five of the six wells are proposed on the southeast portion of the block while one of them is proposed on the northern portion. The drilling of the six wells is supported by an operator exploration plan approved by CNH.

48. The surface area associated with this project has a “high” value for the socio-organizational factor. This flags a high risk for potential development and for the activities related to the exploration, appraisal and production of hydrocarbons, so special attention should be given to the relation between the socio-organizational variables and the viability of the hydrocarbon projects. It should be noted that high marginalization can be seen from two points of view, one negative considering that the development of projects could be affected by unsatisfied communities or from a positive point of view, where it represents a good opportunity to improve their living conditions along with hydrocarbon projects development.

49. There are 23 human settlements and one indigenous region (Sierra Norte de Puebla-Totonacapan) within the project area. There are five communities that have more than 40 per cent of indigenous population, which indicates that they should be consulted by SENER according to the standards adopted by the National Commission for the Development of Indigenous Population (CDI)^{12,13}. Concerning the social land ownership, there are 30 communal lands (ejido) dispersed in the area.

50. The main land use in the area is for agricultural purposes and the value of the marginalization index is high.

51. The main water use comprises urban public use (64 aquifers) and to a lesser extent for livestock (two aquifers). The entire block is under a regulation that prohibits the uncontrolled extraction of underground freshwater. The drilling, completion and development of unconventional reservoirs must meet the strict regulations managed by the National Water Commission, ASEA and CNH.

52. It should be noted that this is an Entitlement block and thus no Social Impact Assessment had to be presented to the authorities.

53. The project area does not affect any Protected Natural Area of a federal, state or municipal nature, nor does it have an impact on Ecological Territory Ordinance Programmes. There is no incidence of wetlands included under an international Ramsar sites agreement.

54. Given the nature of the Entitlement, authorizations are not mandatory in terms of environmental impact, nor SASISOPA (Sistema de Administración de Seguridad Industrial, Seguridad Operativa y Protección del Medio Ambiente) or insurance and guarantees for compliance with the authorizations related to security and protection of the environment.

55. An economic evaluation was not conducted given the level of maturity of the project.

56. The E-axis evaluation matrix helped to assess the social, environmental, legal and economic aspects to determine potential viability of development; additionally, evaluation

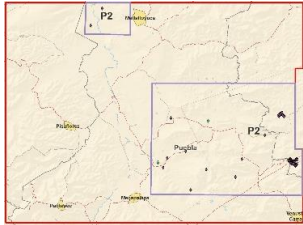
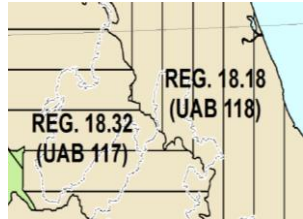
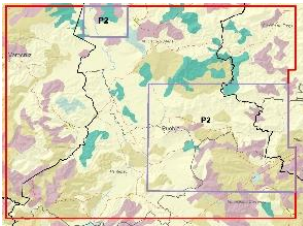
¹² http://www.diputados.gob.mx/LeyesBiblio/pdf/LHidro_151116.pdf, Art. 120

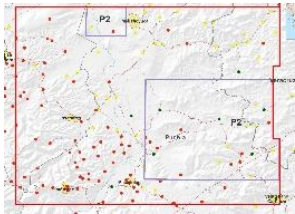
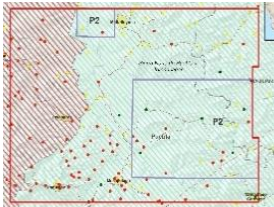
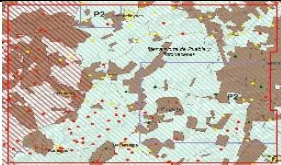
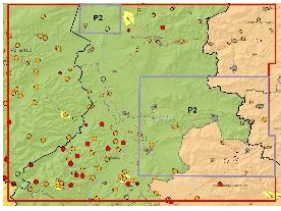
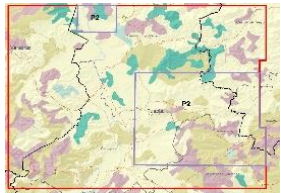
¹³ <https://www.gob.mx/cdi/documentos/indicadores-de-la-poblacion-indigena>

must be compliant with UNFC definitions, so this project was classified as an E3.2 (Exploration Project). The E axis evaluation is shown in Table 2.

