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Subject:	Reply to the Document Title: "Resolution Approving Appointment of Lithium Valley Commission Members" – Docket Number 20-LITHIUM-01; TN #: 235988
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Attachments:	Outlook-ut44yssc.png Public Comment, 1-28-21.docx ++(I) Harnessing Energy and Water in the Salton Sea 25041 (1).docx ++(II) Harnessing Hydro Power - May, 2019 - Copy.docx ++(III) Harnessing Solar Energy - May, 2019 - Copy.docx ++(IV) Harnessing Geothermal Energy.docx ++(V) Drilling Deeper & Wider Wellbore 21055 (1).docx +(I) ImportingSeawater - May, 2019.docx

December 21, 2020

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Subject: Reply to the Document Title: "Resolution Approving Appointment of Lithium Valley Commission Members" – Docket Number 20-LITHIUM-01; TN #: 235988

Greetings, Commissioner Karen Douglas, and Chair David Hochschild:

I am sorry to hear that I was not appointed as a member of the "Lithium Valley Commission – Blue Ribbon Commission on Lithium Extraction". I was hoping that I will be appointed as "A member appointed at the CEC's discretion".

That is an unfortunate decision because now I will not have an official platform to provide a report to the EPA and DOE about the new methodology for harnessing Lithium from the salty water of the Salton Sea. I believe that that is also an unfortunate decision because I would not be able to communicate on equal terms with selected members.

As you know from my previously submitted letters (two "Public Comments"), I am in dispute with the SSA because I have been ignored by members of the SSA since 2013, because my proposal for the restoration of the Salton Sea interfered with the ill-conceived proposal “Perimeter/Brine Lake” that they support and promote.

My methodology to produce Lithium from salty water from the Salton Sea is in addition to the production of Lithium from the geothermal brine used in the conventional geothermal power plants. Also, with my methodology, we could produce much more Lithium than what is estimated from the brine of a known geothermal reservoir. Also, with my proposal for the restoration of the Salton Sea, the salinity of the Salton Sea will equate to the salinity of the Ocean in several years, and in process of desalination generate potable water and salty brine which can be used to produce Lithium.

As you know from my material, my technologies are in perfect harmony with the main goal of the California Department of Energy - Commission - which is “100% renewable & zero-carbon energy by 2045”. In fact, with the implementation of my methodologies, that goal could be reached much sooner.

I believe that you - Commissioner Karen Douglas and Chair David Hochschild - made mistake by not appointing me to serve as a member of “Lithium Valley Commission, but life is going on. Mistakes are OK if those who made them learn from those mistakes and not repeated them in future similar situations. Although, I might say that opportunities and cases of this magnitude are rare events, and I might not be available in the future as I am these days. I believe that everything that happens in our lives, is good for some reason.

I am hoping that “Lithium Valley Commission” will invite me to make a presentation at several of their meetings so that members can learn about a new methodology for harnessing Lithium from the salty water of the Salton Sea. I say “several” meetings because my proposal for the restoration of the Salton Sea is substantial material and harnessing Lithium is just one part of it, but members must understand the whole project.

Regardless of the subject of “Lithium Valley Commission”, I respectfully urge you to study my material so that you can make the right decisions relevant to energy. You are occupying important seats in California DOE and these unusual developments are happening during your tenure.

I would like to clarify that I am not a contractor looking for funding – I am the author of several breakthrough methodologies that will eventually change the energy industry (hydro, solar, geothermal) and tremendously help the DOE to achieve its primary goal.

I think that you should be interested to know about new systems in the energy industry. If invited, I would be glad to personally explain to you my systems and answer any questions that you might have.

As I did inform you about my recent activities (my two “Public Comments) through Ms.

Elisabeth de Jong, I am sending you my additional “Public Comment” which I just submitted to be read at the next Salton Sea Authority Board Meetings scheduled for January 28, 2021.

Also, I am using this opportunity to resend you summaries of five segments of my proposal for the restoration of the Salton Sea.

Sincerely,

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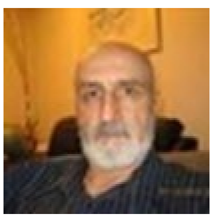

December 21, 2020

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Subject: **“Public Comment” for 1/28/21, a meeting of the SSA’s Board Directors - via Zoom Webinar**

Greetings, distinguish SSA’s Board Members:

1. I am thankful for the opportunity to submit the following comment.

2. In response to my “Public Comment” on Dec. 17, 2020, Director Manuel Perez commented that you (the SSA) will work with me on the project for the restoration of the Salton Sea”. That is a **step** in the **right** direction. I do appreciate that.

3. But **he** also said that my proposal might **NOT** be accepted, or some **other** proposal might be accepted, or a **combination** of proposals might be accepted. It is obvious, that despite our several **short** meetings, he still does not completely understand my proposal. That is understandable, no-pun-intended. Therefore, a **complete** presentation is necessary.

4. I would like to emphasize **again** that my proposal is a **comprehensive design** that besides the architectural design, it incorporates **several breakthrough** technologies. For easier understanding, I have summarized the system into five segments. Each segment is an **integral** (co-dependent) **part** of the **whole** design of the **self-sustain** long-term solution for the restoration of the Salton Sea.

5. Any **changes** in the **framework** of my concept would **diminish** its function. An analogy would be - **taking out** a piece from the transmission box and **replacing** it with a **not fitting** piece and **expecting** that device will work.

6. Because of your background and **well-documented** record (you promoted and **endorsed** the “Perimeter/Brine Lake” concept, and most recently the concept for pumping water from depleting Lake up into Marine bay - Sorry to say but both projects are **nonsensical** concepts), I would **respectfully** urge you to **consult** with **“impartial”**

experts who understand the **subject** and **technologies** involve before you make important decisions.

7. **Finding** a comprehensive design for a very complex situation **is not** a job for an Environmental Scientist or Biologist or Politician. **It is** a job for an Architect with knowledge in planning, construction, hydrology, mechanical engineering / thermodynamic who is also environmentally conscious, or for a team of people with such attributes.

8. We lost 7 years needlessly and it would be foolish to lose additional time and money on the projects doomed to fail. If you have **not been ignorant** for the last 7 years, we **would have** a functional lake **today** and in process of generating revenue in **billions** of dollars.

9. The problem with your practice was/is that you use the following principals: “It is better to do **something** than **nothing**” and/or “Let start and contractors will **somehow** find some solution **as we go**”. The **right practice** should be: “Let find a **feasible solution first** (have a blueprint) and then **do i**t”.

10. Fast action is necessary. I would be glad to explain to you the whole project (five segments). If additional confirmation is needed about the **validity** of **my proposal**, I would suggest that you consult with **“impartial”** experts from several universities such as Stanford, MIT, SMU, and Laboratories such as NREL, and Lawrence Berkeley National Laboratories, - to mention a few. That should be done a long time ago. That is not a difficult task.

11. You need to understand that a **significant** job is in front of “**us**” (our generation / local, state, and federal officials). You need to understand that the “**project of the century**” is in front of us and that the rest of the World will be learning from and implementing technologies in their similar projects in the future.

12. If you want to be effective and useful, your focus at **this time** should **not** be on **incorporating** the ”current course of action” and continue spending **money** and **time** on trying to **salvage wrongdoing**, but rather on **redirecting** actions towards purchasing an old pipeline from Long Beach to Whitewater, (the focus is on purchasing “**right-of-way**”), and initiating negotiation with Mexico through “International Boundary and Water Commission” and their corresponding team in Mexico regarding **redirecting** New River and Alamo River back to Mexico **in return** for the corridor for 48” pipeline with a service road from the Gulf of California to the **central section** of the Salton Sea. Just the inflow pipeline would be fine - we need salt to produce Lithium.

13. Regarding mentioned option of “combining” my proposal with some other proposal: It really comes to “**take it**” or “**leave it**”. Butchering my design is **unacceptable** and would be **unproductive**. If there is some proposal that would function better and generate more revenue – I would support, it. But such a design would need to be proven and verify by “impartial” experts.

14. By following the framework of my concept, will be many opportunities for secondary projects such as exclusive real estate, hotels, motels, surfing facilities, reestablishing old beaches, tourism, wildlife sanctuaries attractions, etc.

15. But **first**, you need to **learn** about the **comprehensive** concept for the restoration of the Salton Sea. That task is long overdue.

16. I would like to finish my comment with the Chinese Proverb *“The person who says - It cannot be done – should not interrupt the person who is doing it”.*

Sincerely,

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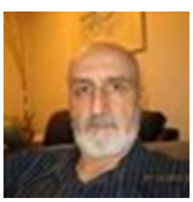

Harnessing Energy and Water in The Salton Sea (Segment I)
(System for Importing Seawater)

Nikola N. Lakic

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Keywords

Geothermal Power, Hydro Power, Electricity, Importing Seawater, In-Line-Pump, In-Line-Generator, Solar Power, Renewable Energy, Heat Exchanger, Desalinization, Potable Water, Lithium, Environment, Wildlife Sanctuary, Tourism.

ABSTRACT

The Salton Sea in California is a terminal lake with reduced inflow from the Colorado River as a result of the water transfers related to the Quantification Settlement Agreement (QSA). The Lake is shrinking and exposing the receding shoreline (toxic playa) to the elements and facing incoming environmental disaster.

The presented proposal is a long-term solution for the restoration of the Salton Sea. It includes an architectural element which harmoniously incorporates several patented technologies into a self-sustaining organism. The presented proposal includes several options based on the same concept: 1) Dividing the Lake into three sections; 2) Importing seawater from the Ocean; 3) Harnessing prevalent geothermal energy.

By dividing lake into three sections (Central and two smaller Northern and Southern sections) and importing seawater into the central section of the lake it provides a condition for tourism (exclusive real-estate, beaches, resorts, hotels, etc.), and vast wildlife sanctuary. Presented proposal also implement several breakthrough technologies such as a) harnessing solar energy in combination with pipeline system; b) harnessing prevalent geothermal energy which is accessible in the Salton Sea area by using completely closed-loop heat exchange system for generation of electricity, desalinization of the lake and production of the potable water as a free by-product; c) Providing source for extraction of lithium and providing depot for waste by-product material.

1. Introduction

1.1 Overview of the Salton Sea situation:

a) The Salton Sea in California is a terminal lake formed accidentally in 1905-1907 after levy at Colorado River has been breached after a storm. The inflow from the Colorado River has been reduced as a result of the water transfers related to the Quantification Settlement Agreement (QSA). The Lake is shrinking and exposing the receding shoreline (playa) to the elements precipitating higher salinity levels and facing incoming environmental disaster, health issues of the nearby communities, as well as a serious threat to its multibillion-dollar tourist trade.

b) The lake is 35 miles long, 15 miles wide, and is located south of Palm Springs in a basin 230 feet below sea level.

c) The Earth's crust at the south end of the Salton Sea is relatively thin. The temperature in the Salton Sea Geothermal Field can reach 680 ºF (360 ºC) less than a mile below the surface. (See FIG. 1)

d) On the southern part of the Lake, there is a known geothermal reservoir.

e) The Salton Sea is California's largest lake and is presently over 50 % saltier than the Ocean. The Salton Sea is a "terminal lake," meaning that it has no outflow and salts, nutrients, pesticides, and other contaminants have concentrated in the Lake. Water flows into Lake from several limited sources, but the only way water leaves the Lake is by evaporation.

f) Geothermal energy in the Salton Sea area is prevalent and topography is unique - the lake is 230 feet below the sea-level and is about 160 miles from the Ocean.

g) Under the terms of the Quantification Settlement Agreement (QSA) the lake's decline is set to accelerate starting year, 2018. About the 1/3 of inflow water from the canal will be diverted to San Diego and Coachella Valley.

h) Runoff water from nearby agricultural fields which contains fertilizers, pesticides and other pollutants such as partially treated sewer from Mexicali contaminate the Salton Sea and make it an undesirable tourist destination especially for beachgoers.

i) There have been many studies and complains about consequences for the nearby community if a solution for the Salton Sea is not found.

j) In several decades had been mentioned several proposal for the restoration of the Salton Sea proposing importing seawater, but they all failed to address: (i) salinity balance of the lake – proposing expensive processes such as reverse osmosis and distillers which require substantial amount of electricity, maintenance of filters, etc.; (ii) not addressing continuation of pollution with pesticides and fertilizers from nearby farmland; (iii) practicality of the projects - proposing canals, tunnels, dozen pipelines - without addressing the practicality of its implementation - extreme cost with difficulties attracting investors for such projects that cannot generate revenue to pay-off initial investment, therefore, deemed unfeasible.

1.2 Five Phases of the Proposal for the Restoration of the Salton Sea:

Phase I - Connecting the Salton Sea with the Ocean with a pipeline 48" (5 pipelines on the uphill routes and 1 pipeline on downhill routes) for importing seawater into the central section of the Lake (several options for pipeline corridors are provided (See FIG. 2 and 9);

Phase II - Dividing lake into three sections by building two main dikes (two-lane roads) strategically positioned - One in northern and one in the southern part of the Salton Sea (See FIG. 4 - 8).

Phase III - Building one power plant using a completely closed loop heat exchange system the (SCI-GHE system) at one of the selected sectors (See segments IV & V).

Phase IV - Building several more power plants using the (SCI-GHE) system - one in each additionally selected sector; and

Phase V - Continuing build-up of many additional power plants using the (SCI-GHE) system at each selected sector;

1.3 The key elements of the presented proposal are:

1) Dividing the Salton Sea into three sections with two main dikes (two-lane roads) to prevent pollution of the larger central section of the lake which would provide the condition for tourism (beachgoers) and wildlife sanctuary in smaller northern and southern sections.

2) If Route 1 (Gulf of California, Mexico - Salton Sea, USA) is selected: To negotiate a treaty with Mexico's officials about diverting the flow of the New River and Alamo River back to Mexico and in return getting corridor for a pipeline for importing seawater from the Gulf of California. The pipeline with maintenance road can have several underpasses to preserve the integrity of Mexico's territory.

3) If Route 1 is selected – then, diverted flow of New River and Alamo Rivers can be treated and used for refilling Laguna Salada or for farmland (See FIG. 2, 3, and 4); (Tips for negotiations with Mexico's officials – in summary: It is in the interest of Mexico to have the flow of New River and Alamo Rivers. It is in the interest of the US to have a corridor for importing seawater from the Gulf of California).

4) For any accepted Route of importing seawater from the Ocean in the central section of the Lake – It is recommended to use In-Line-Pump/Generator system which generates electricity in downhill routes which can be used as a supplement to the energy needed for horizontal and uphill routes. (See Segment II - FIG. 6 -8);

5) Optionally, the US can treat water from the New River and Alamo River and use it for farmland or sell it to Mexico;

6) Generation of the electricity by using the pipeline as a foundation for solar panels assembly. Solar energy is prevalent in the area averaging 280 sunny days per year (See Segment III);

7) Implementing pipeline with sprinkler system for farmland (Northern and Southern area of the Lake) to conserve limited source of water from Colorado River, received through All-American Canal, and to prevent the formation of runoff waters from nearby farmland. (See FIG. 4 and 8); That pipeline system can also be used as a foundation for solar panels for generation of additional electricity and increasing revenue for several hundred million dollars per year (See Segment III).

8) Generation of electricity by harnessing prevalent geothermal sources with a new technology using a completely closed loop system that is not limited to a known geothermal reservoir. (See Segments IV & V);

9) Desalinization of the lake by using gravity - pumping out higher salinity water - which has tendency to accumulate at from bottom of the lake - and pumping it into the boilers of a new Power Plants for generation of electricity and for production of potable water as a free by-product (See also Segments IV and V);

10) Providing a source (brine) for extraction of lithium (See Segments IV & V);

11) Providing vast wildlife sanctuary (See FIG. 4, 5, 7 and 8); and

12) Providing condition for tourism - exclusive real-estate, beaches, resorts, hotels, etc.- (See FIG. 8, 10, and 11).

1.4 Preliminary Estimate for Water Needed for Balancing Evaporation in the Salton Sea.

The necessary inflow of water to balance evaporation of the whole lake is about 1,200,000-acre-feet per year. The surface of the southern section of the Lake is about 10% of whole Lake (See FIG. 4 and 5). Water needed to balance evaporation of the southern section is about 120,000-acre-feet per year. Water needed for farmlands south of the lake is about 200,000-acre-feet per year. Water needed for balancing evaporation in the southern section of the Lake and for nearby farmland adds up to about 320,000-acre-feet per year.

The surface of the northern section of the Lake is about 5% of whole Lake (See FIG. 4 and 8). Water needed to balance evaporation of the southern section is about 60,000-acre-feet per year. Water needed for farmlands north of the lake is about 100,000 acre-feet per year.

Water needed for balancing evaporation in the northern section of the Lake and for nearby farmland is about 160,000 acre-feet per year.

Water needed for balancing evaporation in the Northern and Southern sections of the Lake and for nearby farmlands is about 480,000 acre-feet per year.

It means that functional Lake can be achieved with less than 500,000-acre-feet per year from Colorado River through All-American Canal, which means that this proposal is in harmony with restrictions from the Quantification Settlement Agreement (QSA).

2. **Illustrations of the Segment (I) -** Importing Seawater for the Restoration of the Salton Sea.

Segment (I)

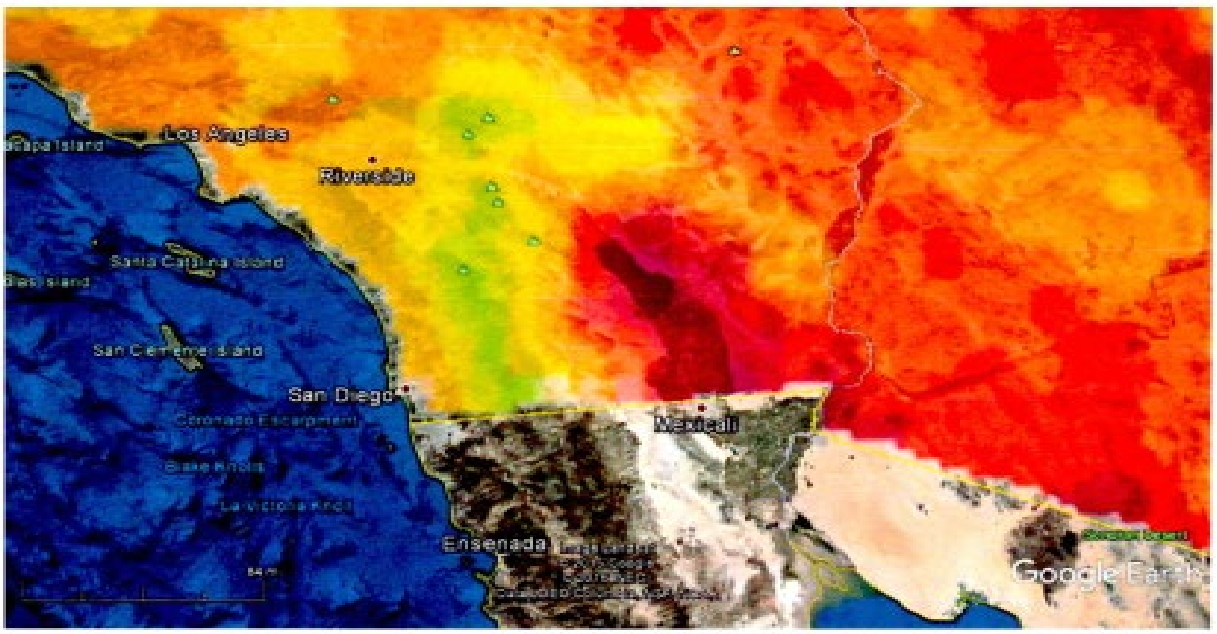

FIG. 1 – Map of Southern California – Temperatures at dept of 3.5 Km

Segment (I)

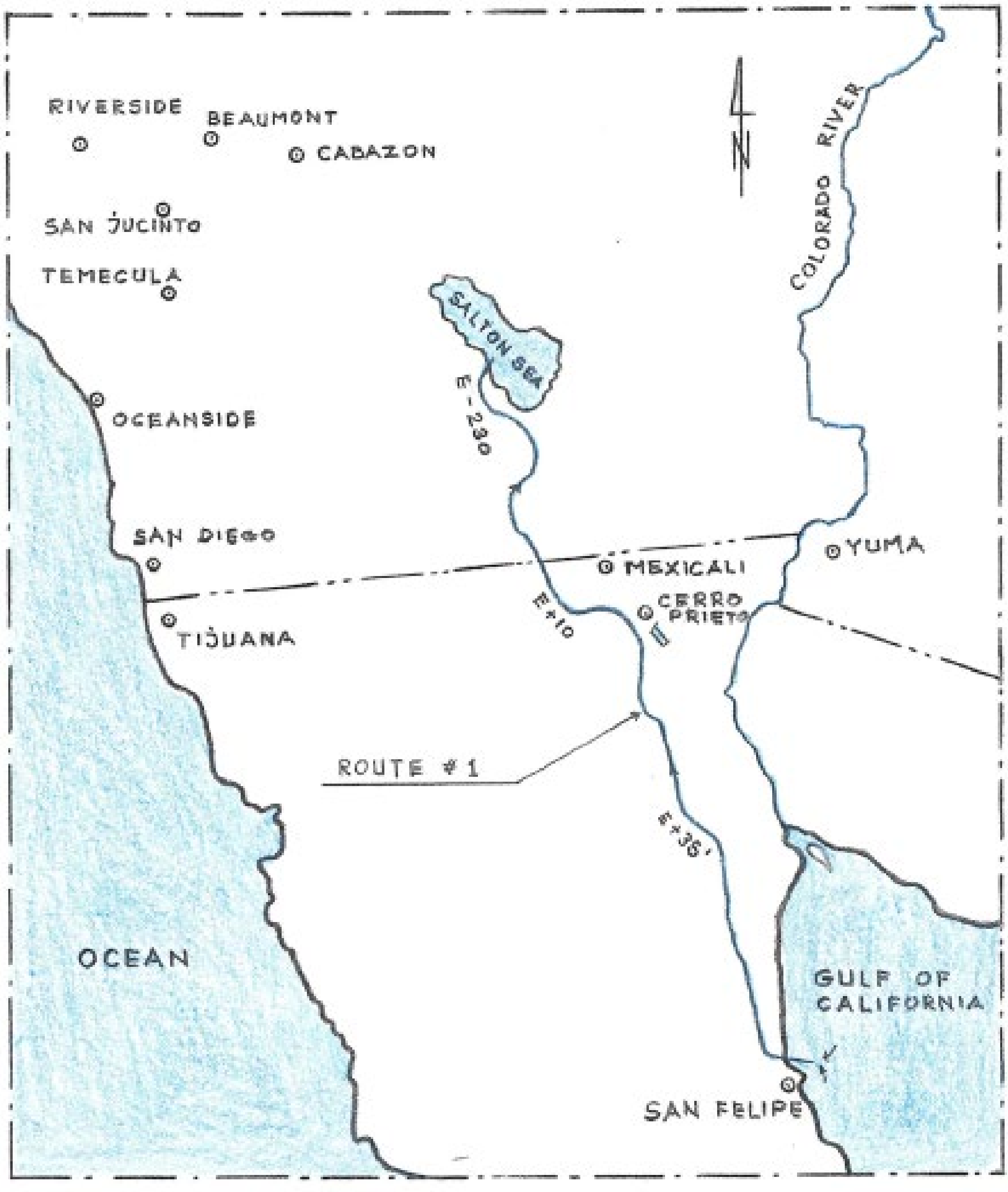

FIG. 2 – Map of the Route #1

Segment (I)

