ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR PRINOS OFFSHORE DEVELOPMENT PROJECT

Chapter 3 Summary Project Description

TABLE OF CONTENTS

TABLES

ABBREVIATIONS

EBRD	European Bank for Reconstruction and Development
ESIA	Environmental & Social Impact Assessment
MARPOL	Marine Pollution
WEEE	Waste Electrical and Electronic Equipment

3 SUMMARY PROJECT DESCRIPTION

3.1 BASIC ELEMENTS OF THE PROJECT

The ESIA has been prepared to cover all of the existing offshore assets that have been in operation since 1981, the planned extensions as well as potential future extensions that Energean is studying, but has not yet committed to implement as those are described in Chapter 1.3 and its subchapters.

For the sake of clarity the following sub-division of assets and projects has been defined as described below.

- The **existing offshore facilities** that include:
  - ⇨ The Kappa platform located on the sweet, non-associated gas field South Kavala;
  - ⇨ The 12” pipeline that transports sweet gas and condensate from South Kavala to Prinos Delta;
  - ⇨ The 12-slot production jackets Prinos Alpha and Prinos Beta which form part of the bridge linked Prinos complex;
  - ⇨ The Prinos Delta platform that contains all offshore processing facilities and which receives oil, gas, water and condensate produced from Prinos, Prinos North and South Kavala fields. Prinos Delta is bridge linked to Prinos Alpha and Prinos Beta as well as the Prinos flare jacket. New risers will be added to Prinos Delta to allow it to receive fluids from Lamda (and potentially Omicron) and send lift gas and water for injection to Lamda;
  - ⇨ The Prinos flare jacket;
  - ⇨ A 12” dry-gas pipeline connecting Prinos Delta to the onshore facilities;
  - ⇨ An 8” oil pipeline connecting Prinos Delta to the onshore facilities;
  - ⇨ A 5.3” pipeline that transfers seet dry lift gas from the onshore facilities to Prinos Delta;
  - ⇨ Two 10kVa submarine power cables that transport electricity from the onshore facility to Prinos Delta.
- The **planned extension project** (included in the current EBRD funding package) that includes:
  - ⇨ The re-entry of nine (9) existing wells on the Prinos Alpha platform and the sidetracking of these to new bottom-hole locations in the Prinos field. These wells target undrained pools of oil in the A, B and C reservoir units;
  - ⇨ The re-entry of one (1) existing Prinos North extended reach well located on the

Prinos Alpha platform, with the objective of side tracking it up dip of the existing bottom hole location to allow attic oil reserves to be drained;

- ⇨ The design, fabrication, installation, commissioning and subsequent operation of a new well-head jacket platform (called "Lamda") approximately 3.5 km's north west of the existing Prinos platforms. The Lamda platform will host between 5 and 9 wells that will be drilled into and produce from the Epsilon field. This platform has been designed to be normally unmanned. All produced fluids are transported to the Prinos Delta platform where existing equipment is used to separate oil, water and gas;
- ⇨ Three (3) sub-marine pipelines that connect Lamda to Prinos Delta. These comprise one 10" pipeline to carry multi-phase well fluids from Lamda to Delta, and two 6" pipelines to carry injection water and lift gas respectively from Prinos Delta to Epsilon;
- ⇨ Between 5 and 9 new wells to be drilled from the Lamda platform into the Epsilon field. These wells will initially be completed as producers with between 2 to 4 being converted after approximately 18 months to water injectors. The range of well numbers planned reflects the uncertainty in recoverable reserves. The designed platform is equipped with 15 slots.

- The **potential further developments**:

  This would introduce a second new wellhead jacket platform ('Omicron'), which would be located between the Prinos North and Prinos platforms and used to further develop Prinos North in addition to the Kazaviti discovery. Kazaviti will be appraised by the 3rd planned Prinos Alpha sidetrack (well PA-36), allowing a decision to be made on the viability of this potential project subsequently.

Current and planned oil and gas production are presented earlier in Chapter 1.3.4, to cover all of the above phasings of the project:

- Design capacity;
- Current production (existing facilities);
- Peak planned production following Prinos Alpha sidetracks (P50 forecast);
- Peak planned production following development of Epsilon field; and
- Peak planned production following potential development of Prinos north through Prinos Beta sidetracks and Omicron platform (P50 forecast).

3.2 DEVELOPMENT PHASES

The development phases of the project are governed by the phasing provided in the aforementioned chapters.

These are defined by:

- **Present phase** whereas the current production occurs solely from the existing facilities, Prinos and south Kavala fields;

- **Peak present phase** whereas planned production will be peaking up following Prinos Alpha sidetracks (P50 forecast) (no additional infrastructure to be installed);
- **Peak future planned phase** whereas production following the planned development of Epsilon field, additional to the existing; and
- **Peak planned production phase** following the potential development of Prinos north through Prinos Beta sidetracks and Omicron platform (P50 forecast), additional to the existing and planned as described above.

Apart from those for the better comprehension of the current assessment and to align with both Greek and international standards of environmental assessment and also in line with EBRD's Performance Requirements, the assessment focuses on the cumulative impacts from all operations offshore. Those can be distinguished as follows:

- **Construction phase:** defined by the installation of the new planned and potentially planned facilities, whereas in parallel the current operations on the existing facilities continue to go on;
- **Operation phase:** defined by the operation of all the planned and the potentially planned in the future offshore facilities and
- **Abandonment phase:** defined by the decommissioning activities that will need to take place at the end of the life cycle of the project.