Table 2
E axis evaluation, case study

<i>"Economic viability": evaluation of the components considered in the E axis</i>					
Assumptions:					
Environmental and social factors are equally important for the "economic viability" of the project					
The components of the E axis are crosslinked, specially the environmental and social factors					
The purely "economic factor" is relevant but not decisive.					
			"E" Classification		
Block I:		Project	Description	3.2	
Location:	Hidalgo, Puebla and Veracruz	2	Exploration Plan Base Scenario		
Category:	Onshore unconventional				

<i>Environmental variables</i>	<i>High (Most likely)</i>	<i>Best (Likely)</i>	<i>Low (Unlikely)</i>	<i>Spatial support</i>	<i>Legend</i>
<p>Is the project located in a restricted area?</p> <ul style="list-style-type: none"> • Natural protected area? • Ramsar Site? • Safeguard zone...? - Lacandon Jungle - Yucatan Platform and Mexican Caribbean - Coral reef: Gulf of Mexico and Mexican Caribbean. - Californian Gulf and Baja California Peninsula 	No	Partially	Yes		<p>Block</p> <p>Area of the project</p>
<p>Comments:</p> <p>There are no restrictions.</p>	<p>Comments:</p> <p>There is possible existence of critical vegetation and species listed in the legislation.</p>				
<p>Is there flora and fauna listed in the NOM-059-SEMARNAT-2010?</p> <ul style="list-style-type: none"> • Species at risk (endangered, threatened, special) - Amphibians? - Birds? - Fungus? - Invertebrate? - Mammals, reptiles, fishes? 	No	Maybe	Yes		<p>Karst Huasteco Sur (32%) and Lomeríos de la Costa Golfo Norte.</p>
<p>Is there a critical ecological land-use planning?</p> <ul style="list-style-type: none"> • General? • Regional? • Specific? • Local? <p>Comments:</p> <p>The area has a general land-use plan with policies of environment restoration and sustainable use?</p>	<p>Comments:</p> <p>There is no critical land-use.</p>				
<p>Is there critical land use?</p> <ul style="list-style-type: none"> • High Jungle? • Wetland? • Forest? • Other? consider the rest of existing categories 	No	Partially	Yes		<p>Rainforest agriculture 58%</p> <p>Grassland 24%</p> <p>Shrubby Sec. Veg. 14%</p> <p>Herbaceous Sec. Veg. 4%</p>
<p>Comments:</p> <p>There is no critical land-use.</p>	<p>Comments:</p> <p>There is no critical land-use.</p>				