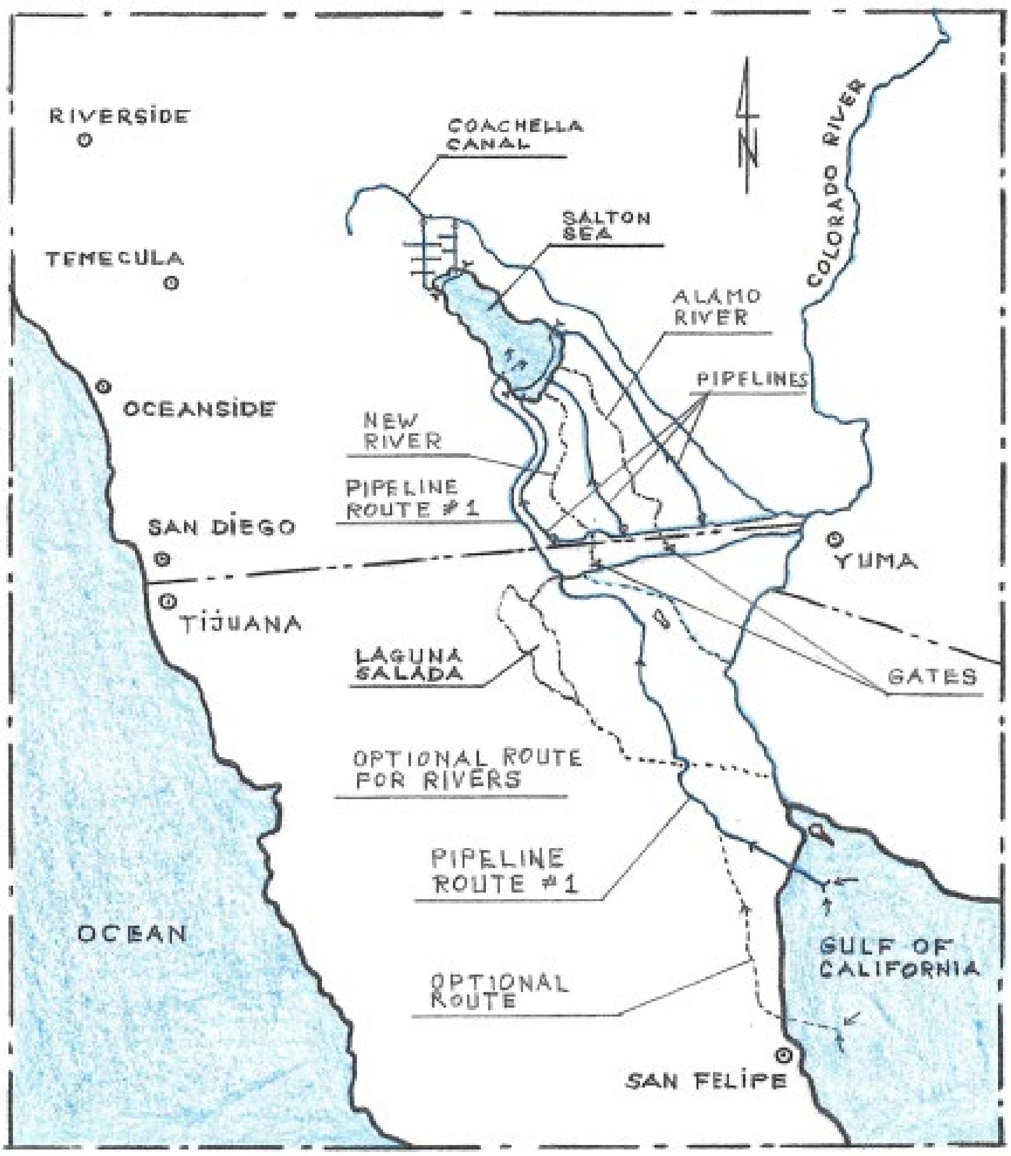

FIG. 3 – Map of redirecting New and Alamo Rivers

Segment (I)

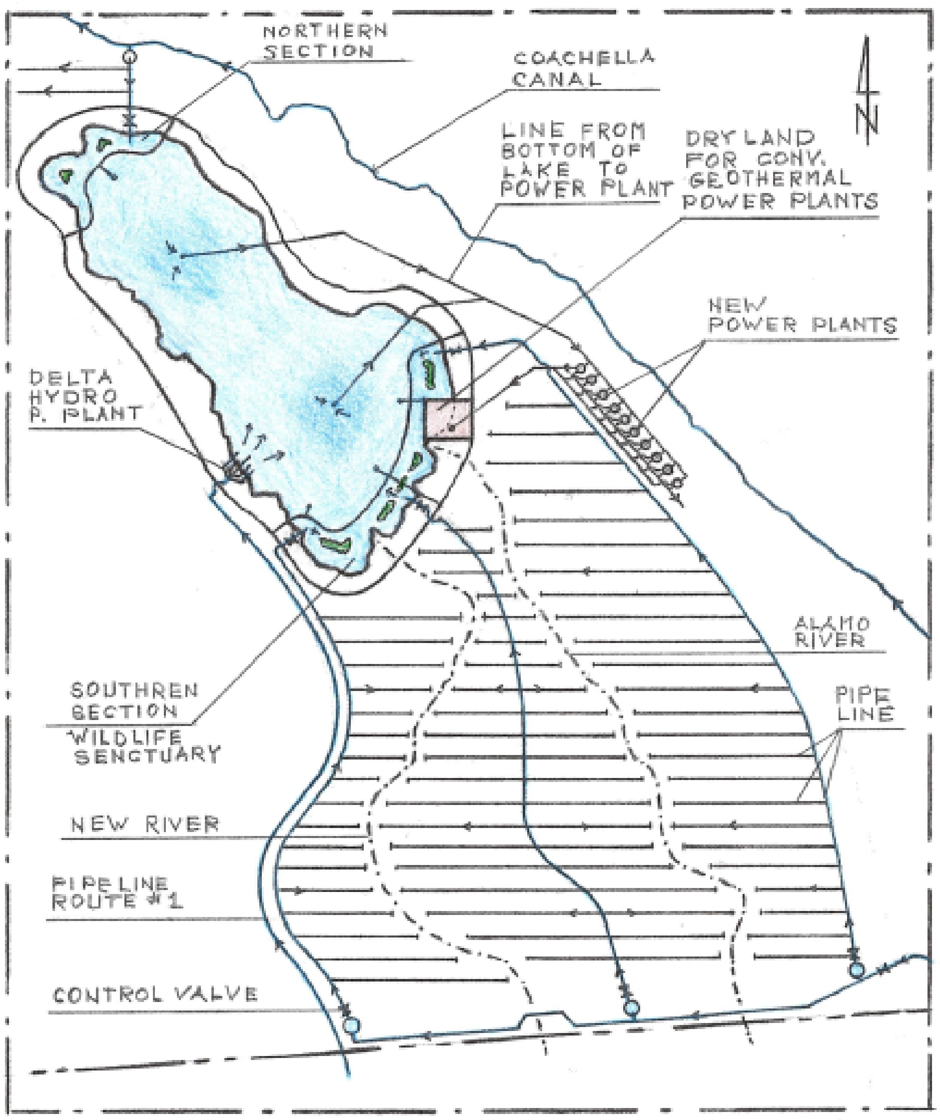

FIG. 4 – **Map of redirecting New and Alamo Rivers – South of the Lake**

Segment (I)

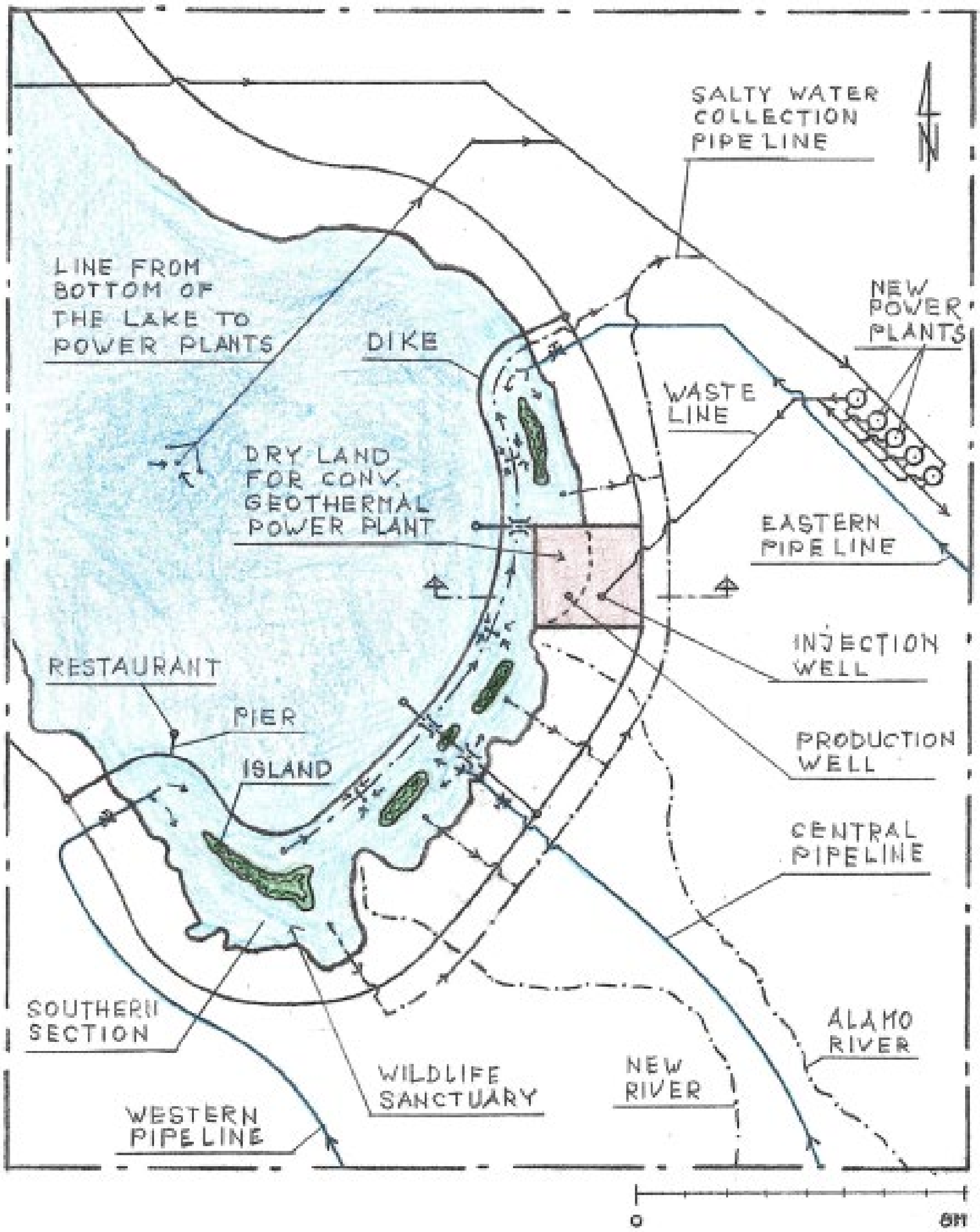

FIG. 5 – **Enlarged Southern Part of the Salton Sea – Wildlife Sanctuary**

Segment (I)

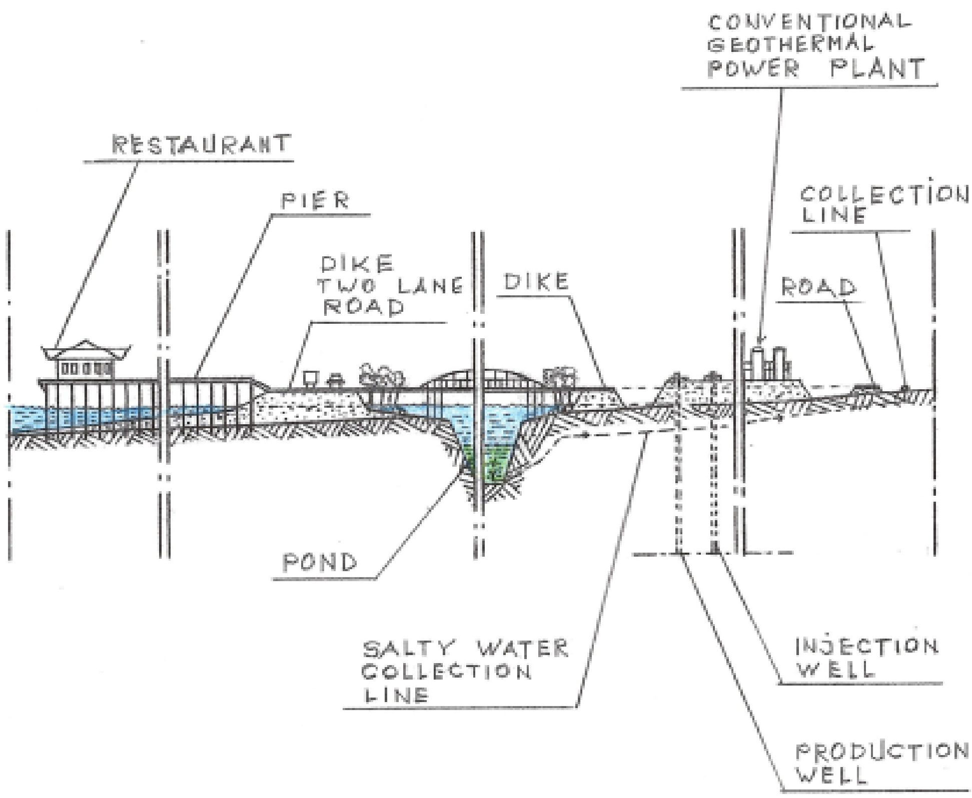

FIG. 6 – **Cross-sectional view taken near a typical dike-pier intersection**

Segment (I)

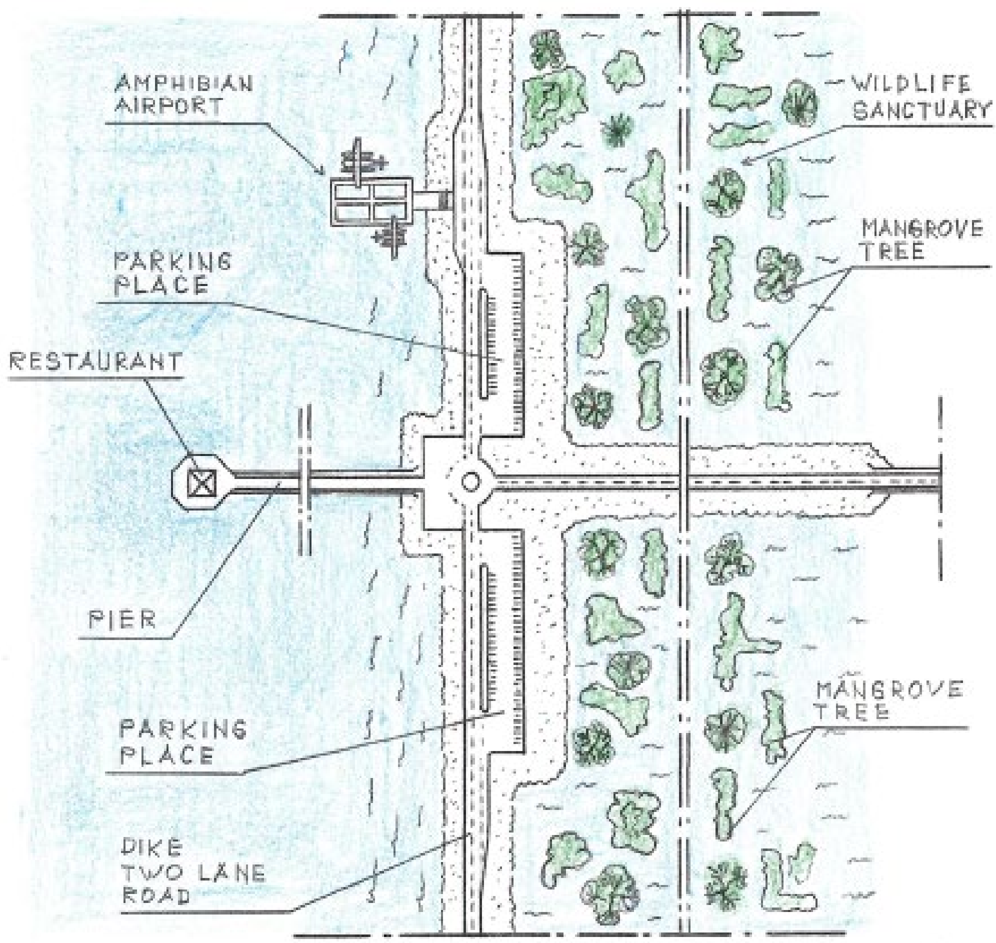

FIG. 7 – Plain view of a typical dike-pier intersection

Segment (I)

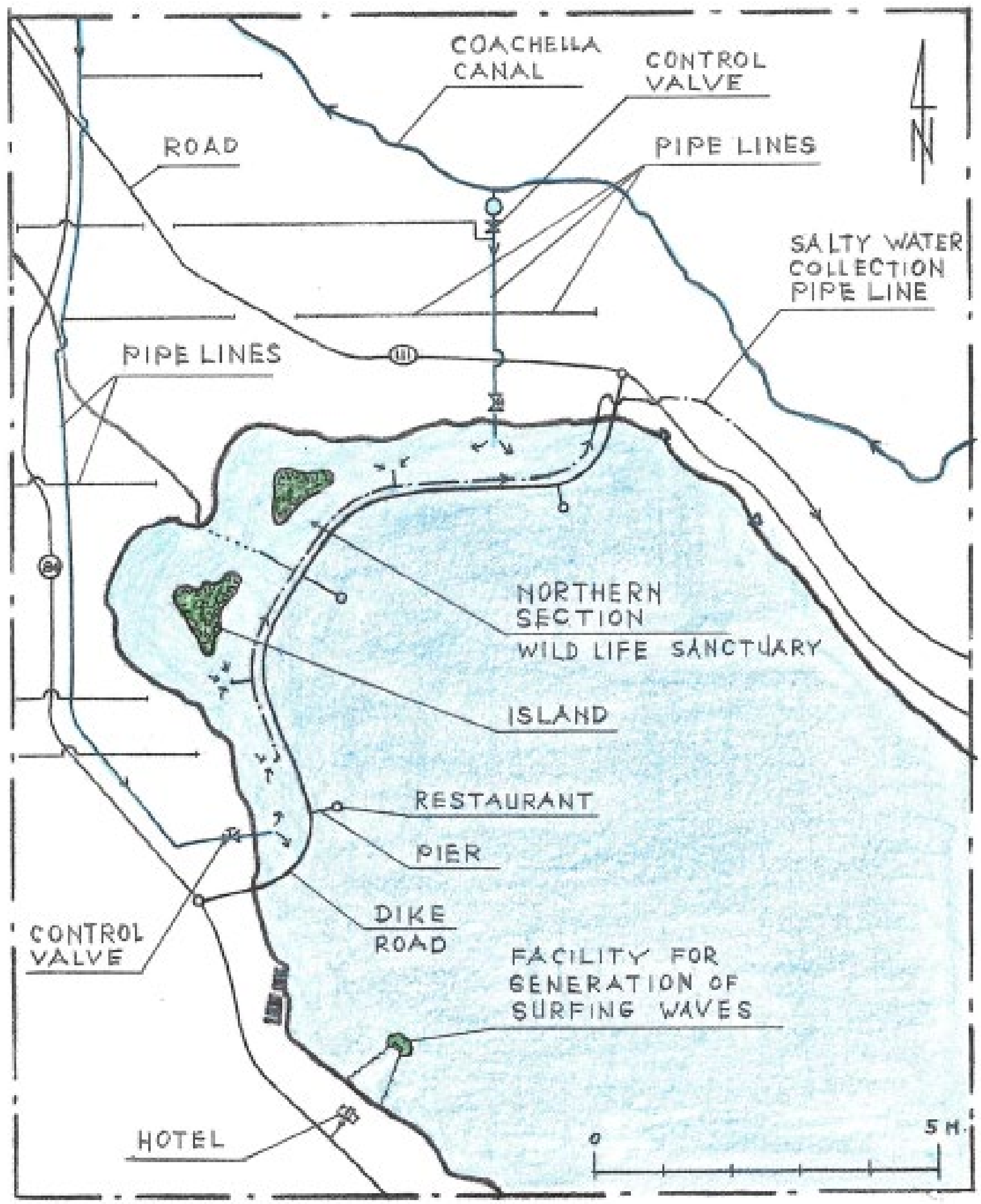

FIG. 8 – Enlarged northern part of the Salton Sea
– Wildlife Sanctuary -

Segment (I)

FIG. 9 – Map of the Route #2

Segment (I)

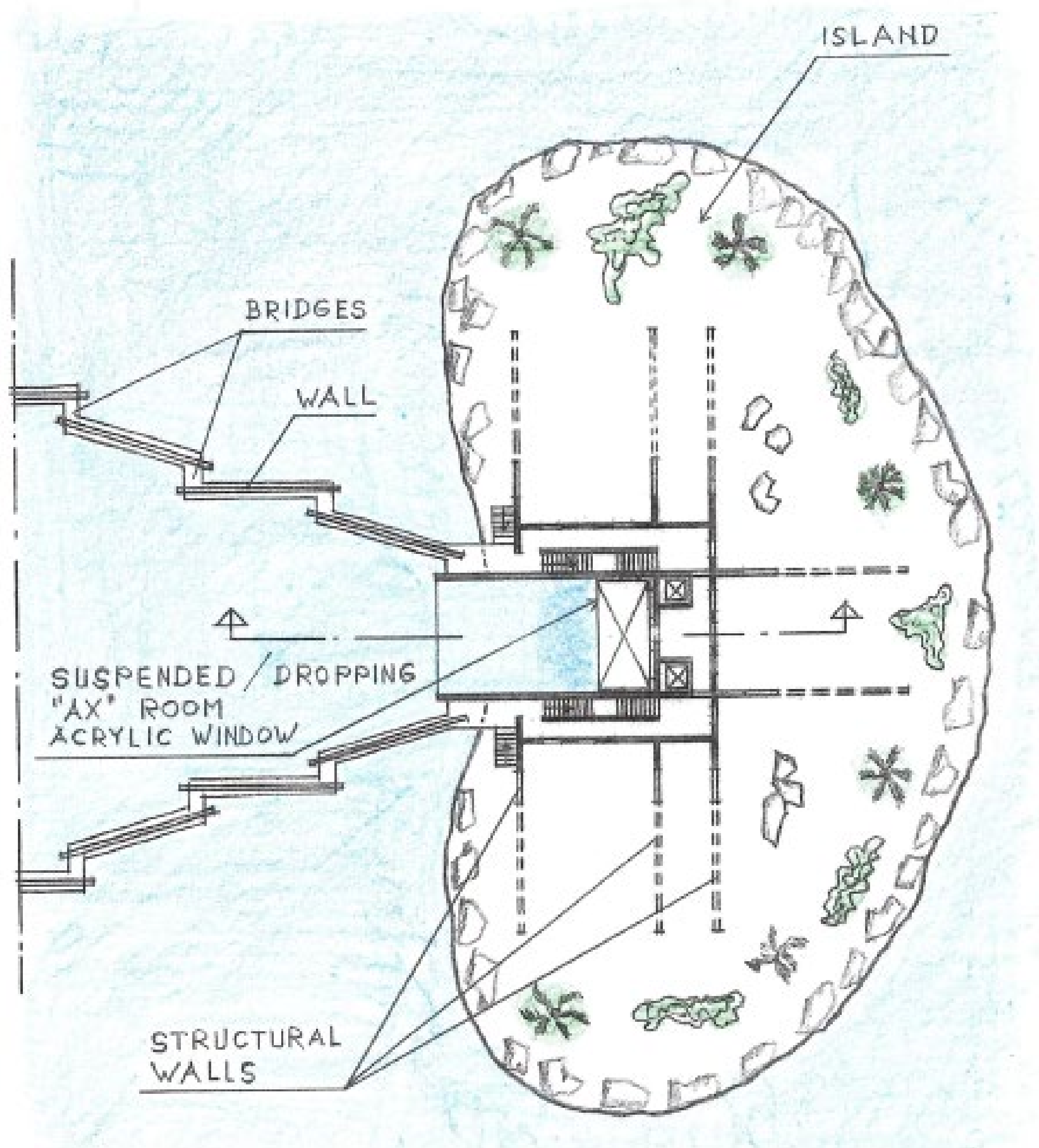

FIG. 10 – Plain cross-sectional view of a wave generation facility

Segment (I)

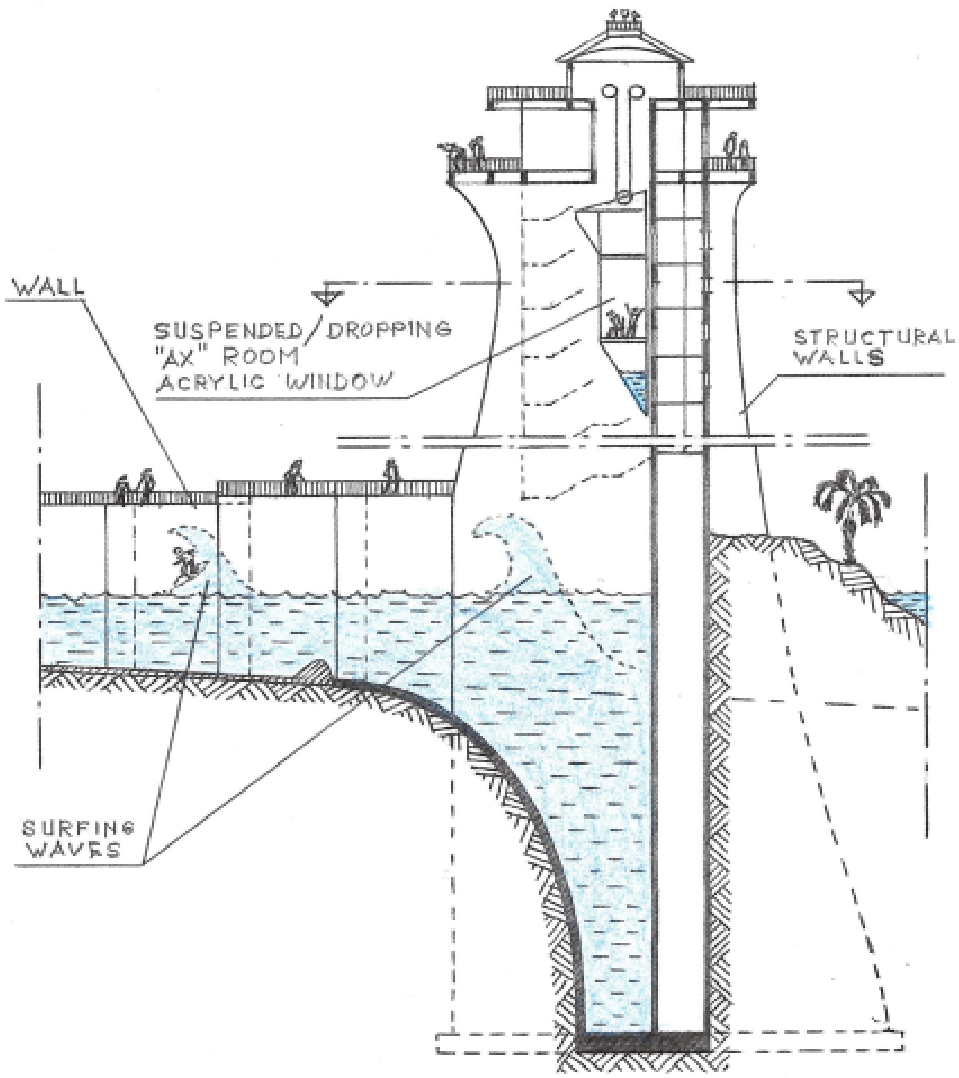

FIG. 11 – Cross-sectional view of a wave generation facility

3. Conclusion:

Importing seawater is a fundamental phase of the presented comprehensive proposal on which other phases depend. Also, importing seawater is an essential element in providing the necessary water for harnessing geothermal energy in the area and is an essential element for the restoration of the Salton Sea.