3.3 REQUIRED RAW MATERIAL, RESOURCES AND EXPECTED WASTES

3.3.1 Construction phase

Due to the nature of activities and the short duration of construction, minimal raw material usage will occur during construction. This will consist mainly of the typical materials used for vessel operation (e.g. fuel) and those associated with the presence of a workforce (e.g. water, food).

No significant waste streams are expected in the construction phase. The platform topsides will be fully constructed onshore and hence there will be little need for mechanical operations following platform installation other than the mating of pipelines and risers subsea.

There will be no offshore accommodation in the field and hence no human related waste streams to deal with. Any produced waste (both solid / wastewater) will be managed by the accompanied boats as per their specific waste management plans (MARPOL, Annex IV and V).

3.3.2 Operation phase

3.3.2.1 Raw material

3.3.2.1.1 Chemicals

For the offshore processing that takes place in the Prinos complex and in particular on platform Delta, the following chemicals and their respective annual dosages are presented in the table below:

Table 3-1: Expected dosage rates - Delta

Chemical	Dosage (tn/yr)
Demulsifier	30
Scale inhibitor	4.2
Scale inhibitor	2
Corrosion inhibitor	12
Corrosion inhibitor	15
Antifouling	12
Antifouling	20
Oxygen scavenger	10
Cationic polyelectrolyte	6
Triethylene glycol	6
Hydrate inhibitor (methanol)	0.5
Citric acid	8

The annual consumption (average) rates for planned Lamda platform and potential Omicron platform for the used chemicals are estimated for the time between 2017 and 2034 to be:

- Corrosion inhibitor: 7.4 to 10.0 m^3/annum
- Demulsifier: 1.8 to 2.2 m^3/annum
- Asphaltene inhibitor: peaking at the first years around 9.1 m^3/annum and then decreasing to 1.5 m^3/annum
- Scale inhibitor: 1.4 to 2.0 m^3/annum

3.3.2.2 Resources

The resources used for the operation of the existing offshore facilities, the planned Lamda platform and the potential Omicron platform development are listed below.

3.3.2.2.1 Fresh water

On Delta platform water is used from the network on an average of 10 m^3/d (maximum of 15 m^3/d) and it reaches Delta through the Energean's supply boats.

There is no routine consumption of potable water foreseen on the Lamda platform.

Omicron platform will be equipped with permanent equipment to allow it to wash wells associated with formations that have high formation salinities.

3.3.2.2.2 Fuel

Total natural gas and diesel consumption is currently in the range of 67 tons/month and 79 tons /month respectively.

3.3.2.3 Wastes

The waste (liquid / solid, hazardous / non-hazardous) generation for the operation of the existing offshore facilities, the planned Lamda platform and the potential Omicron platform development are further detailed in the paragraphs below.

3.3.2.3.1 Wastewater generation

Wastewater produced by the offshore facilities consists of the following:

- Produced water removed from the crude oil on existing Delta platform accounting for 1,600 m^3/d on average;
- Produced water removed from condensate on planned Lamda and potential Omicron platforms expected to reach average values of 11,759.6 m^3/annum and 3,570.3 m^3/annum respectively;
- Washing liquids of decks and rain accounting for 0.8 m^3/d on average;
- Washing liquids of wells, vessels and piping accounting for 5,000 to 8,000 m^3 per year or about for 4.1 m^3/d on average;
- Human wastewater accounting for 0.15 m^3/d on average.

3.3.2.3.2 Solid wastes

3.3.2.3.2.1 Hazardous waste

The estimated hazardous waste production, in total from all platforms is:

- Oil-containing drilling muds and wastes (01 05 05*) : 1,000,000 t/yr
- Oil sludges from maintenance operations (05 01 06)* : 60,000 t/yr
- Oily water from oil-water separator (13 05 07*) : 60,000 t/yr
- Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances (15 02 02*) : 1 t/yr
- Drill cuttings : 4,719 MTs (total)

3.3.2.3.2.2 Non-hazardous waste

The estimated amounts of non-hazardous wastes are:

- Paper and cardboard (20 01 01) : 8,460.80 kg/yr
- Biodegradable kitchen & canteen waste (20 01 08) : 25,404.00 kg/yr

- Plastic (20 01 39) : 2,115.20 kg/yr
- Metals (20 01 40) : 2,115.20 kg/yr
- Mixed municipal wastes (20 03 01) : 4,234.00 kg/yr

3.3.3 Abandonment phase

3.3.3.1 Raw material

Raw material usage will be similar to construction, but with the addition of cement to plug wells and potentially explosives to cut legs for the existing platforms (not the new platforms).

3.3.3.2 Waste

The most significant waste generated in a decommissioning exercise is the marine growth from the jacket structures that it is preferable to be removed with water jets rather than onshore during the scrapping stage. The quantities of the organic matter will need to be estimated when the exact time of the abandonment is known.

Further to that, typical specific waste streams like: scrap metal, batteries, electrical and electronic equipment (WEEE) are expected, however those cannot be determined at this stage in terms of their quantities.

Specifically, with regards to the quantities of scrap metal (that is expected to be the bulk quantity) that will need to be managed will highly depend on the method of decommissioning (i.e. deep water disposal or towing onshore for dismantling).