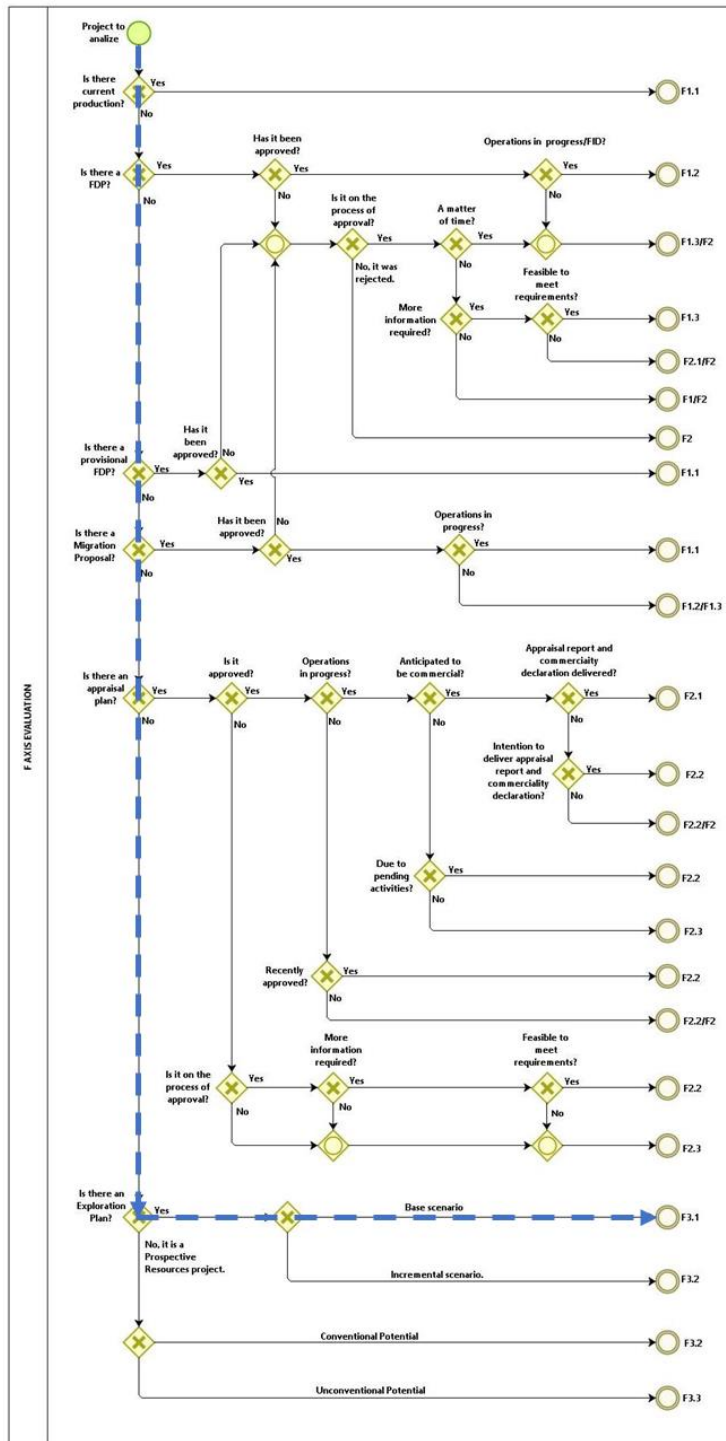
<i>Socio-organizational variables</i>	<i>High (Most likely)</i>	<i>Best (Likely)</i>	<i>Low (Unlikely)</i>	<i>Spatial support</i>	<i>Legend</i>
Presence of indigenous communities? (Communities > 50 people)	No	Partially	Yes		<ul style="list-style-type: none"> Communities > 40% Communities < 40% Comm. of interest
<ul style="list-style-type: none"> Communities with less than 40%? Communities with more than 40%? Communities of interest? 	Comments: 5 communities >40% (1,144 people) 8 communities <40% (541 people) 11 communities of interest (2,278 people)				
Is there an indigenous region?	No	Partially	Yes		<ul style="list-style-type: none"> Huasteca Sierra Norte de Puebla y Totonacapan
<ul style="list-style-type: none"> Mayo-Yaqui? Tarahumara? Huicot o Fran Nayar? Purépecha? Huasteca? Sierra Norte de Puebla & Totonacapan? Otomí de Hidalgo & Querétaro? Mazahua-Otomí? Other? Consider 17 more existing regions 	Comments: There are 2 indigenous regions, but only one region within the area of the project.				
Is there a social land ownership?	No	Partially	Yes		<ul style="list-style-type: none"> 0 irrigation districts 30 Ejidal lands
<ul style="list-style-type: none"> Ejidal land (Ejido)? Communal Land? 	Comments: Yes, dispersed in the surface.				
Is there marginalization? As measured by the marginalization index	No	Partially	Yes		<ul style="list-style-type: none"> 23 rural comm. (2,524 hab.) 0 urban communities
<ul style="list-style-type: none"> Very high? High? Medium? Low? Very low? 	Comments: The value of the marginalization index is high.				
Is the project interfering with an economic activity?	No	Maybe	Yes		<ul style="list-style-type: none"> Rainforest agriculture
<ul style="list-style-type: none"> Agriculture? Mining? Tourism? Other? 	Comments: Yes, probably with agriculture.				
Is there a concern with water?	No	Partially	Yes	The entire block is under a regulation that prohibits the uncontrolled extraction of underground freshwater.	The development of unconventional reservoirs will have to meet the regulation of CONAGUA, and the one of ASEA and CNH
<ul style="list-style-type: none"> Hydrological basins? Aquifers? Water wells? Other? 	Comments: There is availability of water. 2 hydrological basins. 66 aquifers (64 urban use & 2 livestock use)				