Presented pipeline with diameter only 48” through Route #1 can import about 1 million acre-feet per year which is enough for the balancing evaporation of the Lake. The pipeline through Route #2 can import about 2 million acre-feet per year meaning that 1 million acre-feet can be used for other purposes including replenishing geothermal reservoirs.

Presented proposal for the restoration of the Salton Sea is a long-term solution which includes an architectural element which harmoniously implements several breakthrough technologies into a self-sustaining organism. Each of the segments (phases) is essential for the final result.

Presented proposal transforms the situation of the Salton Sea from the liability which would exceed $70 billion (environmental disaster – toxic dust storms, health issues, and economic fold) - to the tremendous assets (clean environment and hundreds billion dollars in revenue) – costing only about $10 billion for building it.

Acknowledgment

The 3.5 km Temperature Map is courtesy of the SMU Geothermal Laboratory and Dr. David Blackwell, Dallas Texas.

REFERENCES

U.S. Patent No. 7,849,690; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on Dec.14, 2010;

U.S. Patent No. 8,281,591; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on October 9, 2012;

U.S. Patent No. 8,713,940; Entitled: “Self-Contained In-Ground Geothermal Generators”; Issued on May 6, 2014;

U.S. Patent No. 9,206,650; Entitled: “Apparatus for Drilling Faster and Wider Wellbore; Issued on December 8, 2015;

U.S. Patent No. 9,978,466; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump; Issued on May 22, 2018;

U.S. Patent No. 9,982,513; Entitled: “Apparatus for Drilling Faster and Wider Wellbore with Casing; Issued on May 29, 2018;

U.S. Patent No. 9,995,286; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump and Several Alternative Applications; Issued on June 12, 2018;

Proceedings World Geothermal Congress 2020
Reykjavik, Iceland, April 26 – May 2, 2020

Harnessing Energy and Water in the Salton Sea

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Keywords: geothermal energy, electricity, desalinization, clean environment, Geothermal Power, Hydro Power, Electricity, Importing Seawater, In-Line-Pump, In-Line- Generator, Solar Power, Renewable Energy, Heat Exchanger, Desalinization, Potable Water, Lithium, Environment, Wildlife Sanctuary, Tourism.

ABSTRACT

The Salton Sea in California is a terminal lake with reduced inflow from the Colorado River and is facing environmental disaster. In several decades had been mentioned several proposals for the restoration of the Salton Sea by importing seawater, but they all failed to address: (i) salinity balance of the lake – proposing expensive processes such as reverse osmosis and distillers which require a substantial amount of electricity, maintenance of filters, etc.; (ii) continuation of pollution from nearby farmland; (iii) practicality of the projects - implementing canals, tunnels, etc., and extreme cost which could not be repaid.

The presented proposal is quite different – it includes an architectural element that harmoniously incorporates several new (patented) technologies into a self-sustaining organism. The presented proposal includes several options based on the same concept: 1) Dividing lake into three sections; 2) Importing seawater from the Ocean and 3) Harnessing prevalent geothermal energy. By dividing the lake into three sections (central and two smaller northern and southern sections) and importing seawater into the central section of the lake it prevents the continued pollution of the Lake and provides a condition for tourism (exclusive real-estate, beaches, resorts, hotels, etc.), and vast wildlife sanctuary. The presented proposal also implements several breakthrough technologies such as a) Harnessing hydropower during import of seawater; b) Harnessing solar energy in combination with pipeline system; c) Harnessing prevalent geothermal energy which is accessible in the Salton Sea area by using a completely closed-loop heat exchange system for generation of electricity; d) Desalinization of the lake and production of the potable water as a free by-product; e) Providing a source for extraction of lithium and providing depot for waste material. Presented proposal transforms the situation of the Salton Sea from the liability which would exceed $70 billion (incoming environmental disaster – toxic dust storms, health issues, and economic fold) - to the tremendous assets (clean environment and hundreds of billion dollars in revenue) – costing only about $15 billion.

1. INTRODUCTION

1.1 Note:

Presented paper with the title “Harnessing Energy and Water in the Salton Sea” is a segment of the comprehensive design for the long-term solution for the restoration of the Salton Sea (Lake in California). The solution for the restoration of the Salton Sea includes an architectural element that harmoniously implements several breakthrough technologies into a self-sustaining organism. There are five phases (segments) of the project including harnessing solar and hydro energy which are excluded for this occasion as not relevant to the geothermal issue. Each of the phases (segments) is essential for the final result of the project. The presented paper “Harnessing Energy and Water in the Salton Sea” is a fundamental segment of the comprehensive design on which the function of other segments depends.

For this occasion, the paper “Harnessing Energy and Water in the Salton Sea” is marked as a (Segment I). For a complete understanding of this segment, it is necessary to review the other two integral parts of the comprehensive design with titles “Harnessing Geothermal Energy with the Self Contained In-Ground Geothermal Generator and Self Contained In-Ground Geothermal Heat Exchanger” as a (Segment II), and “System for Drilling Deeper and Wider Wellbores” as a (Segment III).

1.2 Overview of the contemporary situation:

a) The Salton Sea in California is a terminal lake formed accidentally in 1905-1907 after the levy at Colorado River has been breached after a storm. The inflow from the Colorado River has been reduced as a result of the water transfers related to the Quantification Settlement Agreement (QSA). The Lake is shrinking and exposing the receding shoreline (playa) to the elements precipitating higher salinity levels and facing incoming environmental disaster, health issues of the nearby communities, as well as a serious threat to its multibillion-dollar tourist trade.

b) The lake is 35 miles long, 15 miles wide, and is located south of Palm Springs in a basin -220 feet below sea level and is relatively a shallow Lake. Average depth is 50 feet. The lower point is -275.

c) The Earth’s crust at the southern end of the Salton Sea is relatively thin. The temperature in the Salton Sea Geothermal Field can reach 680 ºF (360 ºC) less than a mile below the surface. (See FIG. 1)

d) On the southern part of the Lake, there is a known geothermal reservoir.

e) The Salton Sea is California’s largest lake and is presently over 50 % saltier than the Ocean. The Salton Sea is a “terminal lake,” meaning that it has no outflow and salts, nutrients, pesticides, and other contaminants have concentrated in the Lake. Water flows into Lake from several limited sources, but the only way water leaves the Lake is by evaporation.

f) Geothermal energy in the Salton Sea area is prevalent and topography is unique - the lake is -220 feet below the sea-level and is about 160 miles from both - the Ocean and Gulf of California.

g) Under the terms of the Quantification Settlement Agreement (QSA) the lake's decline is set to accelerate starting year, 2018. About 1/3 of inflow water from the canal will be diverted to San Diego and Coachella Valley.

h) Runoff water from nearby agricultural fields which contains fertilizers, pesticides, and other pollutants such as partially treated sewer from Mexicali contaminate the Salton Sea and make it an undesirable tourist destination especially for beachgoers.

i) There have been many studies about consequences (environment, toxic dust storms, health) for the nearby community if a solution for the Salton Sea is not found.

j) In several decades had been mentioned several proposals for the restoration of the Salton Sea proposing importing seawater, but they all failed to address: (i) salinity balance of the lake – proposing expensive processes such as reverse osmosis and distillers which require a substantial amount of electricity, maintenance of filters, etc.; (ii) not addressing continuation of pollution with pesticides and fertilizers from nearby farmland; (iii) practicality of the projects - proposing canals, tunnels, dozen pipelines - without addressing the practicality of its implementation - extreme cost with difficulties attracting investors for such projects that cannot generate revenue to pay-off initial investment, therefore, deemed unfeasible.

1.3 Five Phases of the Proposal for the Restoration of the Salton Sea:

Phase I - Connecting the Salton Sea with the Ocean with a pipeline 48" (5 pipelines on the uphill routes and 1 pipeline on downhill routes) for importing seawater into the central section of the Lake (several options for pipeline corridors are provided (See FIG. 2 and 9);

Phase II - Dividing the lake into three sections by building two main dikes (two-lane roads) strategically positioned - One in the northern and one in the southern part of the Salton Sea (See FIG. 4, 5, and 8).

Phase III - Building one power plant using a completely closed-loop heat exchange system (SCI-GHE system) at one of the selected sectors (Fig. 4, 5 and 7).

Phase IV - Building several more power plants using the (SCI-GHE) system - one in each additionally selected sector; and

Phase V - Continuing build-up of many additional power plants using the (SCI-GHE) system at each selected sector.

1.4 The key elements of the presented proposal are:

1) Dividing the Salton Sea into three sections with two main dikes (two-lane roads) to prevent pollution of the larger central section of the lake which would provide the condition for tourism (beachgoers) and wildlife sanctuary in smaller northern and southern sections.

2) If Route 1 (Gulf of California, Mexico - Salton Sea, USA) is selected: To negotiate a treaty with Mexico's officials about diverting the flow of the New River and Alamo River back to Mexico and in return getting corridor for a pipeline for importing seawater from the Gulf of California. The pipeline with a maintenance road can have several underpasses to preserve the integrity of Mexico's territory.

3) If Route 1 is selected – then, the diverted flow of New River and Alamo Rivers can be treated and used for refilling Laguna Salada or for farmland (See FIG. 2, 3, and 4); (Tips for negotiations with Mexico's officials – in summary: It is in the interest of Mexico to have the flow of New River and Alamo Rivers. It is in the interest of the US to have a corridor for importing seawater from the Gulf of California).

4) For any accepted Route of importing seawater from the Ocean in the central section of the Lake – It is recommended to use the In-Line-Pump/Generator system which generates electricity in downhill routes which can be used as a supplement to the energy needed for horizontal and uphill routes.

5) Optionally, the US can treat water from the New River and Alamo River and use it for farmland or sell it to Mexico.

6) Generation of the electricity by using the pipeline as a foundation for solar panels assembly for the generation of additional electricity and increasing revenue for several hundred million dollars per year. Solar energy is prevalent in the area averaging 280 sunny days per year.

7) Implementing pipeline with sprinkler system for farmland (Northern and Southern area of the Lake) to conserve limited source of water from Colorado River, received through All-American Canal, and to prevent the formation of runoff waters from nearby farmland. (See FIG. 4 and 8);

8) Generation of electricity by harnessing prevalent geothermal sources with new technology using a completely closed-loop system that is not limited to a known geothermal reservoir. (See Segments II & III);

9) Desalinization of the lake by using gravity - pumping out higher salinity water - which tends to accumulate at bottom of the lake - and pumping it into the boilers of a new Power Plants for the generation of electricity and production of potable water as a free by-product (See also Segments II and III);

10) Providing a source (brine) for the extraction of lithium (See Segments II, III, and IV).

11) Providing vast wildlife sanctuary (See FIG. 4, 5, and 8); and

12) Providing conditions for tourism - exclusive real-estate, beaches, resorts, hotels, etc.- (Not included in this presentation).

2. DISCLOSURE - ILLUSTRATIONS - HARNESSING ENERGY AND WATER IN THE SALTON SEA (SEGMENT I)

Segment (I)

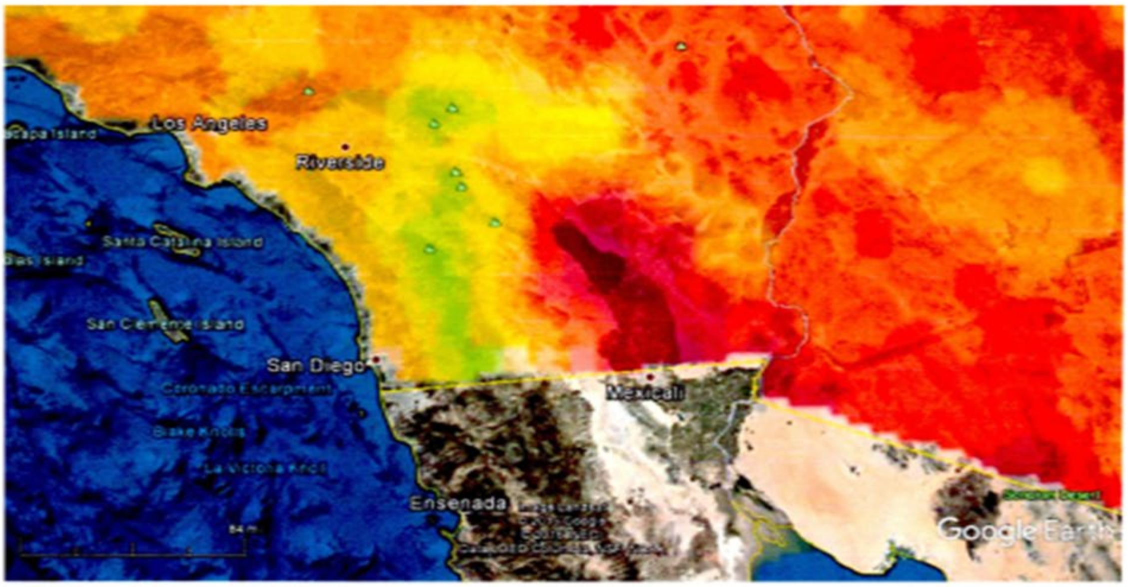

FIG. 1 – **Map of Southern California – Temperatures at dept of 3.5 Km**

Segment (I)

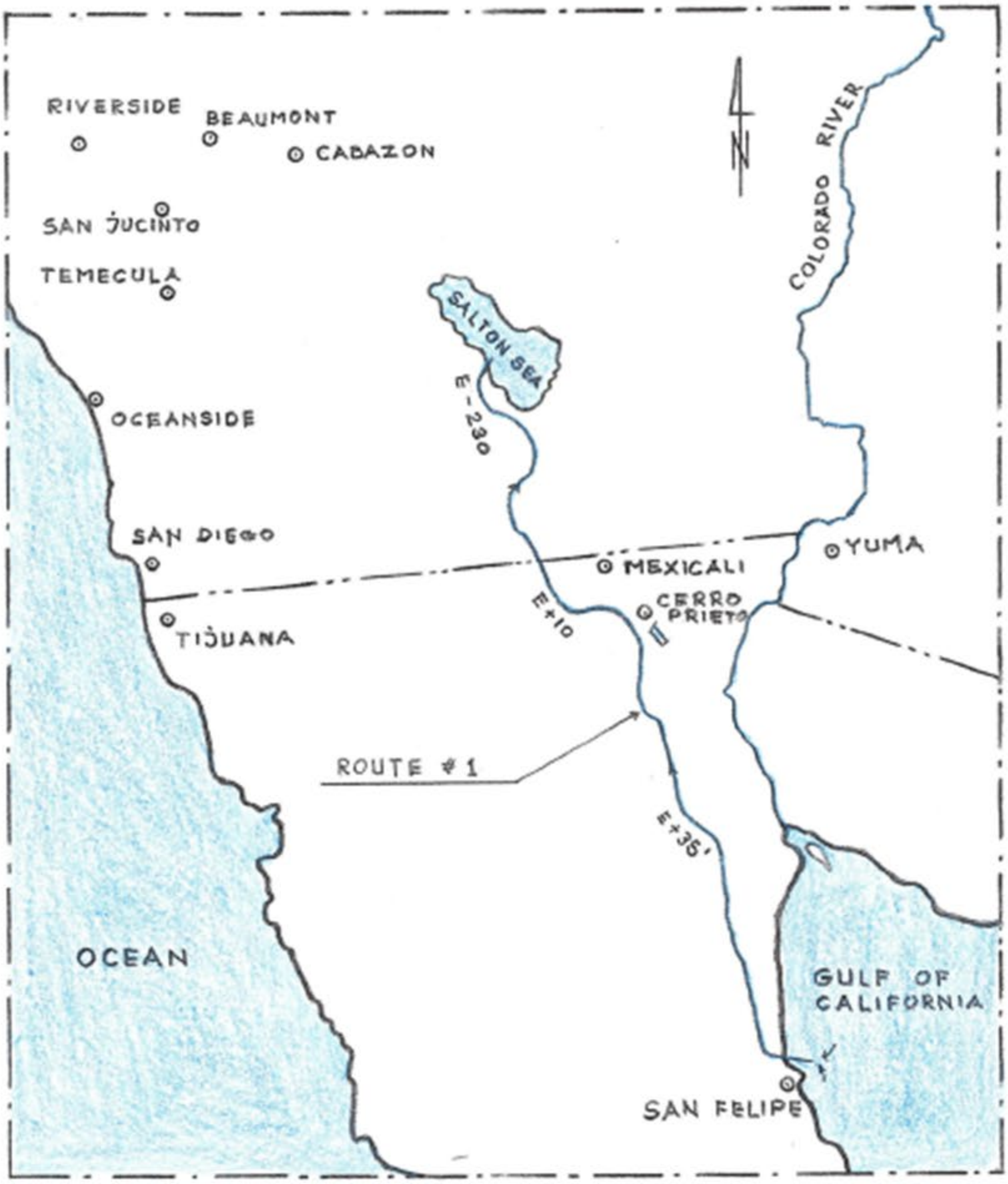

FIG. 2 – **Map of the Route #1**

Segment (I)

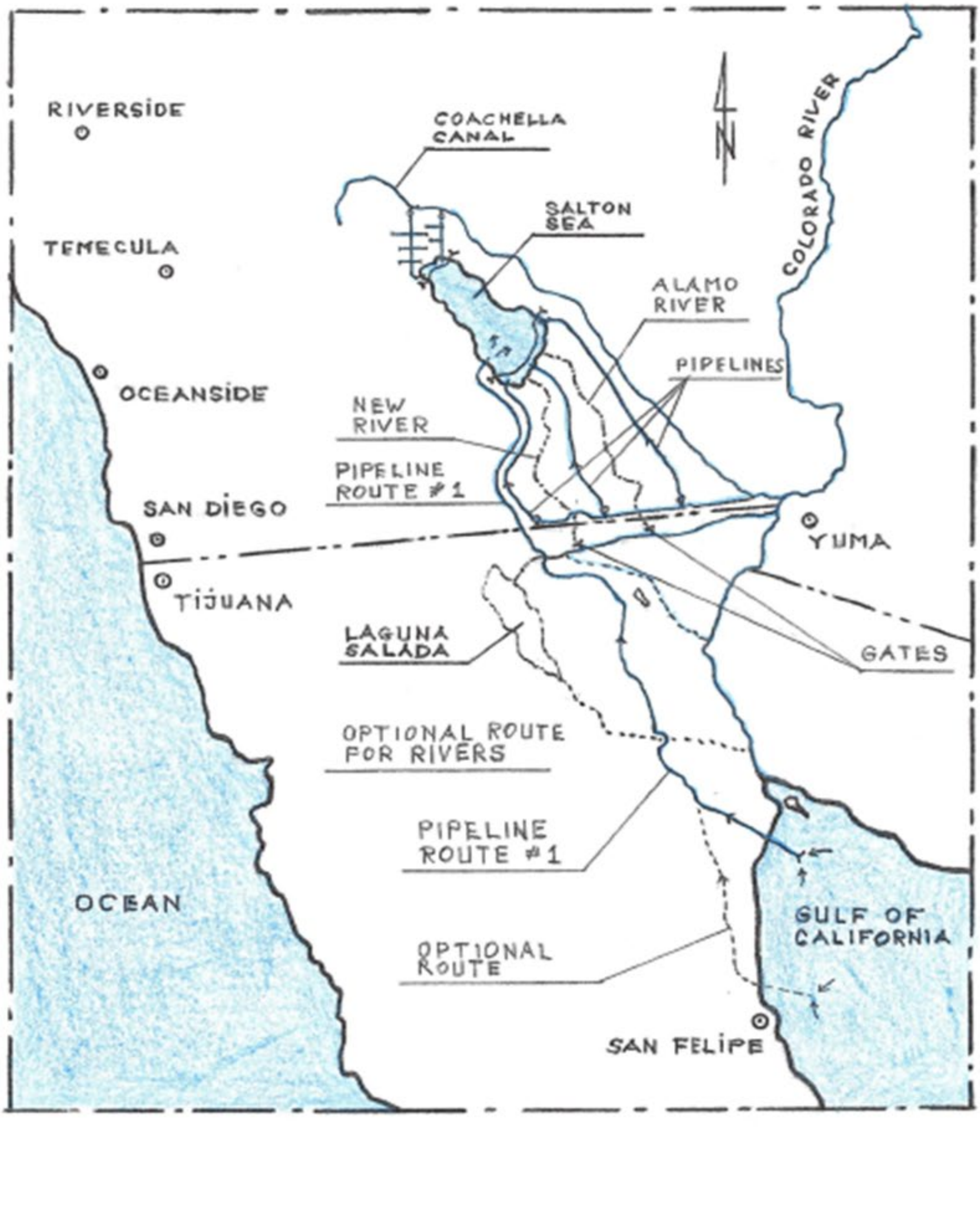

FIG. 3 – Map of redirecting New and Alamo Rivers

Segment (I)

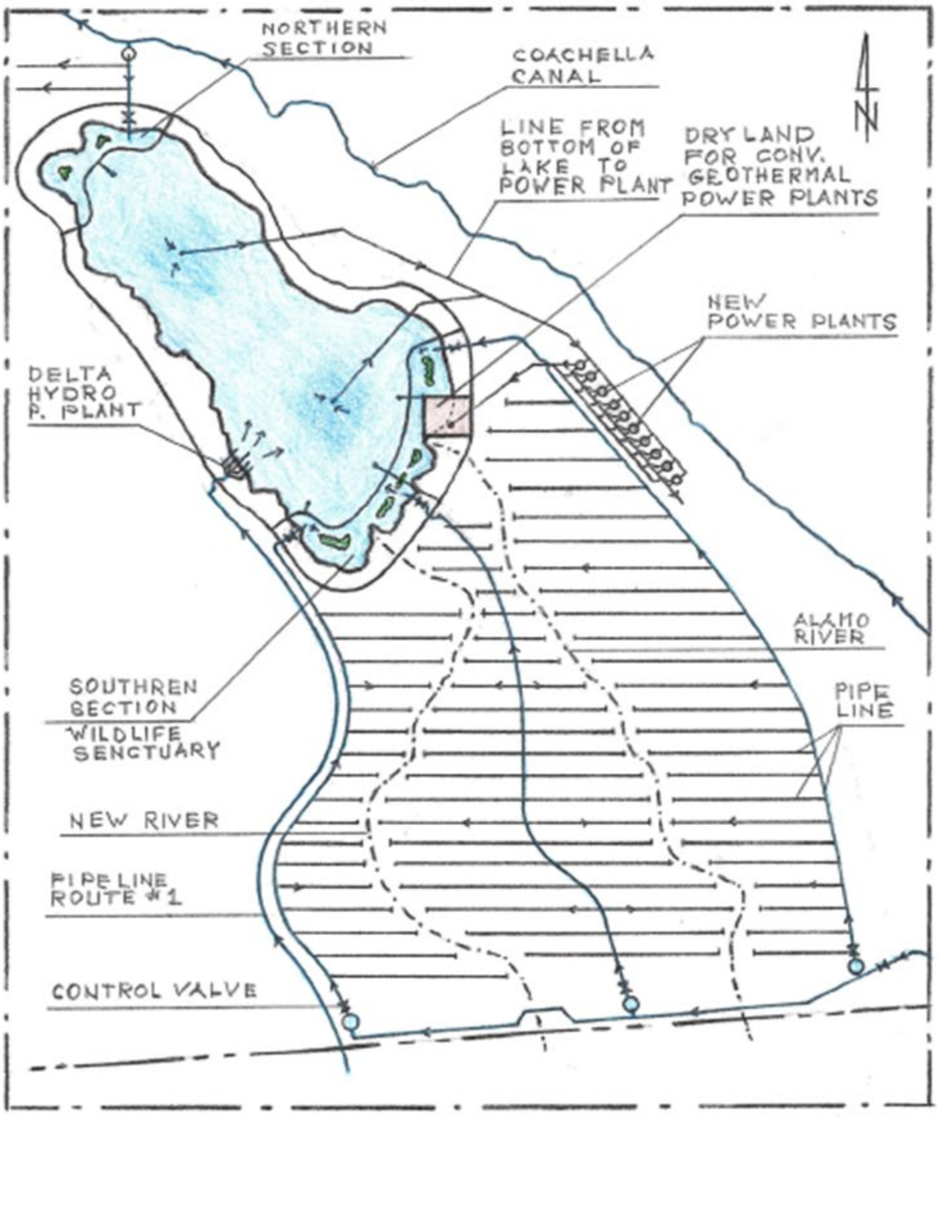

FIG. 4 – **Map of redirecting New and Alamo Rivers – South of the Lake**

Segment (I)