<i>Legal variables</i>	<i>High (Most likely)</i>	<i>Best (Likely)</i>	<i>Low (Unlikely)</i>	<i>Relevant information</i>	<i>Additional information</i>
Is there any concern with the legal status of the project?	No	Partially	Yes	Start date: August 27th, 2014. Duration: 22 years.	
<ul style="list-style-type: none"> Contract? Migration? Entitlement? 	Comments: The project is part of an Entitlement				
Are there environmental approvals and permits?	No	N/A	Yes		
<ul style="list-style-type: none"> Environmental base line? Environmental Impact Assessment? Industrial, Operational, and Environmental Safety Administration System (SASISOPA)? Insurance policy? Any other applicable: Change of land use in a forest area? 	Comments: It has environmental authorization conditioned.				
Are there social assessments presented?	No	N/A	Yes	There is no Social Impact assessment presented to the authorities.	
<ul style="list-style-type: none"> Social Impact Assessment? Others? 	Comments:				

<i>“Pure” economic variables</i>	<i>High (Most likely)</i>	<i>Best (Likely)</i>	<i>Low (Unlikely)</i>	<i>Relevant information</i>	<i>Additional information</i>
Is there an economic evaluation?	Yes	NA/ Maybe	No		
<ul style="list-style-type: none"> Acceptable Net Present Value (NPV)? Acceptable Internal Rate of Return (IRR)? 	Comments:				

57. Following the process established to evaluate the F axis, classification F3.1 was obtained. The project is supported by an approved exploration plan and there is a strong commitment from the operator of the block to drill the planned wells, therefore it is possible to categorize them as Prospects. **Figure VI** shows the F axis evaluation process for this project.

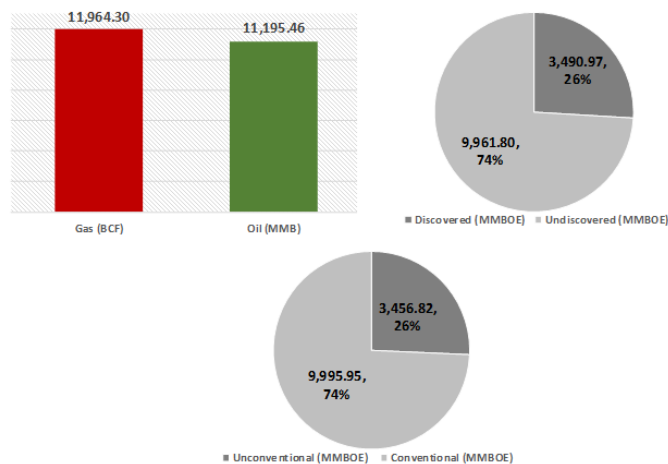
Figure VI
F axis evaluation, case study



IV. Results

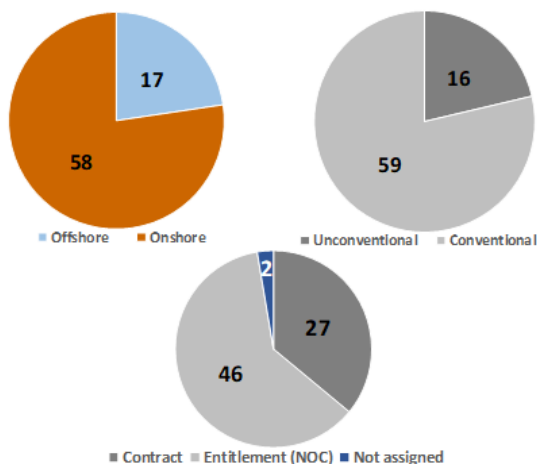
58. The total discovered and undiscovered hydrocarbon volumes (P50) associated with the seventy-five projects were considerable, estimated to be 11.9 Trillion cubic feet of gas (TCF) and 11.2 Billion barrels of oil. These volumes represent approximately 13.4 BBOE, this being the volumes associated with undiscovered and conventional hydrocarbons (see **Figure VII**). For comparative purposes, the volume of discovered hydrocarbons classified (this may include commercial, potentially commercial and non-commercial projects) represents 21 per cent of the country’s 2P reserves as of 1 January 2018 and in the case of undiscovered hydrocarbons represents nine per cent of the country’s total prospective resources.

Figure VII
Classified volumes



59. Fifty-eight of the seventy-five projects were located on land while seventeen were located offshore. Most of the analyzed projects (fifty-nine) are associated with exploration, appraisal or development of conventional hydrocarbons. The legal situation of the evaluated blocks and thus of the projects was varied, with forty-six projects included in Entitlement areas, twenty-seven in contractual areas and two in non-assigned blocks (see **Figure VIII**).

Figure VIII
Evaluated projects



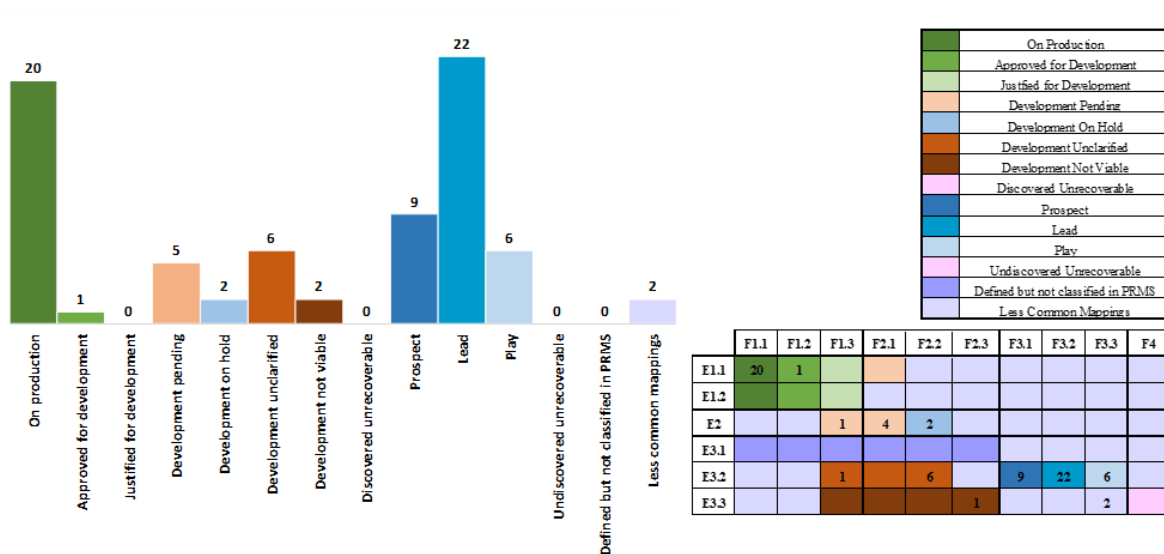
60. The projects analyzed allowed the evaluation of many classes and sub-classes defined by UNFC. Based on the analysis, commercial, potentially commercial, non-commercial projects were identified, as well as those exploration projects. It should be noted that in this pilot project, the additional quantities on site of both discovered and undiscovered accumulations were not considered. **Table 3** shows the number of projects classified based on the category defined for each of them (primary classes).

Table 3
Projects classification, primary classes

<i>Projects classified (E vs F)</i>				
<i>Classes</i>	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>
<i>E1</i>	21	0	0	0
<i>E2</i>	1	6	0	0
<i>E3</i>	1	7	39	0

61. Application of UNFC to the seventy-five projects added granularity to their classification. The sub-classes defined in UNFC were used in the pilot project and the distribution of the classified projects based on these sub-classes is shown in **Figure IX**.

Figure IX
Projects classification, sub-classes



62. Considering the above, twenty-one projects were classified as commercial projects, seven projects as projects with commercial potential, eight as non-commercial projects, thirty-seven exploration projects and two projects as less common mappings.