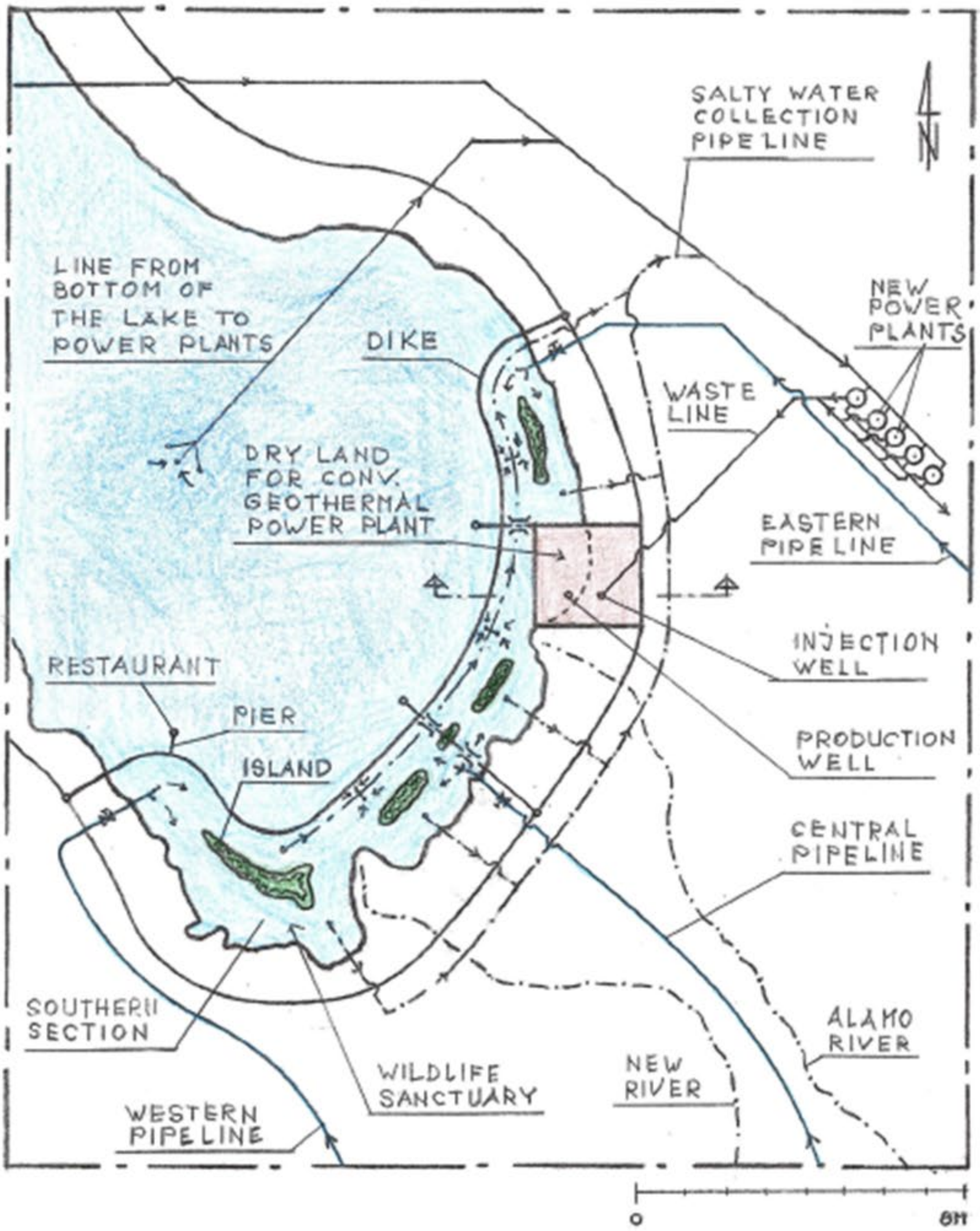

FIG. 5 – Enlarged Southern Part of the Salton Sea – Wildlife Sanctuary

Segment (I)

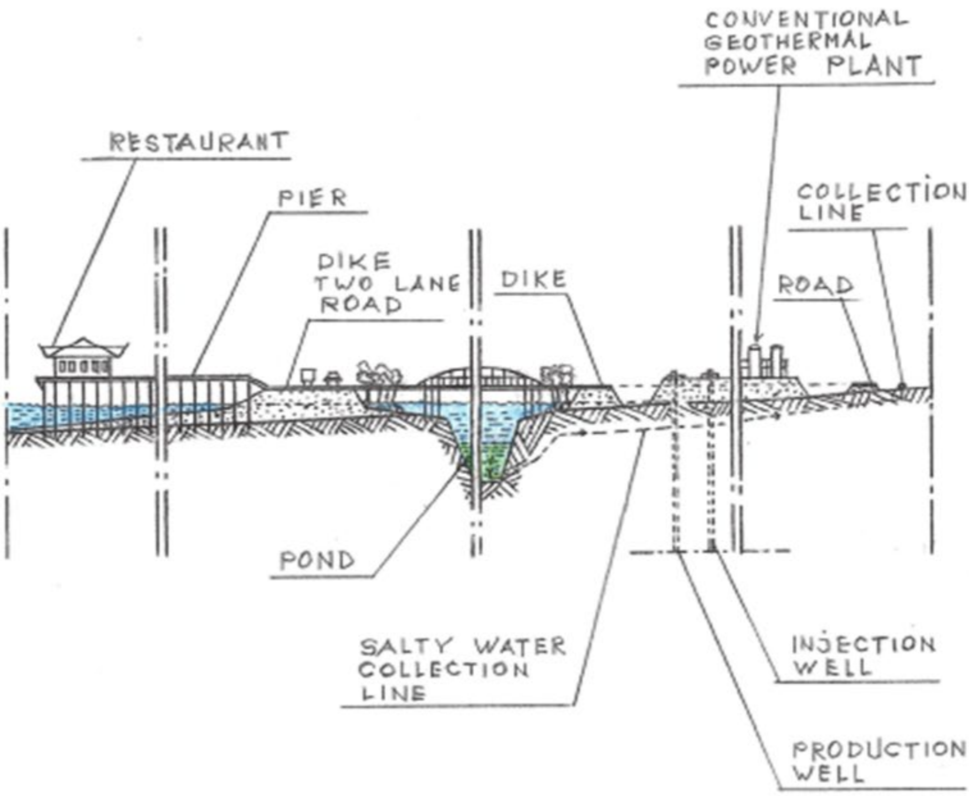

FIG. 6 – Cross-sectional view taken near a typical dike-pier intersection

Segment (I)

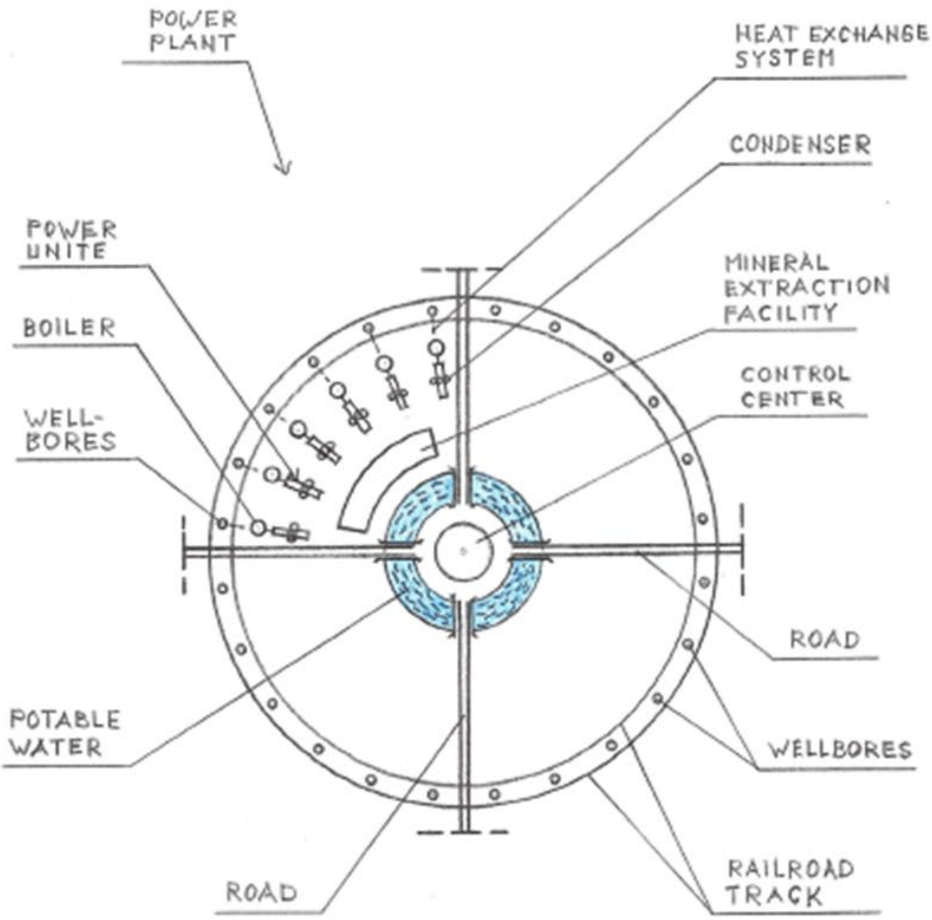

FIG. 7 – Plain View of a typical Power Plant

Segment (I)

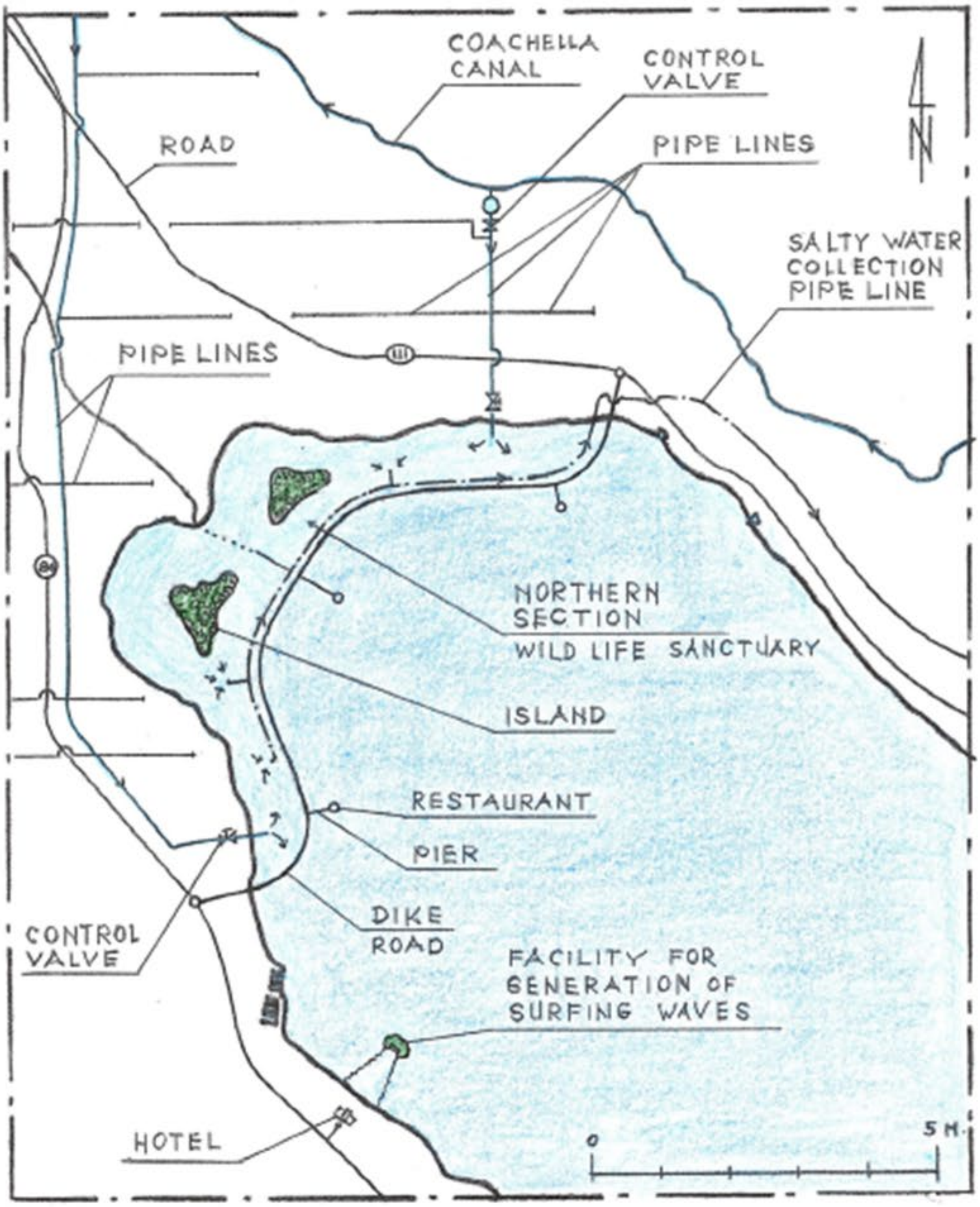

FIG. 8 – Enlarged northern part of the Salton Sea
– Wildlife Sanctuary -

Segment (I)

FIG. 9 – Map of the Route #2

2. CONCLUSION

Importing seawater is a fundamental phase of the presented comprehensive proposal on which other phases depend. Also, importing seawater is an essential element in providing the necessary water for harnessing geothermal energy in the area for refiling depleting known geothermal reservoir, and is an essential element for the restoration of the Salton Sea.

Presented pipeline with a diameter of only 48” through Route #1 can import about 1 million acre-feet per year which is enough for the balancing evaporation of the Lake. The pipeline through Route #2 can import about 2 million acre-feet per year meaning that 1 million acre-feet can be used for other purposes including replenishing geothermal reservoirs.

Presented proposal for the restoration of the Salton Sea is a long-term solution that includes an architectural element that harmoniously implements several breakthrough technologies into a self-sustaining organism. Each of the segments (phases) is essential for the final result.

Presented proposal transforms the situation of the Salton Sea from the liability which would exceed $70 billion (environmental disaster – toxic dust storms, health issues, and economic fold) - to the tremendous assets (clean environment and hundreds of billion dollars in revenue) – costing only about $10 billion for building it.

3. REFERENCE

U.S. Patent No. 7,849,690; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on Dec.14, 2010;

U.S. Patent No. 8,281,591; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on October 9, 2012;

U.S. Patent No. 8,713,940; Entitled: “Self-Contained In-Ground Geothermal Generators”; Issued on May 6, 2014;

U.S. Patent No. 9,206,650; Entitled: “Apparatus for Drilling Faster and Wider Wellbore; Issued on December 8, 2015;

U.S. Patent No. 9,978,466; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump; Issued on May 22, 2018;

U.S. Patent No. 9,982,513; Entitled: “Apparatus for Drilling Faster and Wider Wellbore with Casing; Issued on May 29, 2018;

U.S. Patent No. 9,995,286; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump and Several Alternative Applications; Issued on June 12, 2018;

ACKNOWLEDGMENT

The 3.5 km Temperature Map is courtesy of the SMU Geothermal Laboratory and Dr. David Blackwell, Dallas Texas.

Harnessing Energy and Water in The Salton Sea (Segm. II) (Harnessing Hydro Power)

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Keywords

Geothermal Power, Hydro Power, Electricity, Importing Seawater, In-Line-Pump, In-Line-Generator, Solar Power, Renewable Energy, Heat Exchanger, Desalinization, Potable Water, Lithium, Environment, Wildlife Sanctuary, Tourism.

ABSTRACT

The Salton Sea in California is a terminal lake with reduced inflow from the Colorado River as a result of the water transfers related to the Quantification Settlement Agreement (QSA). The Lake is shrinking and exposing the receding shoreline (toxic playa) to the elements and facing incoming environmental disaster.

The presented proposal includes an architectural element that harmoniously incorporates several patented technologies into a self-sustaining organism. It is a long-term solution for the restoration of the Salton Sea.

The presented proposal includes several options based on the same concept: 1) Dividing the Lake into three sections; 2) Importing seawater from the Ocean; 3) Harnessing prevalent geothermal energy.

In this segment (II), the emphasis is on Harnessing Hydro Power during the import of seawater from the Ocean. The presented system for importing seawater is the essential phase for harnessing geothermal energy and for the restoration of the Salton Sea, CA, although is not limited to the Salton Sea project.

Contemporary pumping stations and hydroelectric power plants are expensive and have restrictions on location, capacity, and access. The presented proposal for importing seawater has several "In-line-Pumps" as segments of the pipeline for uphill routes and has several "In-Line-Generator" as segments of the pipeline for generating electricity on downhill routes. This system also has "Split and Join" and "Delta" mini Hydroelectric Power Plants on downhill routes.

1. Introduction

The presented system for importing seawater is the essential phase for harnessing geothermal energy and for the restoration of the Salton Sea, CA, although is not limited to the Salton Sea project.

Contemporary pumping stations and hydroelectric power plants are expensive and have restrictions on location, capacity, and access. The presented proposal for importing seawater has several “In-line-Pumps” as segments of the pipeline for the uphill routes and has several “in-line-generator” as segments of the pipeline for generating electricity on downhill routes (See Fig. 1-4). This system also has “Split and Join” and “Delta” mini Hydroelectric Power Plants on downhill routes. Downhill routes of the pipeline can be built using several cascades with “split and join” mini Hydroelectric Power Plants to avoid the buildup of extreme hydrostatic pressure in the pipeline especially in the last section of the final downhill routes (See Fig. 4 and 5). The system uses primary and secondary “In-Line-Generators” (See Fig. 6-8). The primary “In-Line-Generators” are the first generators after the cascade drop with less exposed spiral blades inside the shaft/pipe generating electricity and allowing fluid flow to continue to the subsequent smaller diameter pipes with slightly lesser speed. After exiting the primary “In-line-generators”, the fluid flow is split into two subsequent smaller branches with smaller “In-line-generators” which have more exposed spiral blades inside shaft/pipe and lesser opening in the middle. By splitting fluid flow into smaller branches with a lesser speed of fluid flow in each subsequent branch, it increases the efficiency of harnessing kinetic energy and at the same time providing the same mass of water to leave the pipeline and enter the lake as the amount of water exiting the primary “In-Line-Generators”. In order to accommodate the same amount of water exiting the downhill pipeline and Delta” mini Hydroelectric Power Plant, the same amount of water needs to enter the pipeline at the uphill route from the Ocean. That is achieved by having several pipelines comprising the uphill route with lesser fluid speed through them.

1.1 Preliminary Estimate for the Cost and Energy Needed for the Pipeline Route # 1: From Gulf of California – San Felipe - Mexicali, Mexico, - To the Salton Sea.

Elevation to overcome is 35‘ (10 m).

Pipeline distance is about 150 miles.

The range of cost today of installed pressure pipe of 48-inch diameter in various terrains is about $600 – $1,000 per linear foot.

Route # 1 has a distance of about 150 miles with preferred topography which has an advantage in pipeline cost. Let’s assume $600 per linear foot.

One mile 5,280‘ x $600 = $3,168,000.

$3,168,000 x 450 miles relatively flat terrain (50 miles x 5 pipelines + 50 miles x 3 pipelines 50 miles 1 pipeline) = $1,425,600,000

Because of a new product development + several pumping stations which will work temporally + final "delta" mini Hydroelectric Power Plant on the final route + adding several freeway underpasses, right-of-way permits - the final cost might increase 20% to about $1.7 billion.

As an option, if to pump-out higher salinity water from the bottom of the Lake into the vast Ocean is accepted through negotiation with Mexico authorities, then the same pumping system for importing seawater, with minor modifications, can be used for exporting higher salinity water (which has tendencies to accumulates at the bottom of the lake) from the Salton Sea into the Ocean by switching the direction of rotation of the In-Line-Pump/Generator 572 and 573 (See FIGS. 6-8). Reverse flow can be activated periodically for example - two weeks twice a year.

1.2 Preliminary Estimate of Energy Needed for the Pipeline Route # 1: Importing Seawater from the Gulf of California – Corridor: San Felipe - Mexicali, Mexico, to the Salton Sea.

Pipeline distance is about 150 miles.

Free Fall 70 meters:

Diameter of pipe is 48"

$S = ½ g x t^2$;

S = Vertical distance;

g = gravity = 9.81;

t = time

A = Area of the cross-section of the pipe.

$A = \pi r^2$ = 3.14 x (2x2) = 12.56 f^2

12.56 f^2 / 9 = 1.39 y^2 = 1.16 m^2

Free Fall values at 70 meters drop:

$S = ½ g x t^2$

$70 = ½ x 9.81 x t^2$

t^2 = 140 / 9.81 = 14.27

$t = \sqrt{14.27}$ = 3.77 seconds

Speed of water at nozzle at the bottom of the vertical fall at 70 meters:

V = Velocity (Speed)

V = g x t

V = 9.81 x 3.77 = 37.05 meters per second (41.01 y/s)

The volume of seawater entering the lake through one pipe with diameter 48" at speed of 41.0 y/s (yard per second) is: 1.39 y^2 x 41.0 y per sec. = 57.00 y^3 x (31,536,000 seconds in a year) = 1,797,674,900 y^3 = **1,114,261 acre-foot per year.**

The volume (mass) of water needed to balance the evaporation of the central section of the Lake is about 1,000,000-acre foot per year.

V = velocity => 7.4 m/s = 8.2 y/s is the speed that is needed to pump water from the Ocean through each of 5 pipelines of 48" diameter to accommodate the volume of seawater entering the Lake through one pipe with diameter 48" at speed of 41.0 y/s (yard per second).

The volume (mass) of water (42,720 kg) per second exiting the primary in-line-generator at speed of 37 m/s (41 y/s) and after "delta" mini hydroelectric power plant entering the Salton Sea is the same volume (mass) of water (42,720 kg) per second entering 5 pipelines in Gulf of Mexico at speed of 7.4 m/s (8.2 y/s).

Kinetic Energy:

For 70-meter drop from the top of the hill to the surface of the lake

The surface of the Lake is 70 meters below the ocean level.

Velocity (Speed) of the water at the surface of Lake or at nuzzle (in-line generator) is 37.05 m/s (41.01 y/s)

Ek = ½ M x V^2

Ek = Kinetic Energy

M = Mass

V = Velocity

M = Ek x 2/ V^2 => M = 1.16 m^2 x 37.05 m/s = 42.98 => 42.98 x (994kg = weight of water at 100 ºF) = 42,720kg

(42,720 kg is the volume (mass) of water passing through pipeline per second).

Ek = ½ M x V^2 = ½ x 42,720 kg x (37.05 x 37.05) => ½ x 42,720 kg x 1,372.7

=> ½ 58,641,744 = 29,320,872 MWs in period of one hour it is 29.3 MWh.

Efficiency factor usually used is 15% loss => 29.3 MWh x 0.85 = 24.9 MWh.

At this early stage without final testing of the new system, it is realistic to expect that by using "delta" mini hydroelectric power plants which harness energy after the main turbine (Primary In-Line-Generator) using mass and speed of fluid (no gravity) can be harnessed an additional 10% of energy which is about 2.4 MWh which end up to about **27.3 MWh**.

Revenue**:** **27.3 MWh** x \$60 = \$1,638 per hour;

\$1,638 x 24 hours = \$39,3210 per day;

\$91,310 x 365 days = **\$14,348,880** per year;

It is realistic to expect that starting with 5 pipelines with a diameter of 48" and speed of seawater 7.4 m/s (8.2 y/s) at the Gulf of California (near San Felipe) and then gradually reducing the number of pipelines to 3 pipelines and 1pipeline through several sections of 50 miles (50 miles x 5 pipelines + 50 miles x 3 pipelines + 50 miles 1 pipeline See GIG. 1) in a few weeks the speed of seawater through the pipeline will be stabilized and will continue without using initial in-line-pumps at the entrance of the pipeline.

1.3 Preliminary Estimate for Cost and Energy Needed for the Pipeline Route # 2: Importing Seawater from Long Beach California to the Salton Sea.

Elevation to overcome is 2,700‘ (823 m).

Pipeline distance is about 200 miles.

There is "Inland California Express" - Existing Pipeline – 60-year-old - diameter 16" for crude oil - 96 miles long from Long Beach to Whitewater area. The Questar Company owns the pipeline. The pipeline is not operational now. The Questar Company has "Right of Way" and is willing to sell it. Emphasis is on the "Right of Way".

The presented new pipeline is 48" in diameter. Downhill routes of the pipeline can be built using several cascades with "split and join" hydropower plants to avoid the buildup of extreme pressure in the pipeline especially in the last section of the final downhill route. By using several cascades with several "split and join" and "delta" hydropower stations this system can harness more kinetic energy.

1.4 Preliminary Estimate of Energy Needed for the Pipeline Route # 2: Importing Seawater from Long Beach California to the Salton Sea.

Free Fall values at 823 meters + (70 meters Ocean to Lake difference) = 893 meters

On this route can be used 3 cascades each with 297 m drop and 9 uphill pumping stations.