63. For projects associated with discovered hydrocarbon volumes, the volumes associated with the commercial projects were approximately 1,769.9 Million barrels of oil equivalent

(MMBOE), for the case of projects with commercial potential approximately 1,455.7 MMBOE, and 265.4 MMBOE in the case of non-commercial projects.

64. For projects associated with undiscovered hydrocarbon volumes, the volumes classified were approximately 9,961.8 MMBOE. The distribution of the classified hydrocarbons volumes associated with discovered and undiscovered accumulations is shown in **Table 4**.

Table 4
Volume distribution by sub-classes (MMBOE)

	<i>G1</i>	<i>G1+G2</i>	<i>G1+G2+G3</i>
E1.1, F1.1	986.4	1,357.4	1,384.4
E1.1, F1.2	122.4	412.5	706.1
E2, F1.3	128.7	187.2	187.6
E2, F2.1	1.0	1,197.8	1,247.3
E2, F2.2	68.8	70.7	554.7
E3.2, F1.3	0.0	0.0	54.6
E3.2, F2.2	57.9	265.4	798.4
E3.3, F2.3	0.0	0.0	979.3
	G4.1	G4.1+G4.2	G4.1+G4.2+G4.3
E3.2, F3.1	708.0	2,193.2	4,518.4
E3.2, F3.2	1,010.8	4,715.0	10,606.2
E3.2, F3.3	814.9	2,852.1	6,519.1
E3.3, F3.3	56.6	201.4	456.0

**G (MMBOE)*

V. Capturing added value with UNFC

65. The pilot project found that application of UNFC requires a multi and interdisciplinary approach. The collaboration and interaction between CNH, SENER and ASEA allowed for identification and evaluation of all factors that influence the development viability of hydrocarbon projects.

66. The formation of the integrated team allowed the consolidation of disparate data sets managed by each institution and that in other situations it would not be easy to analyze independently. The consolidation of social, environmental, technical, legal, economic information, under a single lens, allowed a holistic evaluation of the feasibility of the projects.

67. Formats and diagrams created for the evaluation of the E and F axes represented a uniquely important milestone in the pilot project and can be used as valuable tools for the classification of projects for different sectors in the future based on UNFC.

68. Further development of the pilot project outcomes with inclusion of other stakeholders represents an area of opportunity for better evaluation of the feasibility of the projects.

69. Detailed inclusion of the social and environmental considerations for the classification of the projects assists project financial investment decision-making through comparative assessment of objectives and priorities of national, regional and local stakeholders.

70. Use of UNFC in Mexico for the classification of not only oil and gas resources, but other types of resources such as renewables, nuclear fuels, minerals, among others, could establish an effective platform for the country's energy and regulatory policy decision-making.

VI. Conclusions

71. Application of UNFC allowed the project team to understand and visualize in different dimensions and perspectives, the development likelihood of the hydrocarbons resources in Mexico, taking into consideration the international standard developed by the United Nations Economic Commission for Europe (ECE).

72. The use of UNFC allowed the identification of the social, environmental and legal factors, related to each other, that directly and indirectly influence the development of oil and gas projects and will be useful to identify the impacts and relationships with the SDGs.

73. The consideration of aspects other than purely technical ones allowed the team to identify barriers or obstacles to be overcome to avoid delays, suspensions or even cancellations of projects.

74. The tools used for the evaluation of the E and F axes were generated considering the local conditions, highlighting the main social, legal, environmental and economic variables present, as well as the approval processes of oil and gas projects. Both tools are only applicable to Mexico; however, they can be modified or adapted for use and implementation in other parts of the world.

75. The main social aspects identified that could represent a barrier to the execution of oil and gas projects within the evaluated blocks are the presence of indigenous localities or regions, rural communities, high rates of marginalization, the economic activity of the locality, availability and restriction of water use, as well as the lack of Social Impact Assessments.

76. Environmental approvals were highlighted as a key project risk.

77. Key social and environmental risks were identified to facilitate discussion with key stakeholders.

78. Future work could be undertaken to identify the impacts and relationships with the SDGs for each block or groups of them, according to the document: "Mapping the oil and gas industry to the Sustainable Development Goals: An Atlas¹⁴" (UNDP, the International Finance Corporation (IFC) and IPIECA, the global oil and gas industry association for environmental and social issues, partnered to develop this Atlas), prioritizing the analysis and development of the resources with considerations on energy security, climate change and economic growth among others.

79. The results of the pilot project support the objective of UNFC as a standardized system that helps to link and analyze the SDGs. UNFC can serve as an effective platform to make decisions on energy policy and regulatory actions and will facilitate the interaction with other government institutions and stakeholders.

¹⁴ UNDP, IFC, IPIECA, 2017, <http://www.undp.org/content/undp/en/home/librarypage/poverty-reduction/mapping-the-oil-and-gas-industry-to-the-sdgs--an-atlas.html>

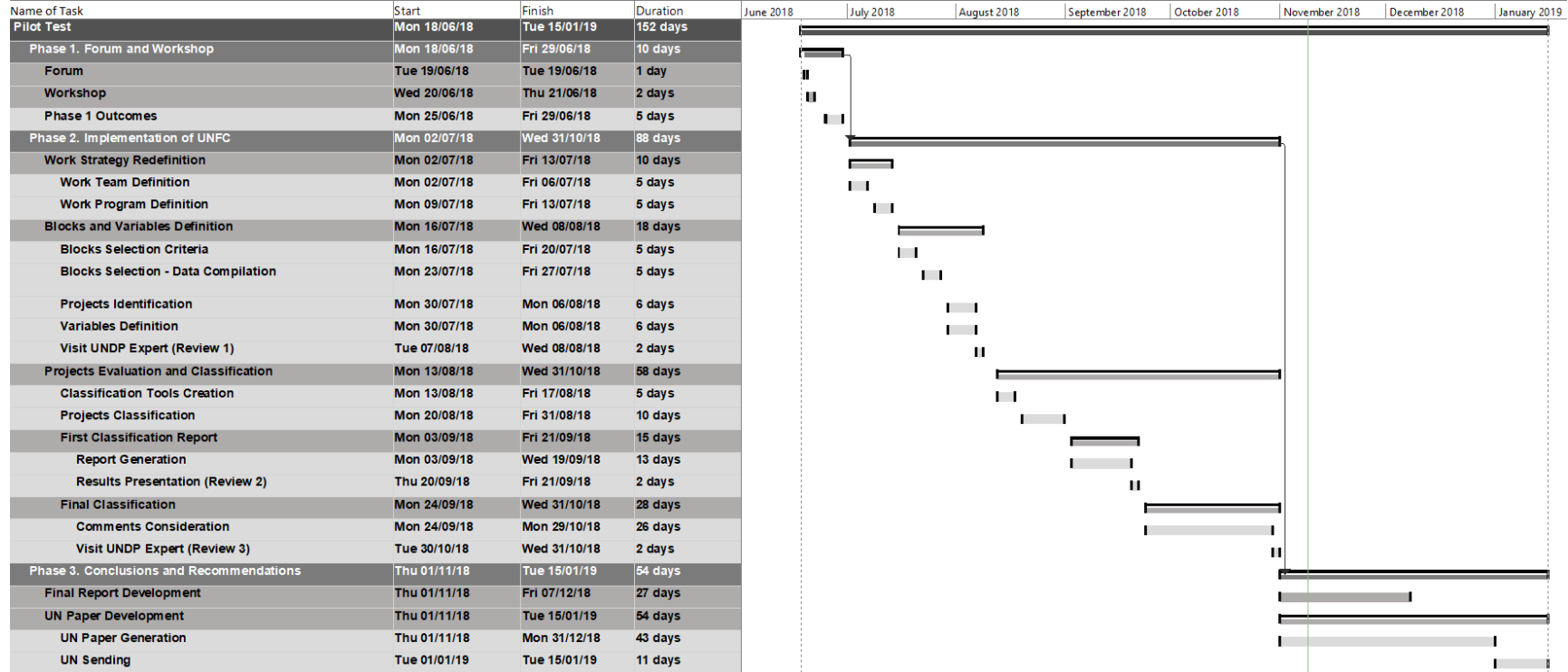
VII. Acknowledgments

80. This document has been prepared thanks to the invaluable effort of the team formed by CNH, SENER and ASEA. The supervision and leadership of the project was undertaken by Alma América Porres Luna and Ulises Neri Flores. Satinder Purewal, Chair of the Petroleum Working Group of the Expert Group on Resource Management, provided substantial assistance, guidance and advice throughout the whole project. The members of the project team were: Fidel Juárez Toquero, Eduardo Simón Burgos, Eduardo Meneses-Scherrer, Elaine Angélica Arellano Sánchez, Mauro Ivan Weimann, Josué Salazar Juárez, Francisco Fuentes Pacheco, Guillermo Guerrero Olivares, and Miguel Ibarra Rangel, National Hydrocarbons Commission; Francisco Pacheco Román and Mayelli Hernández Juárez, Ministry of Energy; and Guillermina Mera Avecias and José León Mella, Safety, Energy and Environment Agency. The technical review of the draft report was carried out by Karin Ask, Alistair Jones, Barbara Pribyl and Claudio Virues, all members of the Expert Group on Resource Management. The comments of the review team have been included.

81. Bizagi Modeler, QGIS, ArcMap and Microsoft Office Suite were used in this project.

Annex

Detailed Project Schedule



Glossary

Agrarian cores. An organized population that has been awarded with an area that is under a special legislation that promotes communal land use without having direct ownership, or ability to transfer it to third parties. Usually, this land is used for farming.

Entitlement. The legal act through which the Federal Government grants exclusively to PEMEX or any other state-owned company, the right to carry out activities of exploration and extraction of hydrocarbons in a specific area and duration.

Environmental Impact Assessment (MIA). This is the document where it is made known (by the operator), based on studies, the significant and potential environmental impact that a project or activity would generate, as well as the way to avoid or mitigate it if it is negative.

Expert Group on Resource Management (Expert Group). Formerly known as the Expert Group on Resource Classification and prior to that the Ad Hoc Group of Experts on Harmonization of Fossil Energy and Mineral Resources Terminology. The Expert Group is responsible for the promotion and further development of the United Nations Framework Classification for Resources (UNFC) and the United Nations Resource Management System (UNRMS).