Free Fall:

$S = ½ g \times t^2$;

S = Vertical distance;

g = gravity = 9.81;

t = time

Free Fall values at 297 meters

$S = \frac{1}{2} g \times t^2$

$297 = \frac{1}{2} \times 9.81 \times t^2$

$t^2 = 594 / 9.81 = 60.55$

$t = \sqrt{60.55} = 7.78$ seconds

Speed of water at nozzle at the bottom of the vertical fall at 297 meters:

V = Viscosity (Speed)

$V = g \times t$

$V = 9.81 \times 7.78 = 76.33$ m/s = (83.47 y/s).

The volume of seawater entering the lake through one pipe with diameter 48" at speed of 83.47 y/s (yard per second) is: 1.39 y^2 x 83.47 y per sec. = 116 y^3 x (31,536,000 seconds in a year) = 3,658,176,000 y^3 = **2,267,464 acre-foot per year**.

The volume (mass) of water needed to balance the evaporation of the central section of the Lake is about a 1,000,000 acre-foot per year.

V = velocity => 15.26 m/s = 16.7 y/s is the speed that is needed to pump water from the Ocean through each of 5 pipelines of 48" diameter to accommodate the volume of seawater entering the Lake through one pipe with diameter 48" at speed of 76.33 m/s = (83.47 yards per second).

The volume (mass) of water (88,008 kg [42,720 kg]) per second exiting the primary in-line-generator at speed of 76.33 m/s = (83.47 y/s) and after the "delta" mini hydroelectric power plant entering the Salton Sea is the same volume (mass) of water 88,008 kg per second entering 5 pipelines in Long Beach at speed of 15.26 m/s = (16.7 y/s).

Kinetic Energy

For 297 m drop (first cascade) to the first in-line-turbine /generator.

Speed of the water at the exit of first in-line-generator is 76.33 m/s = (83.47 y/s)

$Ek = \frac{1}{2} M \times V^2$

Ek = Kinetic Energy

M = Mass

$M = Ek \times 2 / V^2$

M = 1.16 m^2 x 76.33 m/s = 88.54 m³ => 88.54 x (994kg = weight of water at 100 ºF) = 88,008kg

(88,008 kg is the volume (mass) of water per second).

Ek = ½ M x V² = ½ x 88,008 kg x (76.33 m/s x 76.33 m/s) => ½ x 88,008 kg x 5,826 m/s

=> ½ 512,734,600 = 256,367,300 MWs => in period of one hour it is 256.36 MWh

Efficiency factor usually used is 15% loss => 256.36 MWh x 0.85 = 217.90 MWh

Three such cascade drops add to 217.90 MWh x 3 (cascade drops) = 653.7 MWh

At this early stage without final testing of the new system, it is realistic to expect that by using "split and join" and "delta" hydropower plant which harness energy after fluid leaves the primary In-Line-Generator (main turbine) using mass and speed of fluid (no gravity) can be harnessed at least additional 10% of energy which is about 65.3 MWh. In this case, it ends up to about 719.0 MWh.

The energy needed to transport the same amount of water through uphill pipeline section(s) which in this case (Route # 2 elevation 2,700' (823 m):

EP = M x g x h = 88,008 kg x 9.81 x 823 m = 710,544,020 MWs in an hour it is 710.5 MWh

Efficiency factor is used 40% => 710.5 MWh x 1.4 = 994.7 MWh.

Energy Net for Route # 2: 719.0 MWh – 994.7 MWh = - 275.7 MWh

(The section "2" below is added later after submission of paper)

2. Preliminary Cost Estimate and Revenue for the pipeline system for irrigation for farmland Southern area of the Salton Sea:

The presented proposal shows south area from the Lake (from the Lake to the border with Mexico) having three main pipelines (central, western, and eastern) and numerous perpendicular ribs lines (See segment I, FIGS. 3, 4, 5).

The rough estimate of the length of all together pipelines is about 870 miles (40 miles West line + 50 miles Central line + 60 miles eastern line = 150 miles + (24 ribs lines x 30 miles = 720 miles) => 870 miles.

2.1 Preliminary Cost Estimate and Revenue for the pipeline system for irrigation for the farmland area Southern from the Salton Sea:

The summary of the length of the pipeline system for irrigation for the farmland area Southern from the Salton Sea is about 870 miles.

The range of cost today of installed pressure pipe of 48-inch diameter in various terrains is about $600 – $1,000 per linear foot.

Because of preferred topography, a relatively flat terrain in this area, which has an advantage in pipeline cost it is selected \$600 per linear foot.

One mile 5,280‘ x \$600 = \$3,168,000 per mile.

\$3,168,000 x 870 miles = **\$2,756,160,000.**

2.1.1 Preliminary Cost Estimate for Energy Generated and Revenue from hydropower of the pipeline system used for irrigation for the farmland area Southern from the Salton Sea:

The topography of the terrain from border with Mexico to the Salton Sea is about 8% slope. The elevation of the Mexicali and Calexico (cities on the border) is about 10-15 feet above the Ocean. The Salton Sea is -220 feet below the Ocean.

The West line of the pipeline system for irrigation is parallel with the section of the pipeline for importing seawater Route #1. Therefore for easier calculation we will use the values calculated earlier in the section (1.2) "The volume of seawater entering the lake through one pipe with diameter 48" at speed of 41.0 y/s (yard per second) is: 1.39 y^2 x 41.0 y per sec. = 57.00 y^3 x (31,536,000 seconds in a year) = 1,797,674,900 y^3 = 1,114,261 acre-foot per year". Energy generated is about 27.3 MWh.

The surface of the South Section of the Lake is about 10% of the surface of the whole Lake. Therefore, the volume (mass) of water needed to balance the evaporation of the South Section of the Lake is about 120,000 acre-foot per year.

The South Section of the Lake is supply with water from All-American Canal near the border with Mexico. The needed water for farmland is about 200,000 acre-feet per year. The water 120,000 acre-foot per year entering the South Section of the Lake can be harnessed with the "Delta Power Plant".

Revenue**:** **2.73 MWh** x \$60 = \$163.8 per hour.

\$163.8 x 24 hours = \$3,930 per day;

\$3,930 per day x 365 days = **\$1,434,888 per year**.

3. Illustrations of the Segment (II) - Importing Seawater from the Ocean for the Restoration of the Salton Sea and for Harnessing Geothermal Energy.

Segment (II)

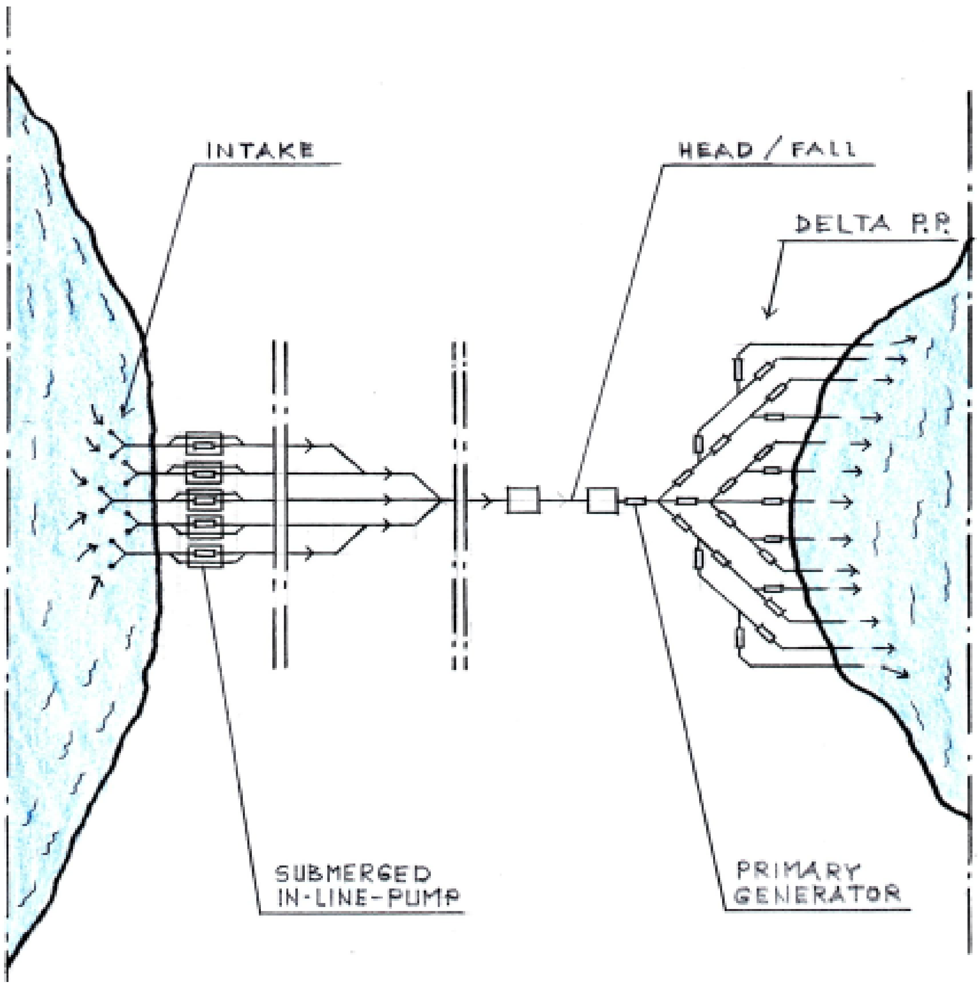

FIG. 1 – Plain View of several segments of the Route #1

Segment (II)

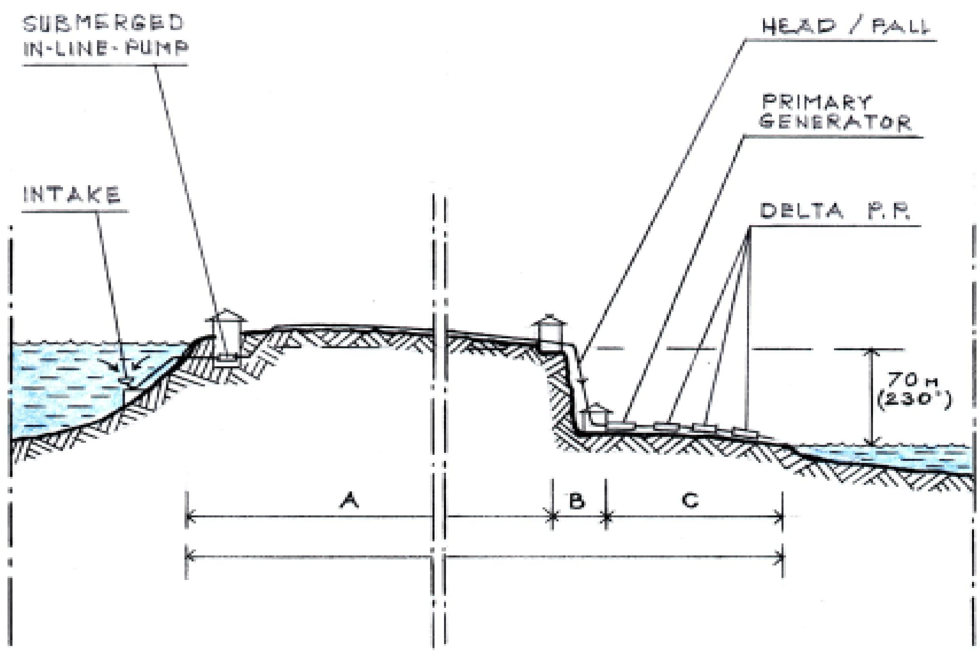

FIG. 2 – Cross-sectional View of the Route #1

Segment (II)

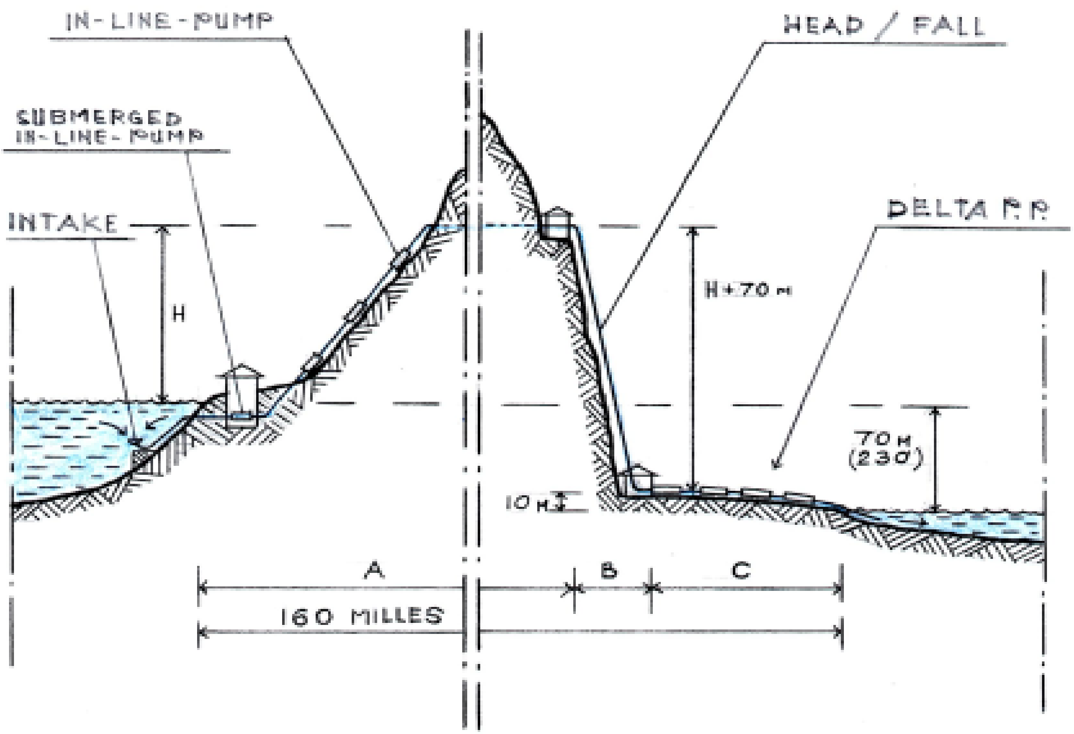

FIG. 3 – Cross-sectional View of Elevations of the Ocean and Salton Sea

Segment (II)

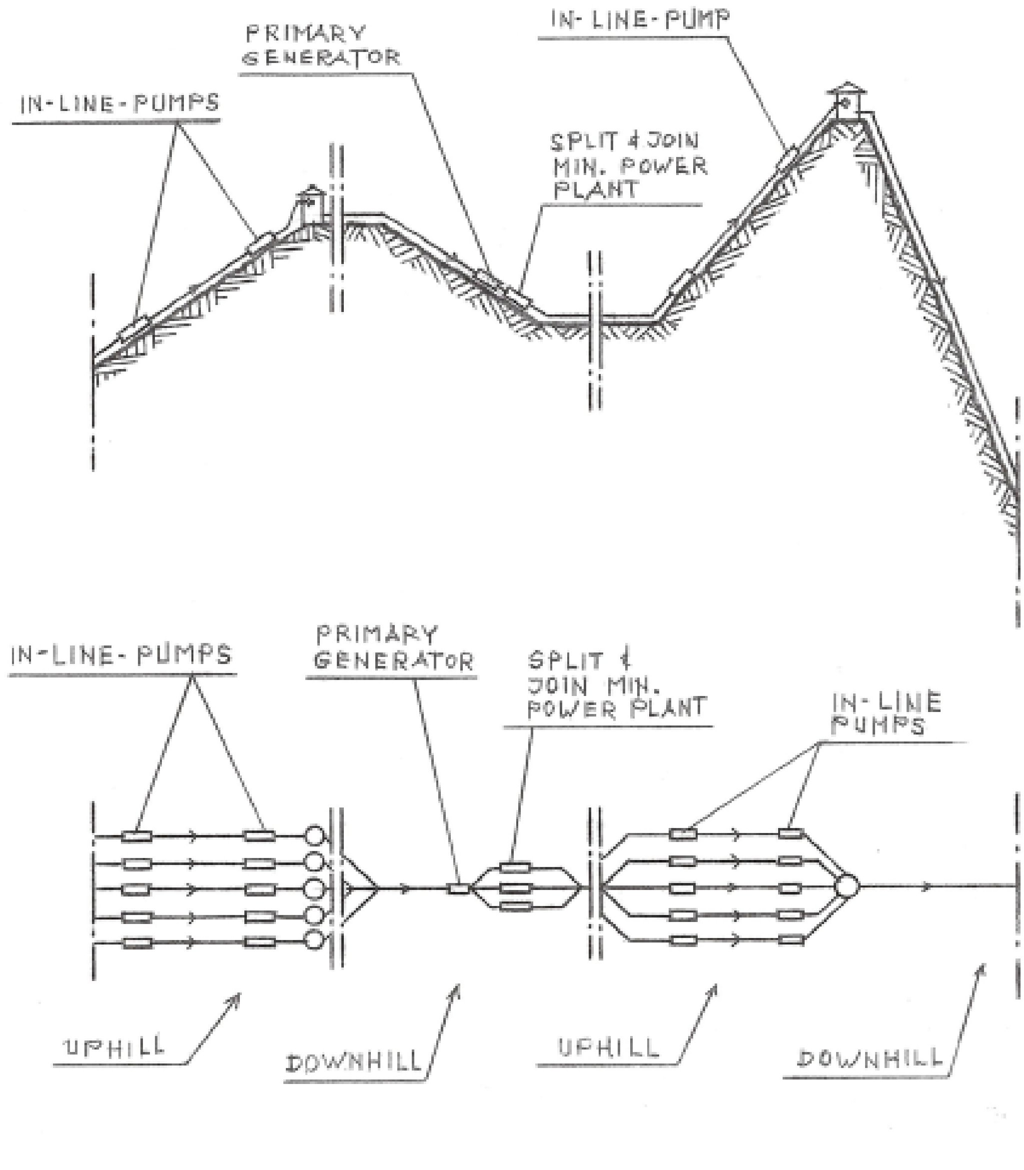

FIG. 4 – Plain and Cross-sectional View of the Mid-section of the Pipeline

Segment (II)

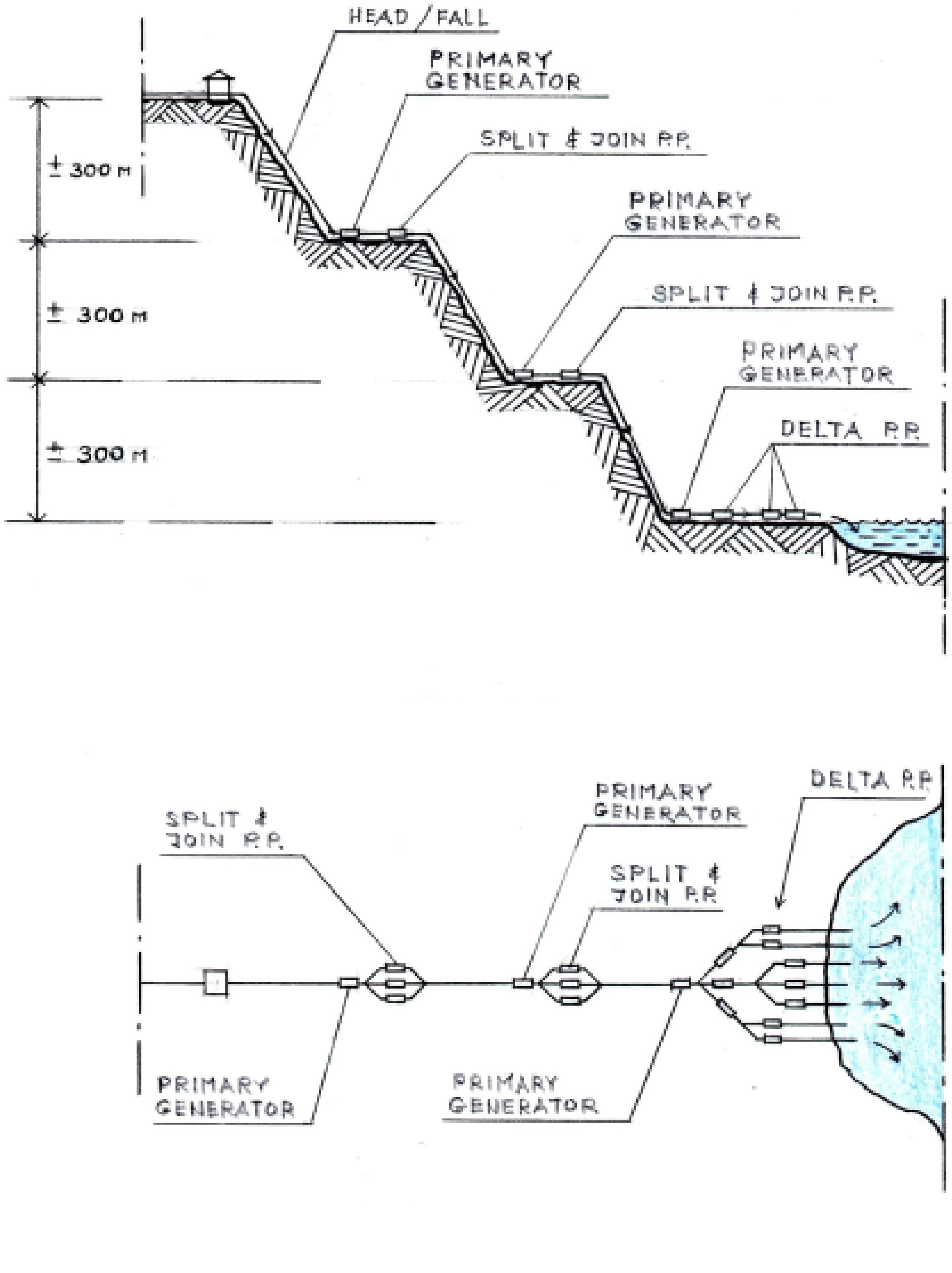

FIG. 5 – Plain and Cross-sectional View of the final downhill route

Segment (II)

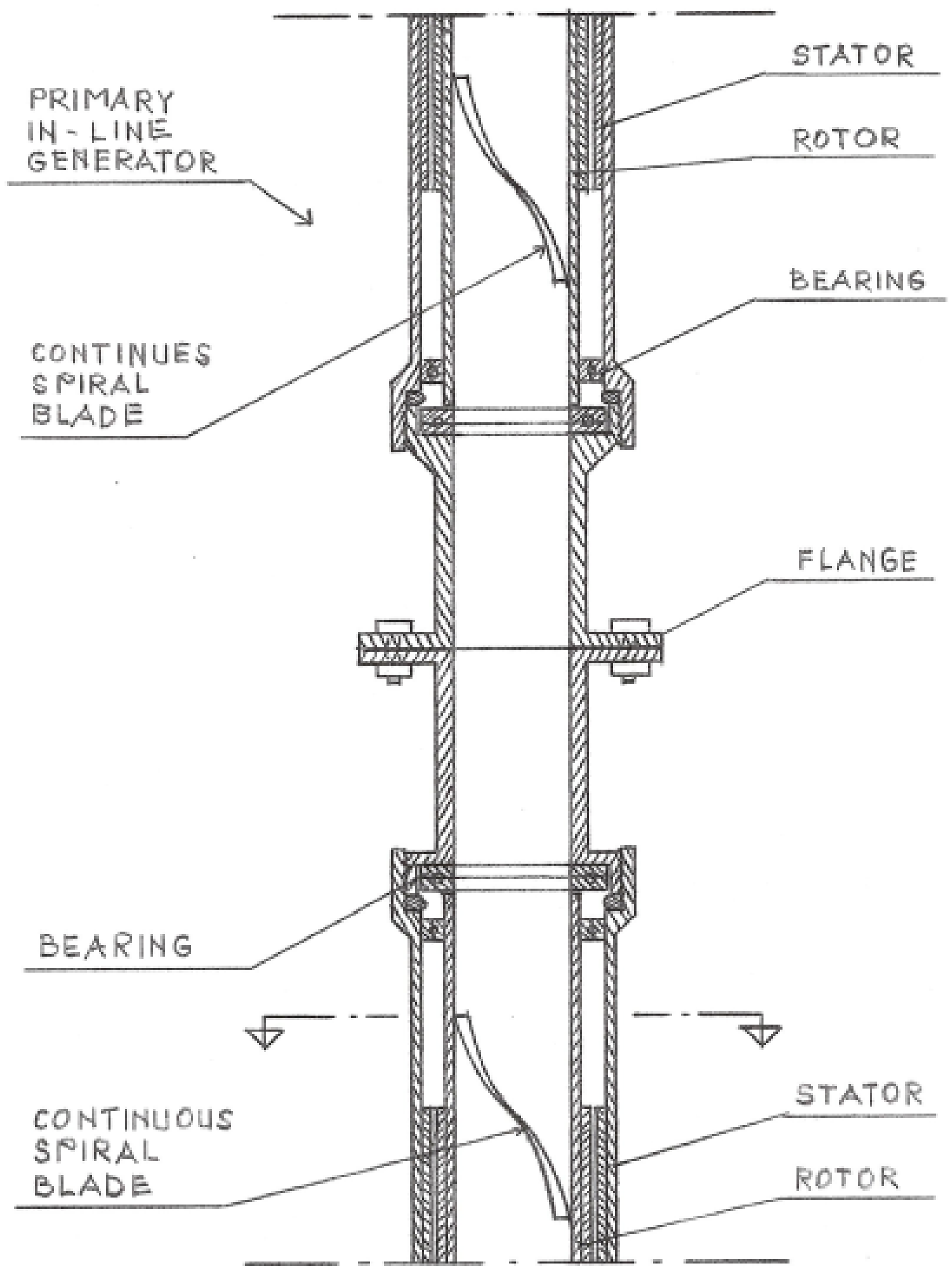

FIG. 6 – Cross-sectional longitudinal View of the Primary In-Line-Pump / Generator

Segment (II)

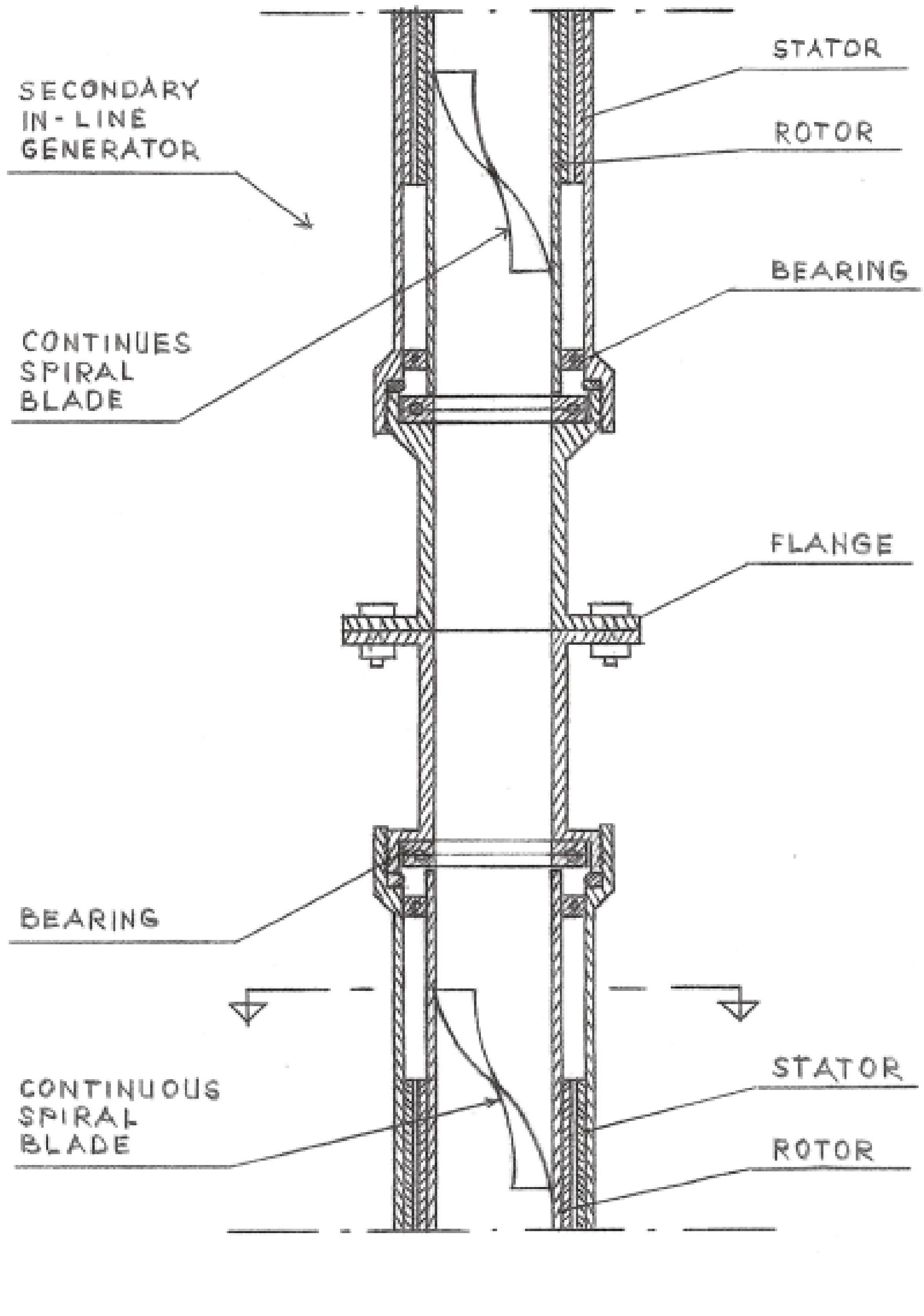

FIG. 7 – Cross-sectional longitudinal View of the Secondary In-Line-Pump / Generator

Segment (II)

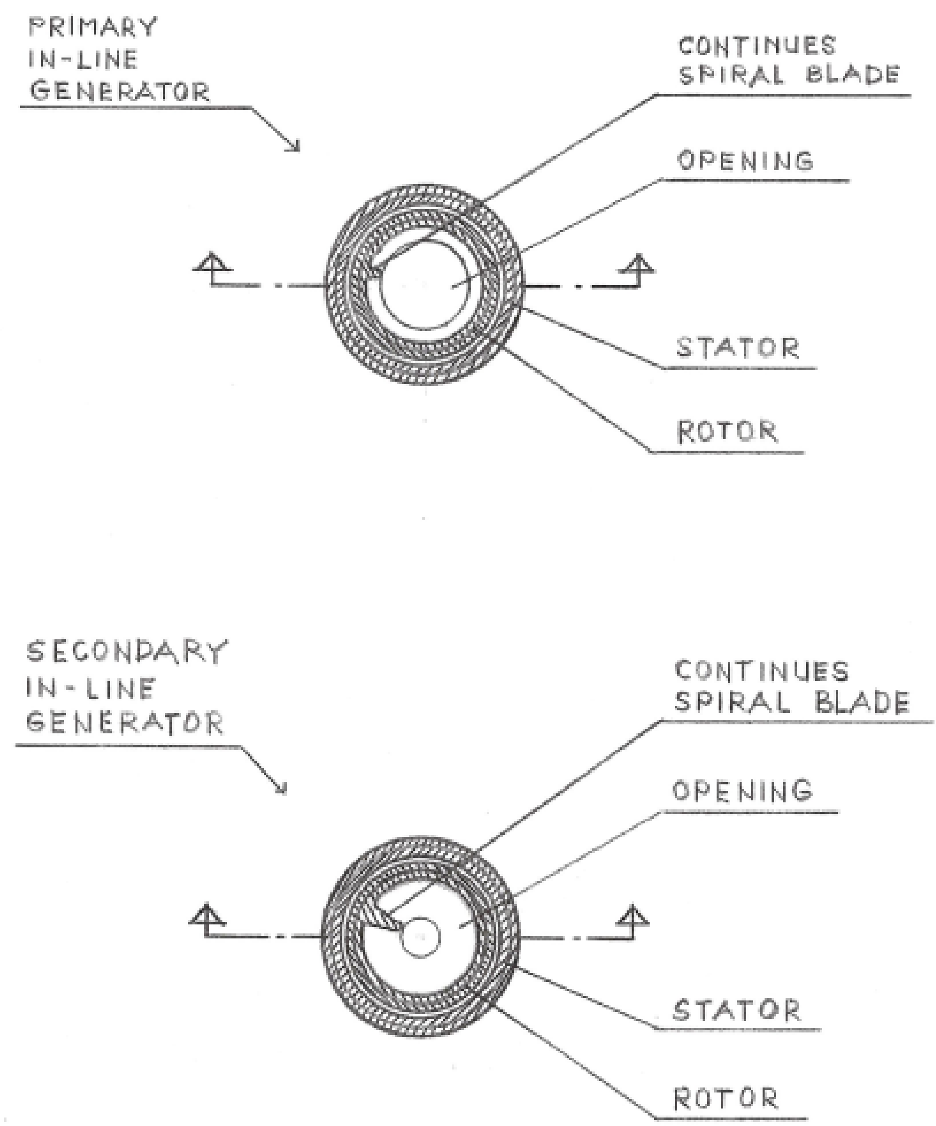

FIG. 8 – Cross-sectional Frontal View of the Primary and Secondary In-Line-Pump / Generator

3. Conclusion:

Importing seawater is a fundamental phase of the presented comprehensive proposal on which other phases depend. This segment also explains the function of necessary elements of the project and provides a rough cost estimate and potential revenue of the project proving the feasibility of the project.

Harnessing hydropower in downhill routes during the process of importing seawater is a fundamental value that makes the phase of importing seawater feasible on which other phases of this comprehensive project depend. Importing seawater is an essential element in providing the necessary water for harnessing geothermal energy in the area and is an essential element for the restoration of the Salton Sea.

Presented pipeline with a diameter of only 48” through Route #1 can import about 1 million acre-feet per year which is enough for the balancing evaporation of the Lake. The pipeline through Route #2 can import about 2 million acre-feet per year meaning that 1 million acre-feet can be used for other purposes including replenishing geothermal reservoirs.

Acknowledgment

The 3.5 km Temperature Map is courtesy of the SMU Geothermal Laboratory and Dr. David Blackwell, Dallas Texas.

REFERENCES

U.S. Patent No. 7,849,690; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on Dec.14, 2010;

U.S. Patent No. 8,281,591; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on October 9, 2012;

U.S. Patent No. 8,713,940; Entitled: “Self-Contained In-Ground Geothermal Generators”; Issued on May 6, 2014;

U.S. Patent No. 9,206,650; Entitled: “Apparatus for Drilling Faster and Wider Wellbore; Issued on December 8, 2015;

U.S. Patent No. 9,978,466; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump; Issued on May 22, 2018;

U.S. Patent No. 9,982,513; Entitled: “Apparatus for Drilling Faster and Wider Wellbore with Casing; Issued on May 29, 2018;

U.S. Patent No. 9,995,286; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump and Several Alternative Applications; Issued on June 12, 2018;

Harnessing Energy and Water in the Salton Sea (Segm. III) (System for Harnessing Solar Energy)

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Keywords

Geothermal, Environment, Wildlife Sanctuary, importing seawater, Tourism, Renewable Energy, Electricity, Solar Power, Geothermal Power, Heat Exchanger, In-Line-Pump/Generator, Geothermal Self Contained In-Ground Geothermal Generator, Desalinization, Lithium.

ABSTRACT

The Salton Sea in California is a terminal lake with reduced inflow from the Colorado River as a result of the water transfers related to the Quantification Settlement Agreement (QSA). The Lake is shrinking and exposing the receding shoreline (toxic playa) to the elements and facing incoming environmental disaster.
The presented proposal includes an architectural element that harmoniously incorporates several patented technologies into a self-sustaining organism. It is a long-term solution for the restoration of the Salton Sea.
The presented proposal includes several options based on the same concept: 1) Dividing the Lake into three sections; 2) Importing seawater from the Ocean, and; 3) Harnessing prevalent geothermal energy.
In this segment (III), the emphasis is on using the pipeline for importing seawater as a foundation for solar panels assemblies.

The presented system for importing seawater and using the pipeline as a foundation for the solar panels is a fundamental value in determining the feasibility of the phase of importing seawater into the Salton Sea which is the essential phase for harnessing geothermal energy and for the restoration of the Salton Sea.

The pipeline provides a substantial surface that otherwise would need to be selected, leased, or purchased. By using the pipeline as a foundation for solar panels assembly it eliminates expenses for leasing or purchasing a location, therefore, increasing the revenue.

Presented Thermo-Optical Solar system (TOS) consists of a panel and/or dish with several indentations in the shape of parabolas with a reflective coating inside and a transparent cover with lenses. The panel or dish also contains a closed-loop heat exchange system with the first heat exchanger positioned in focal points of parabola and lenses, and a second heat exchanger positioned into the boiler of the binary power unit nearby. The power units consisting of the evaporator with a working fluid, a piston engine with generators, and a condenser.

1. Introduction

The solar farms on an industrial scale require a substantial surface of the land for solar panels positioned around power generating facilities. That land needs to be selected, leased, or purchased. The Conventional Photo Voltaic (PV) solar panels are efficient only about 15% -20%.

The pipeline corridor provides a substantial surface of the land that otherwise would need to be selected, leased, or purchased. By using the pipeline as a foundation for solar panels assembly 610 (See FIG. 1) eliminates expenses and increase the revenue. In this proposal is presented a new Thermo-Optical Solar system (TOS) which consists of a panel or dish (See FIG. 1 – 5).

Presented Thermo-Optical Solar system (TOS) consists of a panel and/or dish with several indentations in the shape of parabolas with a reflective coating inside and a transparent cover with lenses. The panel or dish also contains a closed-loop heat exchange system (See FIG. 1-4 and 6) with the first heat exchanger positioned in focal points of parabola and lenses, and a second heat exchanger positioned into the boiler of the binary power unit nearby (See FIG. 1). The power units consisting of the evaporator with working fluid, pistons with generators, and a condenser (See Fig. 7-8). There is also a battery pack (See FIG. 1).

The dish has a parabolic indentation with a reflective surface to reflect sunrays into the focus of the parabolic cavity where the heat exchanger is positioned. This system also uses lenses to focus sunrays in an additional part of the heat-exchanger positioned in a focal point of the lances. The synthetic oil circulates through the first heat-exchanger positioned into panel and/or dish, which are connected to the second heat exchange positioned into the evaporator of the power unit which generates electricity(See FIG. 6- 8). The power unit consists of a Boiler (evaporator), pistons unit, gearbox, generators, and condenser.

In this presentation, the Thermo-Optical solar system use breeze and cooler temperature of the pipeline for cooling the condensers (See Fig. 1). The presented system for harnessing solar energy used in the process of importing seawater is a necessary part for the restoration of the Salton Sea, CA, although technology is not limited to the Salton Sea project. The presented system can be used in the residential sectors and for desalinization and production of potable water.

The presented "thermo-optical solar system" has not been tested yet, but it is realistic to expect that it can generate multi-fold electricity per unite surface than a photovoltaic system because power density is substantially higher. The size of the panels is similar to the conventional PV panels with slightly higher thickness.

1.1 Overview of the Proposal for Harnessing Solar Energy in the Process of Importing Seawater for the Restoration of the Salton Sea and for Harnessing Geothermal Energy.

The presented "thermo-optical solar system" has not been tested yet, but it is realistic to expect that it can generate multi-fold electricity per unite surface than the photovoltaic system because power density is substantially higher.

1.2 Preliminary Estimate for Cost and Energy generated from Thermo-Optical Solar System used in the process of importing Sea Water from the Ocean into the Salton Sea.

The length of most of the proposed pipeline routes (5 although here because of limited space presented only 2) is about 160 miles. Here for easier calculation will be calculated the length of the pipeline to be 1 mile. For any particular distance, final results can be easily calculated.

There are two solar panels assembly on each segment of the pipeline (see FIG. 1). One solar assembly has two sets of three panels of dimensions about 3.5' x 5.2'. The length of one segment of the pipeline is about 30 '.

1 mile : 30' = 5,280 feet : 30' (length of a segment) = 176 pipeline segments.

One set of panels 5.2' x 3.5' = 18.2 square feet; => 18.2 square feet x 6 panels = 109.2 square feet. 109.2 square feet x 2 assembly = 218.4 square feet.

218.4 square feet (two assembly) x 176 (segments) = 38,438.4 square feet.

38,438.4 square feet = 0.882332 acres.

One mile of a pipeline can have 0.882332 acres of panels.

0.882332 acres (of panels) x 100 miles (length of pipeline) = 88.2 acres of panels.

(1 acre of solar panels produces 1.5 MWh – 1.68 MWh).

88.2 acres (of panels) x 1.5 MWh = 132.34 MWh

0.882332 acres (of panels) x 160 miles (length of pipeline) = 141.137 acres of panels.

141.137 acres (of panels) x 1.5 MWh = 211.75968 MWh.

1.3 Preliminary Cost Estimate of the Solar Panel Assembly System:

The preliminary cost estimate of one set of the "Thermo-Optical Solar (TOS) panel assembly (see FIG. 1) costs about $ 2,000. The preliminary estimate of two sets of the "Thermo-Optical Solar (TOS) panel assembly assembled on one pipeline segment 30 feet long cost about $4,000 (See FIG. 1 and 2).

176 (pipeline segment per mile) x $4,000 = $704,000; Assuming that every two pipeline segments there are a power unit and a battery.

The preliminary cost estimate of one power unit is $3,000;

The preliminary cost estimate of one battery unit is $3,000;

Let's call it power pack about $6,000.

176 segments: 2 = 88 power pack;

88 power pack x $6,000 = $528,000;

For one mile the cost of (88 power pack = $528,000) + (352 Thermo-Optical Solar (TOS) panel assembly = $704,000) = $1,232,000;

For 160 miles the cost for the Thermo-Optical Solar system is $197,120,000 ~ **$200,000,000**;

1.4 Preliminary Estimate for Cost and Energy generated from the Thermo-Optical Solar System used in importing Sea Water from the Ocean into the Salton Sea Routes 1 and 2.

<u>1.4.1 Preliminary estimate for Energy, Cost, and Revenue Generated, of the solar system on the Route 1:</u>

Photo Voltaic PV panels on 160 miles (length of pipeline) = 141.137 acres of panels ==>.

141.137 acres (of panels) x 1.5 MWh (average production of electricity by PV system) = 211.75968 MWh.

Although the a several-fold ratio would be more realistic ratio, here is calculated the only two-fold ratio. 211.75968 MWh. X 2 = **423.519 MWh.**

Thermo-Optical Solar (TOS) System installed on pipeline Route #1 can generate 423,519 MWh.

Revenue generated from the Thermo Optical Solar (TOS) system installed on pipeline Route #1:

423,519 MWh x $60 = $25,411 per hour;

$ 25,411 x 6 hours = $152,466 per day;

$152,466 x 300 days (sunny days in area per year) = $45,740,052 per year.

Revenue generated from the Thermo-Optical Solar (TOS) System installed on pipeline Route #1 would be at least **$45,740,052** per year.

<u>1.4.2 Preliminary estimate for Energy, Cost, and Revenue Generated, of the solar system on the Route 2:</u>

Photo Voltaic PV panels on 200 miles (length of pipeline) = 176.4664 acres of panels ==>.

176.4664 acres (of panels) x 1.5 MWh = 264.6996 MWh.

(1 acre of solar panels produces 1.5 MWh – 1.68 MWh).

Although a several-fold ratio would be a more realistic ratio, here is calculated the only two-fold ratio.

264.6996 MWh x 2 -fold estimate = 529.34 MWh.

The Thermo-Optical Solar System installed on route #2 pipeline can generate 529.34 MWh.

529.34 MWh - 275.7 MWh (energy needed for pumping up seawater) = 253.64 MWh.

The remaining 253.64 MWh can be sold to the grid.

Revenue**:** 253.64 MWh x $60 = $15,218 per hour;

$15,218 x 6 hours = $91,310 per day;

$91,310 x 300 days = **$27,393,120** per year;

2. Overview of the Proposal for Harnessing Solar Energy from the pipeline system for irrigation for the farmland Northern and Southern area from the Salton Sea.

See Segment I, Figs 3, 4, and 8.

2.1 Preliminary Calculation for Harnessing Solar Energy from the pipeline system used for irrigation for the farmland area Southern from the Salton Sea:

The presented proposal shows south area from the Lake (from the Lake to the border with Mexico) having three main pipelines (central, western, and eastern) and numerous perpendicular ribs lines (See segment I, FIGS. 3, 4, 5).

<u>2.1.1 Preliminary estimate for Energy Generated of the solar system on the pipeline system used for irrigation for the farmland area Southern from the Salton Sea:</u>

The rough estimate of the length of all together pipelines is about 870 miles (40 miles West line + 50 miles Central line + 60 miles eastern line = 150 miles + (24 ribs lines x 30 miles = 720 miles) => 870 miles.

Presented "thermo-optical solar system" has not been tested yet, but it is realistic to expect that it can generate multi-fold electricity per unite surface than photovoltaic system because power density is substantially higher.

Photo Voltaic PV panels on 870 miles (length of pipeline) = 767.43 acres of panels ==>.

767.43 acres (of panels) x 1.5 MWh (average production of electricity by PV system) = 1,151.145 MWh.

Although several-fold ratio would be a more realistic ratio, here is calculated the only two -fold ratio. 1,151.145 MWh x 2 = **2,302.29 MWh.**

2.1.2 Preliminary estimate for Revenue Generated, of the solar system on the pipeline system used for irrigation for the farmland area Southern from the Salton Sea:

The Thermo-Optical Solar System installed for the irrigation for the farmland area Southern from the Salton Sea can generate about 2,302.29 MWh.

Revenue**:** 2,302.29 MWh x $60 = $138,137 per hour;

$138,137 x 6 hours = $828,824 per day;

$828,824 x 300 days = **$248,647,200** per year;

2.1.3 Preliminary Calculation for the Cost Estimate for the Thermo-Optical Solar System used on the pipeline system for irrigation for farmland Southern area of the Salton Sea:

There are two solar panels assembly on each segment of the pipeline (See FIG. 1). One solar assembly has two sets of three panels of dimensions about 3.5’ x 5.2’. The length of one segment of the pipeline is about 30‘.

The preliminary cost estimate of one set of the “Thermo-Optical Solar (TOS) panel assembly cost about $2,000. Preliminary estimate of two sets of the “Thermo-Optical Solar (TOS) panel assembly assembled on one pipeline segment 30 feet long cost about $4,000.

176 (pipeline segment per mile) x $4,000 = $704,000 per mile;

Assuming that every two pipeline segments there are a power unit and a battery.

Preliminary cost estimate of one power unit is about $3,000;

Preliminary cost estimate of one battery unit is about $3,000;

Let’s call it power pack $6,000.

176 segments / 2 = 88 power pack per mile.

88 power pack x $6,000 = $528,000;

For one mile the cost of (88 power pack = $528,000) + (352 Thermo-Optical Solar (TOS) panel assembly = $704,000) = $1,232,000;

For 870 miles of the Thermo-Optical Solar System preliminary cost is $1,151,010,000 ~ **$1,200,000,000;**

2.1.4 Preliminary Calculation for the Cost Estimate for the pipeline system for irrigation for farmland Southern area of the Salton Sea:

Pipeline distance is about 870 miles.

The range of cost today of installed pressure pipe of 48-inch diameter in various terrains is about \$600 – \$1,000 per linear foot.

Because of preferred topography in this area which has an advantage in pipeline cost it is assumed \$600 per linear foot.

One mile 5,280‘ x \$600 = \$3,168,000.

\$3,168,000 x 870 miles relatively flat terrain = **\$2,756,160,000.**

2.2 Preliminary estimate for Energy and Revenue Generated, and Cost of the solar system on the pipeline system used for irrigation for the farmland area Northern from the Salton Sea:

Since the farmland area north of the Salton Sea is about half of the farmland area south of the Salton Sea, the results of the “Harnessing Solar Energy” and **“**Cost Estimate for the Thermo-Optical Solar System” are simply divided on half.

Therefore the preliminary estimate for energy generated is 2,302.29 MWh : 2 = **1,151.14 MWh**;

The preliminary estimate for revenue generated is \$248,647,200 : 2 = **\$124,323,600** per year;

The cost estimate for the Solar System is \$1,200,000,000 ; 2 = **\$600,000,000.**

The cost estimate for the pipeline system is \$2,756,160,000 : 2 **= \$1,378,080,000.**

2.3 Preliminary estimate for Energy and Revenue Generated, and Cost of the solar system on the pipeline system used for irrigation for the farmland area Northern and Southern from the Salton Sea:

Preliminary estimate for Energy Generated is 2,302.29 MWh + 1,151.14 MWh **= 3,453.43 MWh** per year;

Preliminary estimate for Revenue Generated is \$248,647,200 + \$124,323,600 = **\$372,970,800** per year;

The cost estimate for the Solar System is \$1,200,000,000 + \$600,000,000 **= \$1,800,000,000.**

The cost estimate for the Pipeline System is \$2,756,160,000 + \$1,378,080,000 = **\$4,134,240,000**.