Marginalization Index. This is a multidimensional indicator that measures the intensity of deprivation suffered by the population through nine forms of exclusion grouped into four dimensions: education, housing, population distribution and monetary income.

Ministry of Energy (SENER). SENER is the institution in charge of conducting the country's energy policy, within the current constitutional framework, to guarantee a competitive, sufficient, high quality, economically viable and environmentally sustainable supply of energy required for the development of national life.

National Commission for the Development of Indigenous Population (CDI). The mission of CDI is to be an institution that guides public policies for the integral and sustainable development of indigenous peoples and communities, which promotes respect for their cultures and the respect of their rights.

National Hydrocarbons Commission (CNH). CNH regulates the upstream sector of hydrocarbons in Mexico. Its mission is to regulate in a reliable and efficient way the exploration and extraction of hydrocarbons in Mexico to promote investment and economic growth.

National Water Commission (CONAGUA). The mission of CONAGUA is to manage and preserve in quantity and quality the national waters and their inherent public goods, with the participation of users and society, and with the linking of the management of the three orders of government, to achieve the sustainable use of the resource.

Safety and Environmental Management System (SASISOPA). This is the integral set of interrelated and documented elements whose purpose is the prevention, control and improvement of the performance of a facility or group of them, in terms of industrial and operational safety and environmental protection.

Safety, Energy and Environment Agency (ASEA). The mission of ASEA is to guarantee the safety of people and the integrity of the environment with legal, procedural and costs certainty in the hydrocarbon sector. It is part of the Ministry of Environment and Natural Resources (SEMARNAT).

Social Impact Assessment (EVIS). This is the document that contains the identification of the communities and villages located in the area of influence of an energy sector project, as

well as the identification, characterization, prediction and assessment of the consequences to the population that could be derive from it, the mitigation measures and the corresponding social management plans.

Study of Environmental Base Line (LBA). The study (made by the operator) that identifies the environmental conditions in which the habitats, ecosystems, elements and natural resources are found, as well as the relations of interaction and environmental services existing in the area, prior to the beginning of the oil and gas activities.