3. Illustrations of the Segment (III) - Importing Seawater for the Restoration of the Salton Sea.

Segment (III)

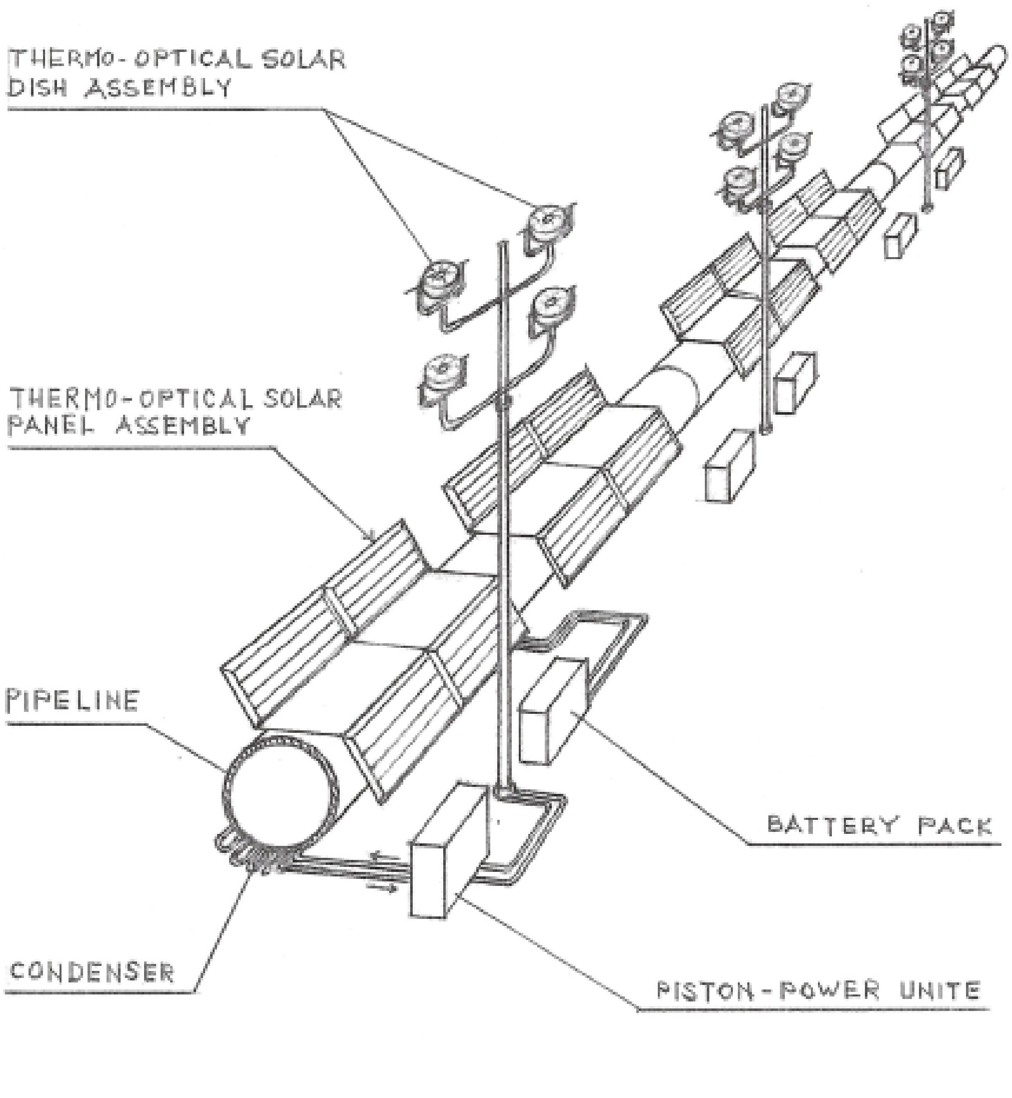

FIG. 1 – Perspective View of a Pipeline with Solar Panels attached to the Pipeline in combination with alternative Solar Dish System aside

Segment (III)

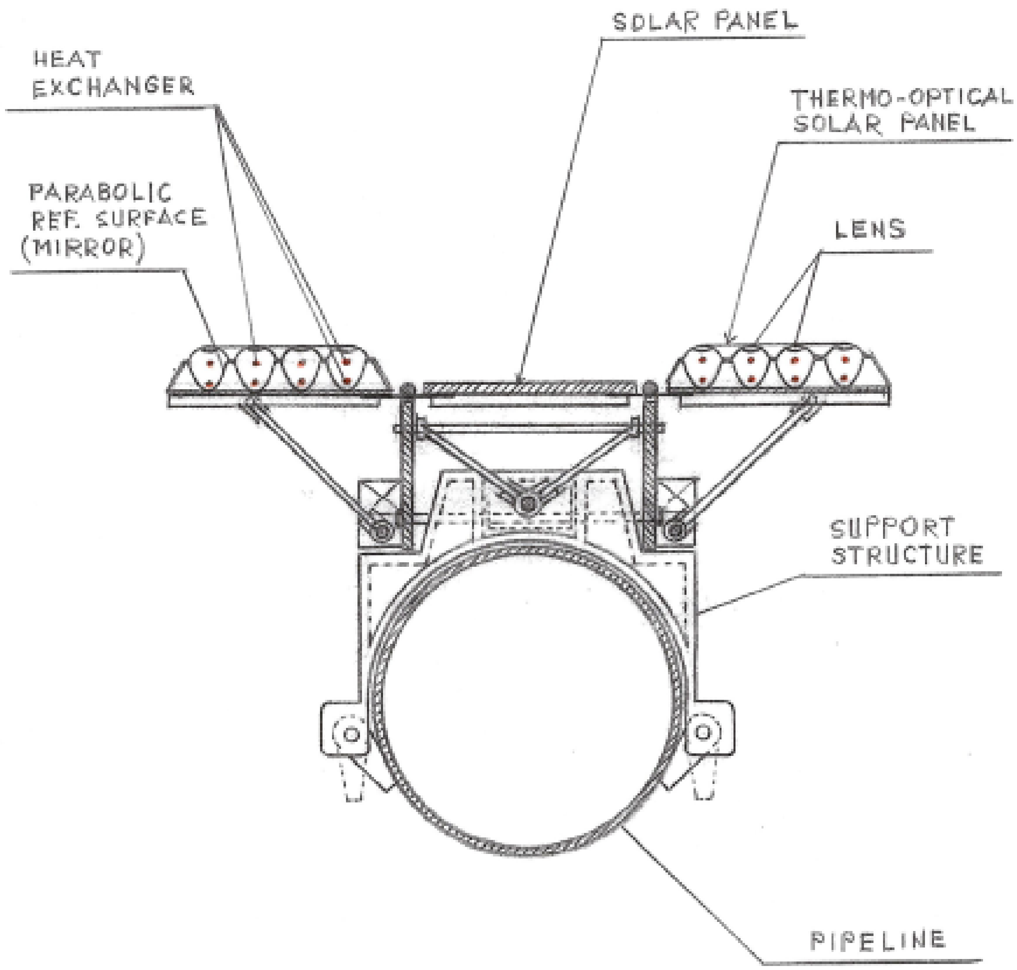

FIG. 2 – Cross-sectional View of a Solar Panel Assembly

Segment (III)

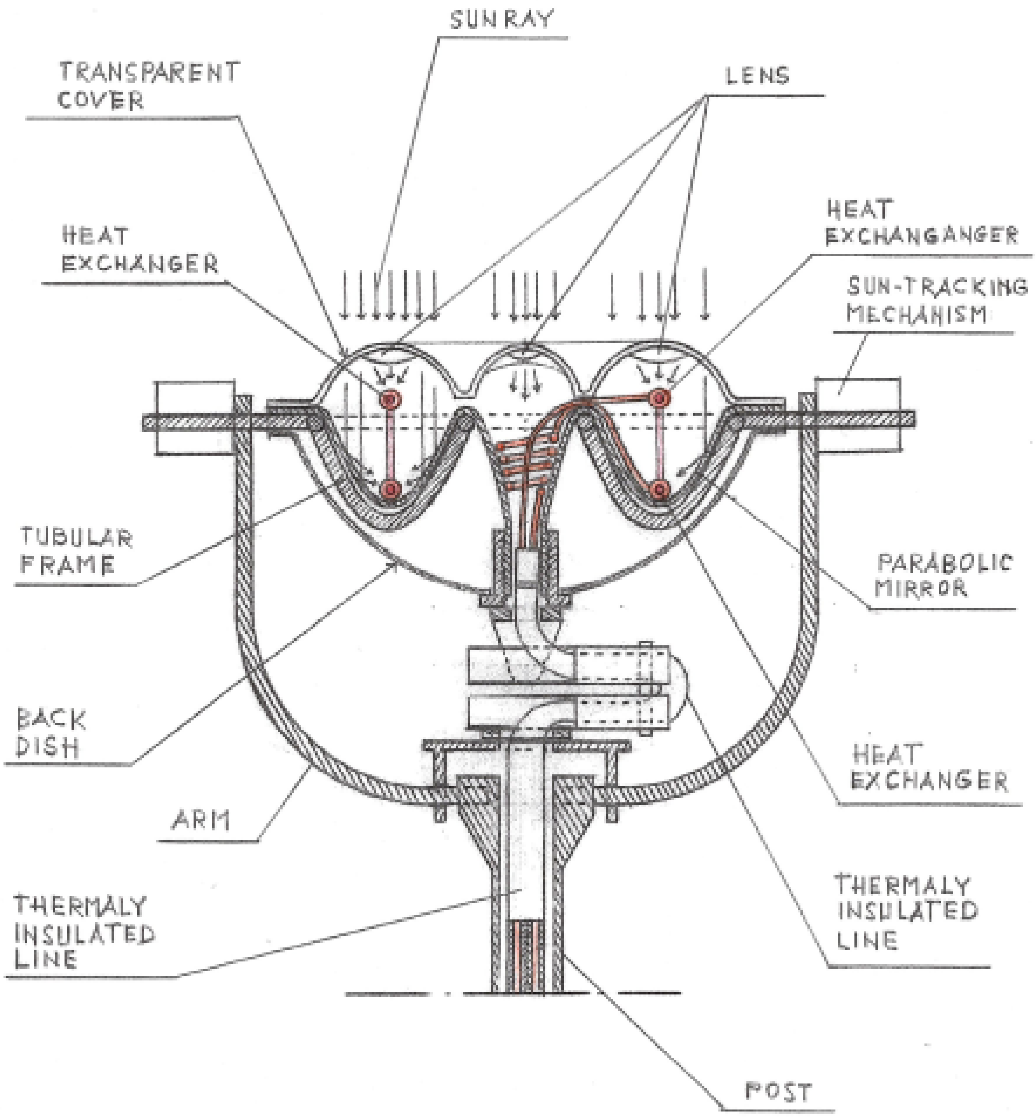

FIG. 3 – Cross-sectional View of the "Thermo –Optical Solar Dish"

Segment (III)

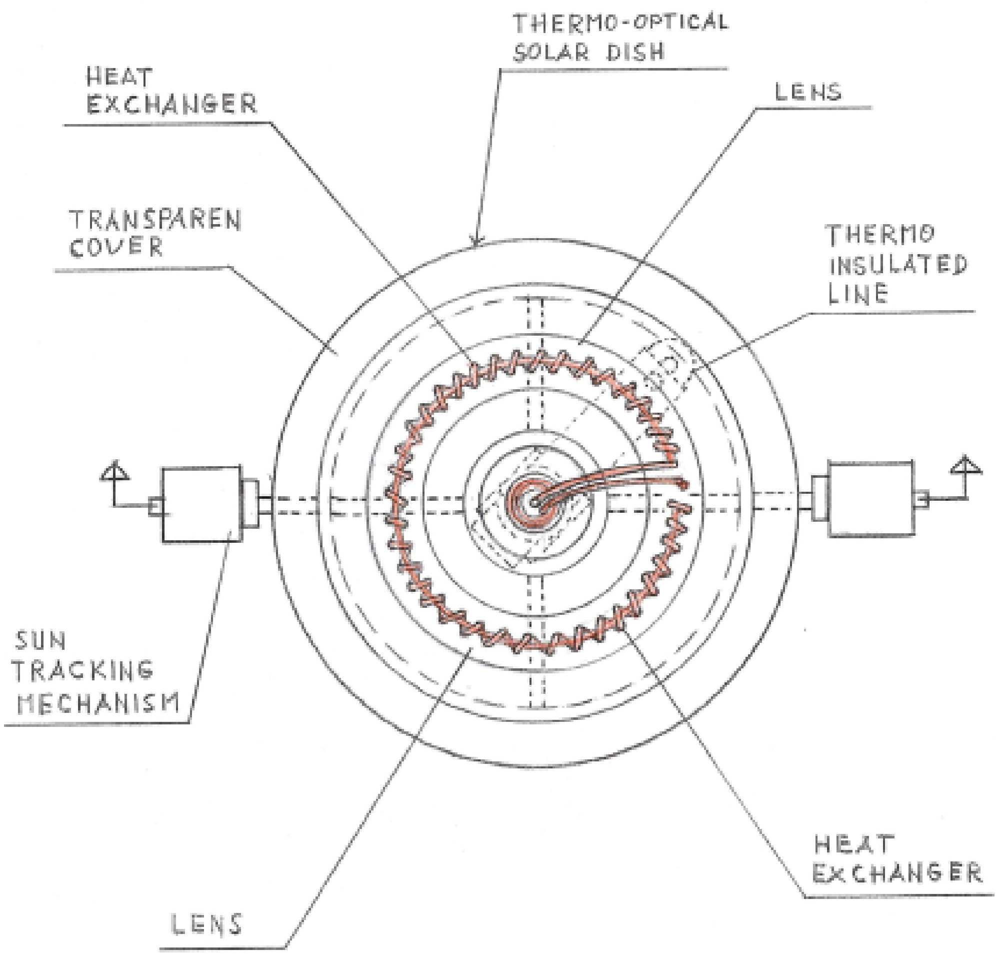

FIG. 4 – Plain View of a "Thermo –Optical Solar Dish"

Segment (III)

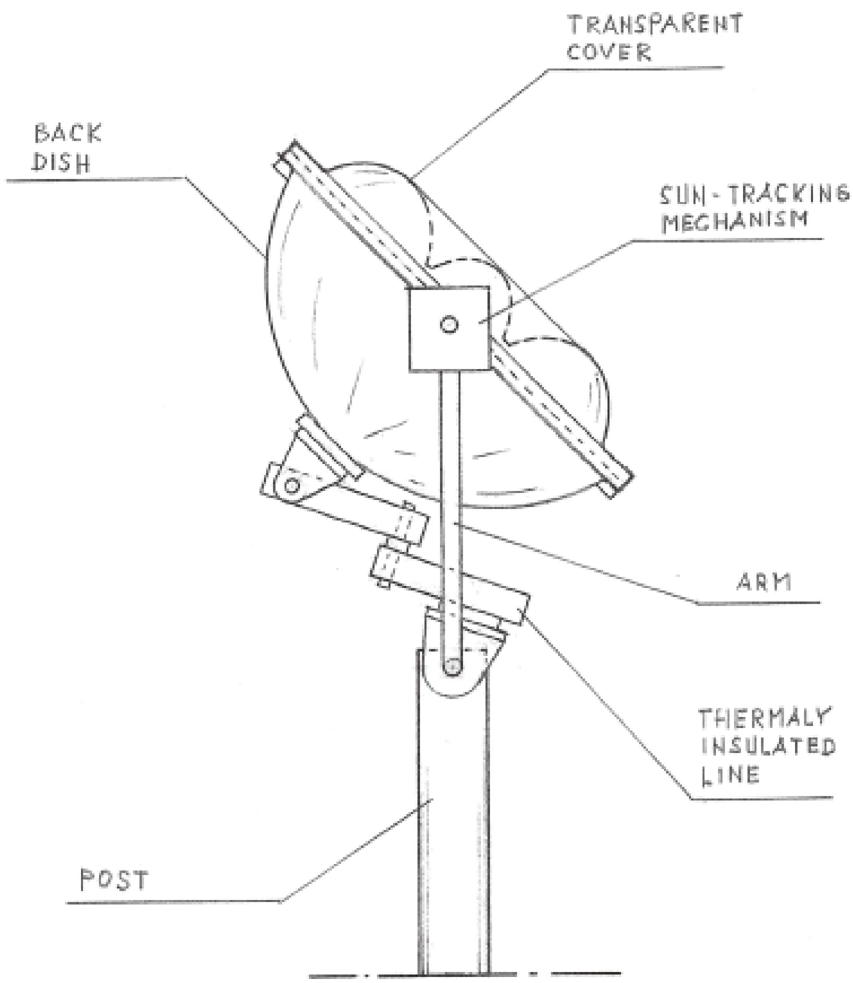

FIG. 5 – **Side View of a "Thermo –Optical Solar Dish{"**

Segment (III)

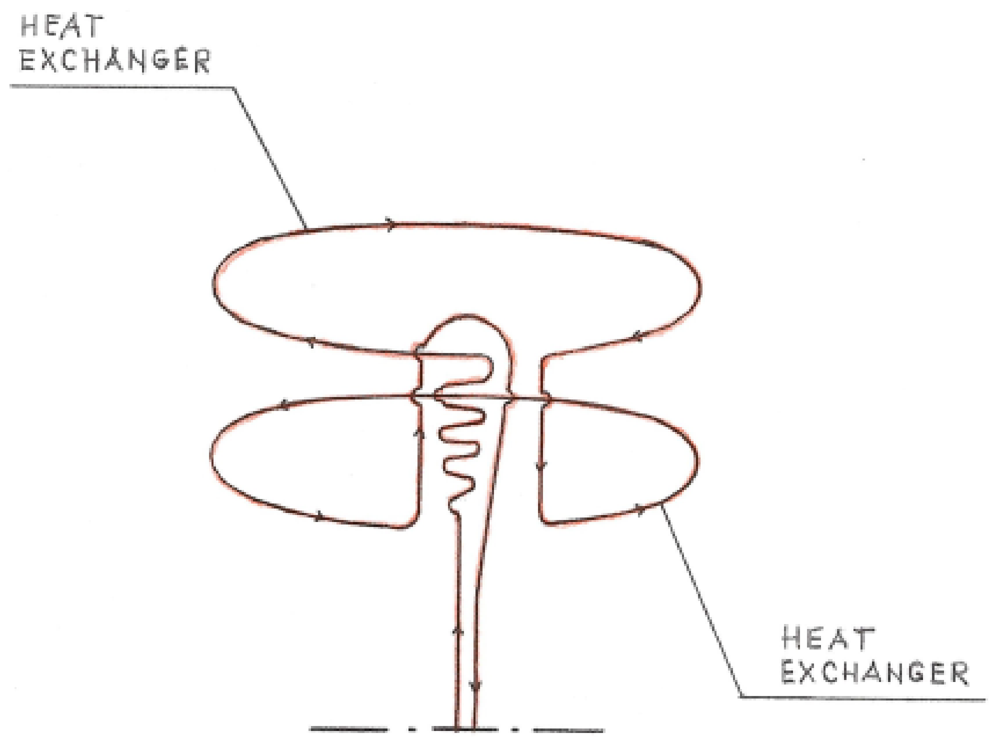

FIG. 6 – Schematic diagram of the flow of the synthetic oil through the heat exchanger of the Thermo-Optical Solar Dish

Segment (III)

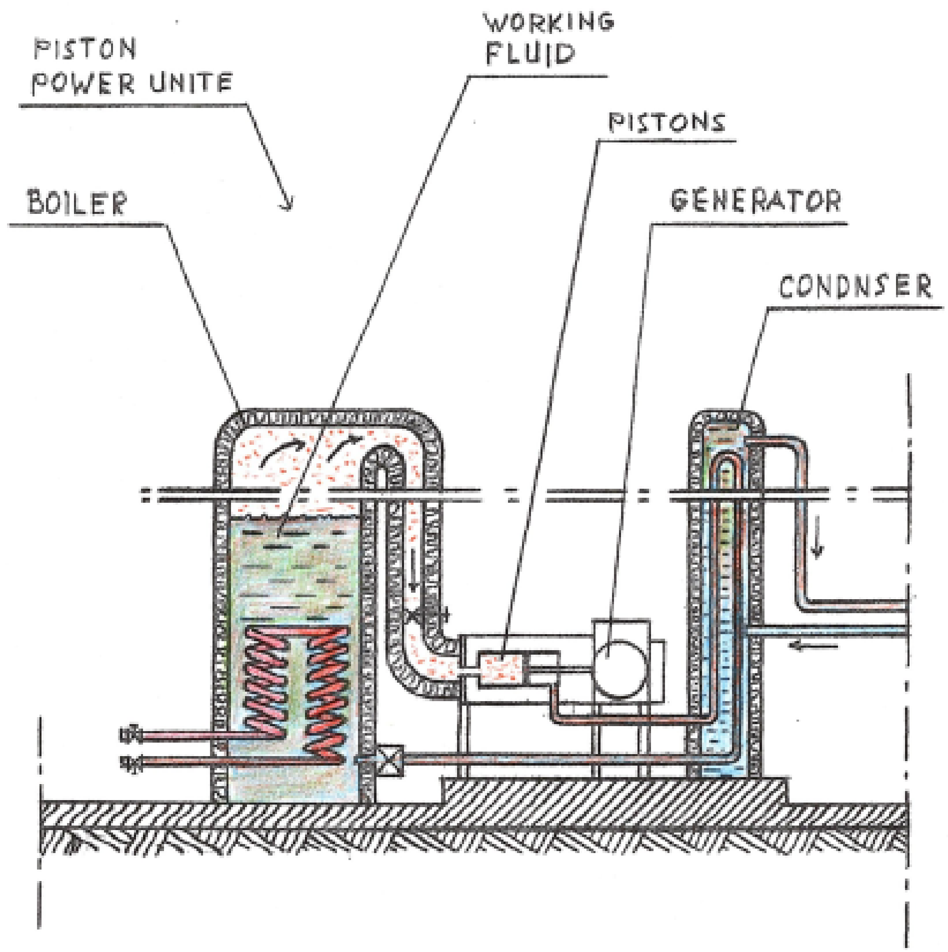

FIG. 7 – Schematic Cross-sectional View of a Power Unit

Segment (III)

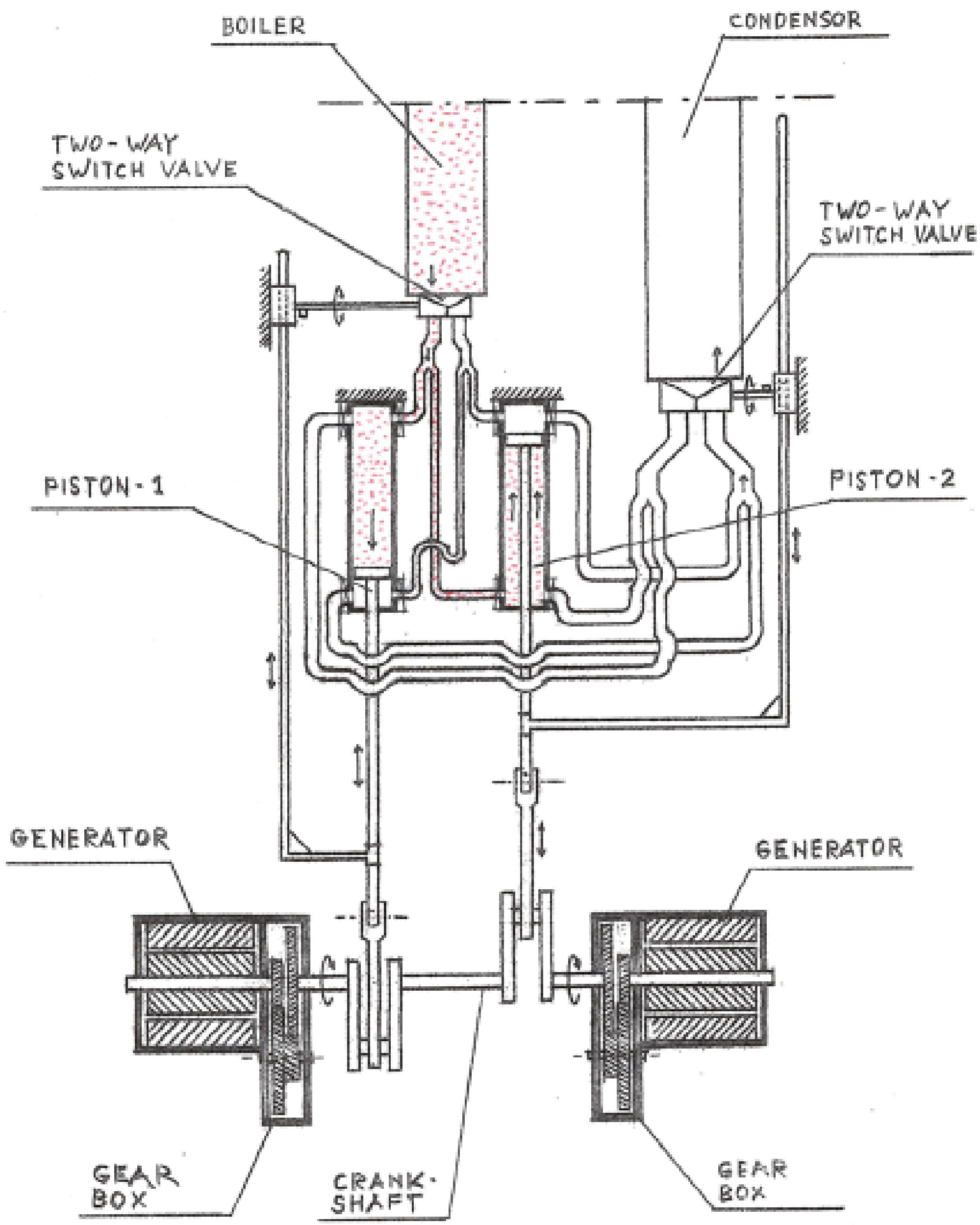

FIG. 8 – Schematic Diagram of a Piston Power Unit – stroke one

Segment (III)

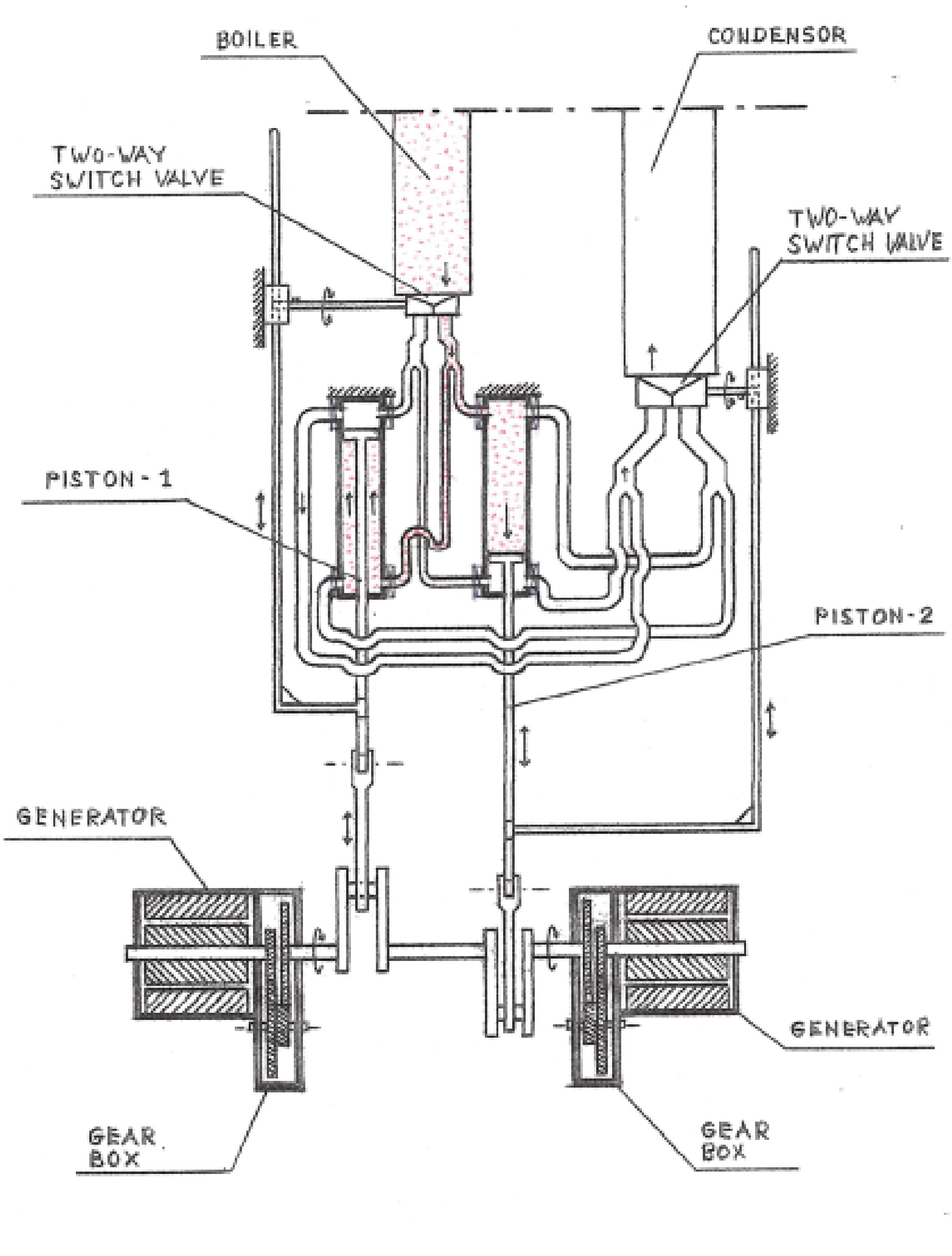

FIG. 9 – **Schematic Diagram of a Piston Power Unit – stroke two**

3. Conclusion:

Harnessing solar energy in combination with the pipeline system for importing seawater makes a phase of importing seawater self-sustainable and profitable. Importing seawater is a fundamental phase of this comprehensive project on which other phases depend and is an essential element in providing the necessary water for harnessing geothermal energy in the area and is an essential element for the restoration of the Salton Sea.

Acknowledgment

The 3.5 km Temperature Map is courtesy of the SMU Geothermal Laboratory and Dr. David Blackwell, Dallas Texas.

REFERENCES

U.S. Patent No. 7,849,690; Entitled: "Self-Contained In-Ground Geothermal Generators" (SCI-GGG); Issued on Dec.14, 2010;

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Harnessing Geothermal Energy with the Self Contained In-Ground Geothermal Generator and Self Contained In-Ground Geothermal Heat Exchanger

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Keywords: geothermal energy, electricity, desalinization, clean environment, Geothermal Power, Electricity, Importing Seawater, In-Line-Pump, In-Line-Generator, Renewable Energy, Heat Exchanger, Desalinization, Potable Water, Lithium, Environment, Wildlife Sanctuary, Tourism.

ABSTRACT

There is an infinite source of energy under our feet, whether it is a few miles underground or on the ground surface in locations such as Hawaii. The question was, until now, how to harness it expediently and efficiently? The presented methodology capitalizes on our planet's natural internal heat. The essence of the Scientific Geothermal Technology is transferring heat from heat sources to the power units with completely closed-loop systems. The Self Contained In-Ground Geothermal Generator (SCI-GGG) system uses several completely closed-loop systems and generates electricity down at the heat source and transmits it up to the ground level by using electrical cables. The SCI-GGG apparatus consists of a boiler; a turbine; a converter; a generator; a condenser distributor; and a condenser that is arranged to function in confined spaces such as in a wellbore. The SCI-GGGG absorbs heat from the heat source (hot rocks, lava, geothermal reservoir, geysers, etc.) and generates electricity at the heat source which is then transmitted by cable up to the ground surface to electrical grids for use in houses and industry. In the process of cooling the engine compartments with a separate closed-loop system which is the Self Contained In-Ground Heat Exchanger (SCI-GHE system) additional electricity is generated on the ground surface.

The Self Contained In-Ground Heat Exchanger (SCI-GHE) system is an integral part of the SCI-GGG system and can function independently. The system consists of a closed-loop thermally insulated line with 2 coiled pipes (heat exchangers) with at least one "In-Line-Pump". The first heat exchanger is lowered at the heat source and the second heat exchanger is coupled into the evaporator of a binary power unit on the ground surface which produces electricity by using the Organic Rankine Cycle (ORC).

1. INTRODUCTION

1.1 Note:

Presented paper with the title "Harnessing Geothermal Energy with the Self Contained In-Ground Geothermal Generator and Self Contained In-Ground Geothermal Heat Exchanger" is a segment of the comprehensive design for the long-term solution for the restoration of the Salton Sea (Lake in California). The solution for the restoration of the Salton Sea includes an architectural element that harmoniously implements several breakthrough technologies into a self-sustaining organism. There are five phases (segments) of the project including harnessing solar and hydro energy which are excluded for this occasion as not relevant to the geothermal issue. Each of the phases (segments) is essential for the final result of the project. Either of two presented systems "Harnessing Geothermal Energy with the Self Contained In-Ground Geothermal Generator" and "Self-Contained In-Ground Geothermal Heat Exchanger" is a fundamental segment of the comprehensive design on which the function of other segments depends.

For this occasion, the paper "Harnessing Geothermal Energy with the Self Contained In-Ground Geothermal Generator and Self Contained In-Ground Geothermal Heat Exchanger" is marked as a

(Segment II). For a complete understanding of this segment, it is necessary to review the other two integral parts of the comprehensive design with titles “Harnessing Energy and Water in the Salton Sea” as a (Segment I), and “System for Drilling Deeper and Wider Wellbores” as a (Segment III).

1.2 Overview of the contemporary geothermal power plants:

Contemporary geothermal power plants are limited to geothermal reservoirs. The production wells need to be drilled into the geothermal reservoirs to bring hot water to the power plant on the ground surface. Then, after removing silica steam is used to spin turbines creating mechanical energy. The shaft from the turbines to the generator converts mechanical energy into electrical energy. The used geothermal fluid is then returned down through injection well into the reservoir to be reheated, to maintain pressure, and to sustain the reservoir. Contemporary geothermal power plants are limited to the location with a geothermal reservoir. The experimental Enhanced Geothermal Systems (EGS) needs the formation of the geothermal reservoir – at least 1 cubic kilometer – which is a serious limitation. There is an infinite source of energy under our feet, whether it is a few miles underground or on the ground surface in locations such as Hawaii. The question was, until now, how to harness it expediently and efficiently?

1.3 Summary of the Self-Contained In-Ground Geothermal Generator (SCI-GGG):

The "Self Contained In-Ground Geothermal Generator" (SCI-GGG) system for harnessing geothermal energy (hot rocks, hydrothermal reservoir) to produce electricity consists of:

a) Lowering the (SCI-GGG) apparatus into a pre-drilled well bore deep to the source of heat.
b) Absorbing heat from the source of heat and generating electricity at the source of heat and transmitting electricity to the ground surface by using electric cable.
c) In the process of cooling engine compartments with separate closed-loop system additional electricity is generated on the ground surface with the binary power unit by using the Organic Rankine Cycle (ORC).

The "Self Contained In-Ground Geothermal Generator" (SCI-GGG) system consists of several main compartments: a boiler compartment; a turbines compartment; a generator compartment; a condenser distributor compartment; and a condenser compartment that is arranged so to function in limited space such as a wellbore (See Fig. 1).

The boiler is exposed to the heat of hot rocks while the rest of the apparatus is thermally insulated from the heat and is additionally cooled with a second closed-loop system. The second closed-loop system is engaged with the third closed-loop system on the ground surface, which is the Binary Power Unit, and can function separately as an independent apparatus – explained further as the "Self-Contained In-Ground Heat Exchanger" (SCI-GHE) system. If needed, the Organic Rankine Cycle (ORC) is applicable here. The condenser compartment is formed between two cylindrical walls which surround the turbines, generator, and condenser distributor compartment, and is cooled by circulating water through the condenser with a second closed-loop system. Heated water is brought up on the ground surface to a heat exchanger which is engaged with a third closed-loop system which is the Binary Power Unit (See Fig. 2). By lowering the SCI-GGG apparatus in a predrilled wellbore to the hot rocks, or hydrothermal reservoir, electricity is generated below the ground and transmitted up to the ground surface by an electric cable and subsequently through an electric grid to the houses and industry.

One power plant consists of a few dozen wellbores with SCI-GGG apparatuses; a cooling system exchanging heat on the ground surface using a multi-phase cooling system and binary production units which also produces additional electricity; and a control center (See Fig. 5). The production capacity of the power plants depends on the number of the wellbores, and diameter and the length of the apparatus, and of course, the temperature of the hot rocks. Deeper we drill the higher temperature of the rock formation we can reach. The (SCI-GGG) system uses several completely closed-loop systems and eliminates the issues of pumping geothermal fluid on the ground surface, filtration, separation, equipment corrosion, scaling, and groundwater pollution, etc., and at no time is there any contact with the environment by the working fluid or the heat exchange fluid, therefore, it doesn’t pollute the environment.

Although the main purpose of the (SCI-GGG) system is to use limitless dry hot rocks for the production of electricity, the (SCI-GGG) system is not limited to dry hot rocks - it can be lowered into the existing hydrothermal reservoir or can be suspended with cable over lava flow (lava tube) in locations such as Hawaii.

Here is introduced a radical change in how geothermal energy can be harnessed more efficiently. This system is not limited to a hydrothermal reservoir. Instead of having an injection well and production well and formation of fractured rocks between them (nest) and need of, at least one cubic kilometer, of water as is the case in the EGS, which is extremely difficult to find these days, and a single power unit - the presented system introduces a “Vertical approach” – multi wellbores – completely closed-loop system – and multi (smaller) power units using piston system instead of turbines although turbines can be used too. With a new drilling methodology, presented in Segment III, that can be achieved because now we can search for and reach a permanent source of energy and not be excessively dependent on the geothermal reservoirs as is the case in the conventional system for harnessing geothermal energy.

1.4 Summary of the Self-Contained Geothermal Heat Exchanger (SCI-GHE):

The "Self-Contained In-Ground Heat Exchanger" (SCI-GHE) system is an integral part of the "Self-Contained In-Ground Geothermal Generator" (SCI-GGG) system and can operate independently. The SCI-GHE system is less powerful than the SCI-GGG system because generates electricity only on the ground surface, but is easier to build and maintain. The "Self-Contained In-Ground Heat Exchanger" (SCI-GHE) system consists of a closed-loop thermally insulated line with two heat exchangers (the first heat exchanger and a second heat exchanger - coiled pipes) and at least one In-Line-Pumps (See FIGs. 3,4 and 7). The first heat exchanger is lowered at the source of heat and the second heat exchanger is coupled into the evaporator of a binary power unit on the ground surface which produces electricity.

The SCI-GHE system can be used in many applications with minor modifications. In the presented application which is relevant to the restoration of the Salton Sea the boiler is filled with salty water from the bottom of the Lake to the level “H” (See Fig. 7). The water in the boiler is heated with a second heat exchanger. The generated steam feeds the “piston power unit” which generates electricity (See Fig. 7-10). Electricity is then transmitted through an electric grid. Exhausted steam enters the condenser where potable water is generated as a byproduct. Remaining water from the boiler level “L” is injected into the wellbore to improve the conduction of the heat from surrounding hot rocks to the first heat exchanger. After a certain period, the wellbore will be filled with brine from the boiler and periodically pumped up trough excavation line to the mineral extraction facility to be used as a source for extraction of lithium. Different methods for extraction of lithium can be used including ion-imprinted polymers.

One of many Power Plant consists of 24 wellbores drilled in a circle of radius of about 500 meters. Each wellbore has the “Self-Contained In-Ground Heat Exchanger" (SCI-GHE) system. The power plant has four identical modular quarters each having a mineral extraction facility (See FIGs. 5 and 6).

The presented the "Self-Contained In-Ground Heat Exchanger" (SCI-GHE) system is designed for a location where there is a substantial heat source and where heat flux is not an issue. For locations where heat flux is an issue, the SCI-GHE system can be modified to incorporate an in-line pump for steering hot fluid around the first heat exchanger and/or can be modified to incorporate a motorized drill-head to drill and move the whole drilling/heat exchange apparatus deeper in search for hotter temperatures (See Fig. 7). That system is presented in more detail in segment III – the System for Drilling Deeper and Wider Wellbores

(The section "2" below is added later after submission of paper)

2. Preliminary Cost Estimate and Revenue for the Proposed Power Plant:

The Proposed Geothermal Power Plant(s) - the "Scientific Geothermal Technology" consists of 24 well-bores and with many projected power plants (in 100s) drilling is most expensive and most important part, therefore we need to implement a new system for drilling faster, deeper and wider wellbores.

2.1 Preliminary Cost Estimate for the Proposed Power Plant:

The cost for 60" diameter wellbore 8,000 feet deep might cost about $4 M;
24 wellbore x $4M = $96,000,000;

Binary Power Unit of 4 MW might cost about $100,000;
(Binary Power Unit of 4 MW is modest assumption.)

24 Binary Power Unit x $100,000 = $2,400,000;

The control center might cost about $4,600,000;

The potable water pond might cost about $5,000,000;

Piping system might cost about $2,000,000;

A new derrick might cost about $10,000,000;

One Geothermal Power Plant might cost about $120,000,000;

8 Power Plant including final development of the drilling system might cost about $1,000,000,000;

The new drilling system is more expensive at this earlier stage because of development cost, but in the long term, it would be better and less expensive solution.
Several initiating power plants on several sectors around the Salton Sea would be able to provide finance for subsequent power plants.

More power plants are built with the initial budget the faster we will proceed with subsequent power plants and the whole project, which final result will be more clean energy and more potable water.

It is realistic to conclude that Phases I – IV, would cost around $15 billion dollars, (preferably less) with the final result of "really" saving the Salton Sea and providing conditions for tourism, clean energy, potable water, and prosperous economy.

2.2.1 Preliminary Estimate of Production Capacity of one Geothermal Power Plant:

Proposed Geothermal Power Plant(s) the "Scientific Geothermal Technology" consist of 24 well-bores and 24 Binary Power Units. Rough estimate for production capacity of one Power Unit is about 4 Mwh.

24 Binary Power Units x 4 MW = 96 MWh; ~ 100 MWh;

2.2.2 Preliminary Estimate of Revenue of one Geothermal Power Plant:

Assumed price of $60 per MWh;

$60 x 96 MWh = $5,760 per hour;

$5,760 x 24h = $138,240 per day;

$138,240 x 365 days = $50,457,600 per year;

3. DISCLOSURE - (ILLUSTRATIONS) - THE SELF CONTAINED IN-GROUND GEOTHERMAL GENERATOR AND SELF CONTAINED IN-GROUND GEOTHERMAL HEAT EXCHANGER (SEGMENT II)

Segment (II)

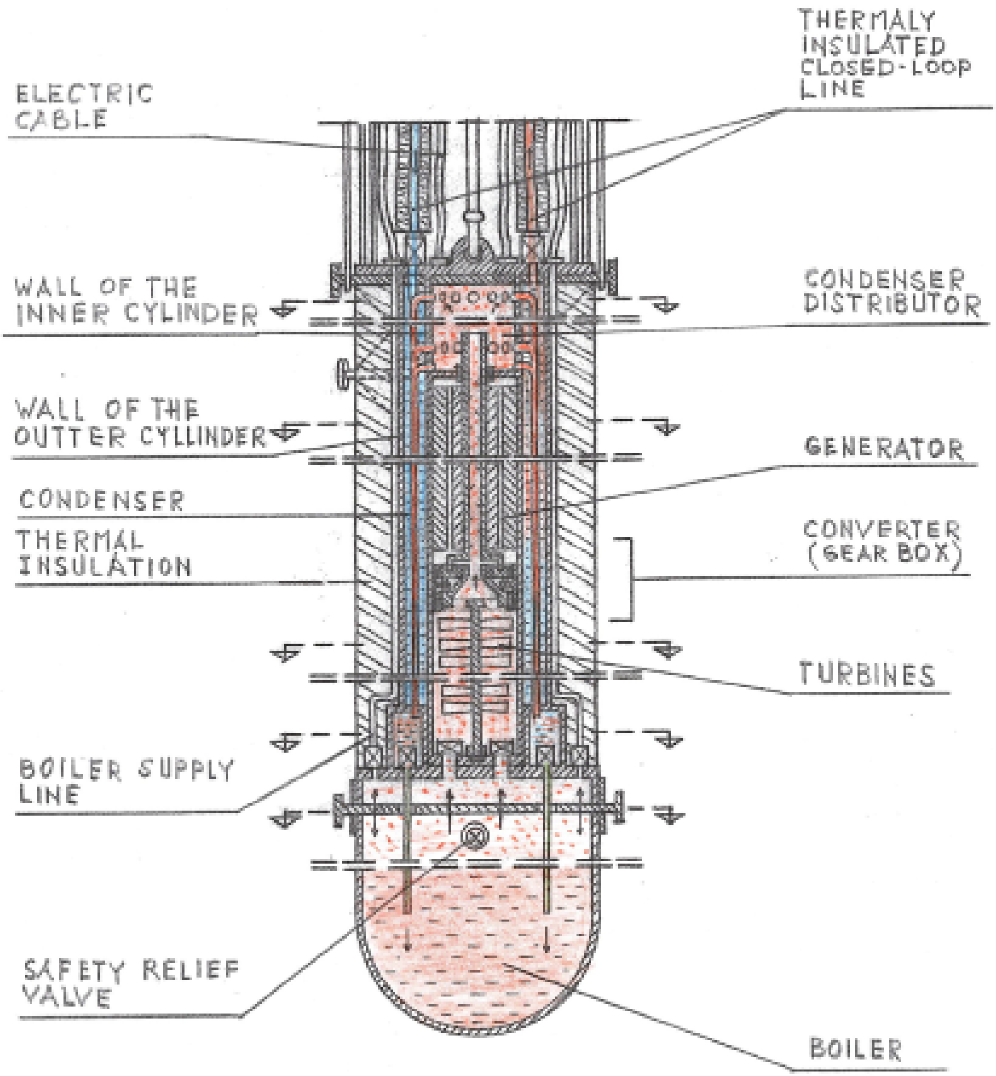

FIG. 1 – **Cross-Sectional view of the Self-Contained In-Ground Geothermal Generator**

Segment (II)

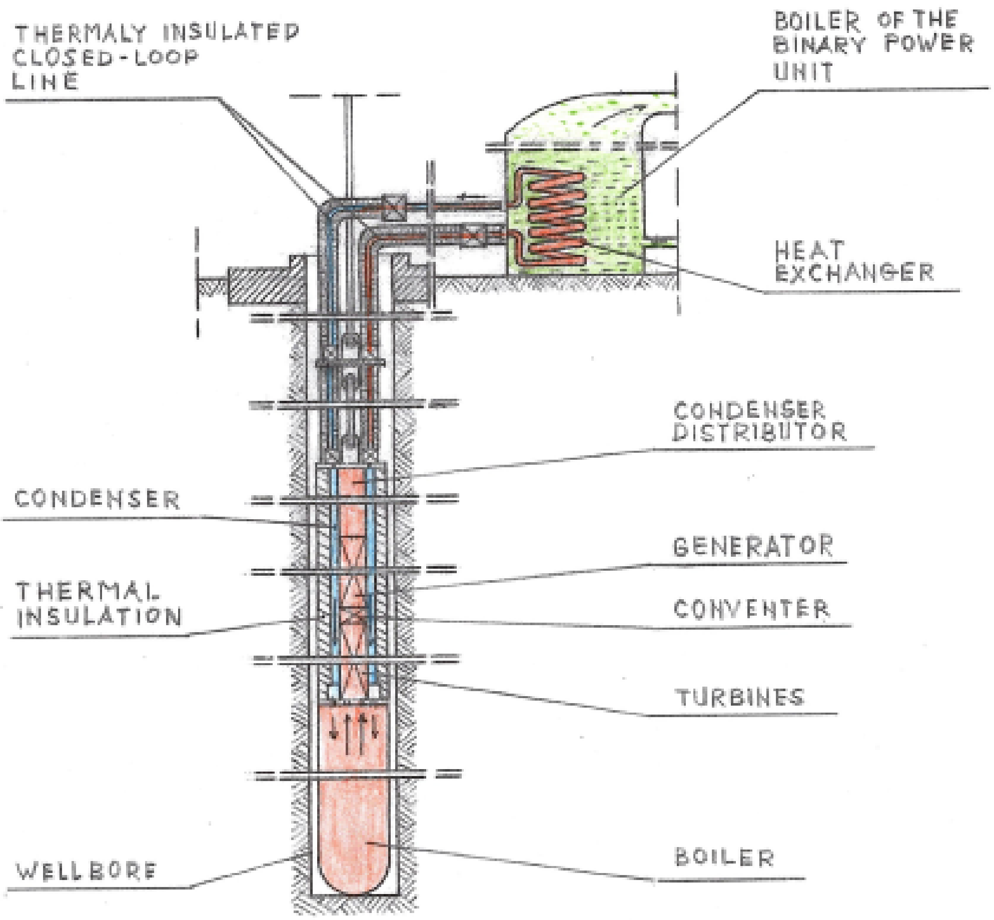

FIG. 2 – **Schematic Diagram of a Self-Contained In-Ground Geothermal Generator**

Segment (II)

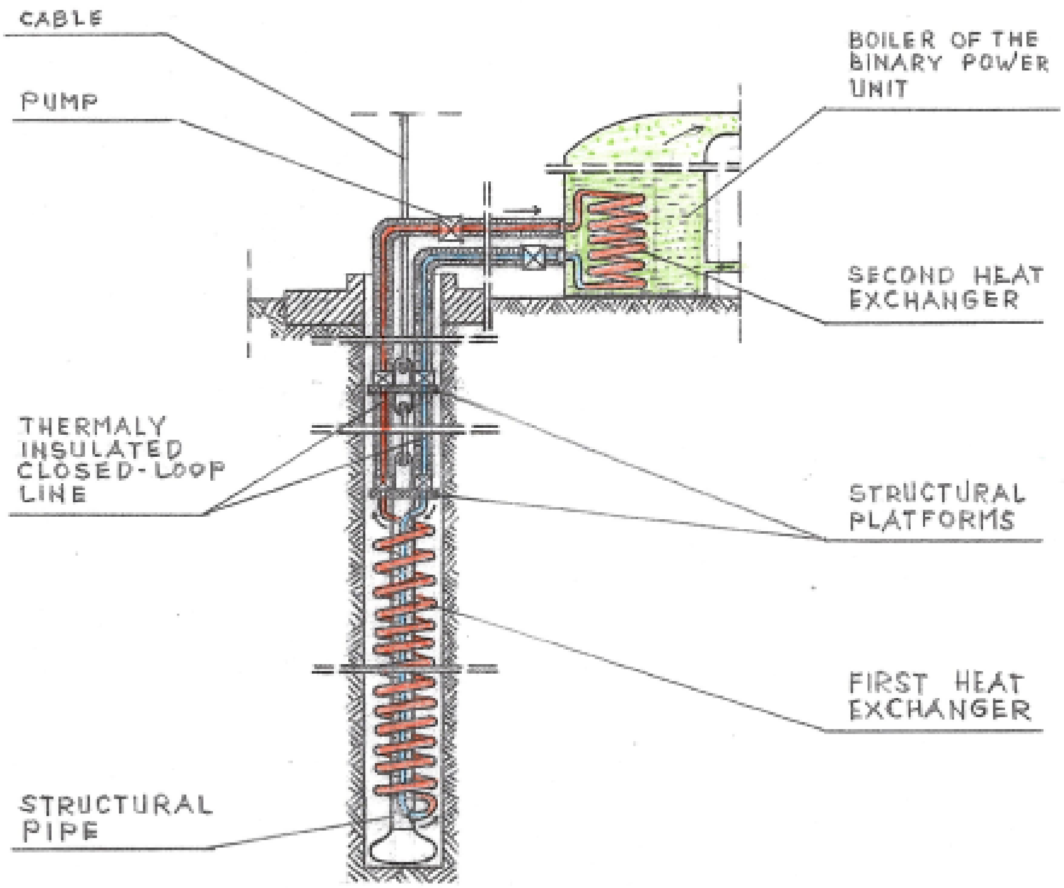

FIG. 3 – Schematic Diagram of a Self-Contained In-Ground Heat Exchange System

Segment (II)

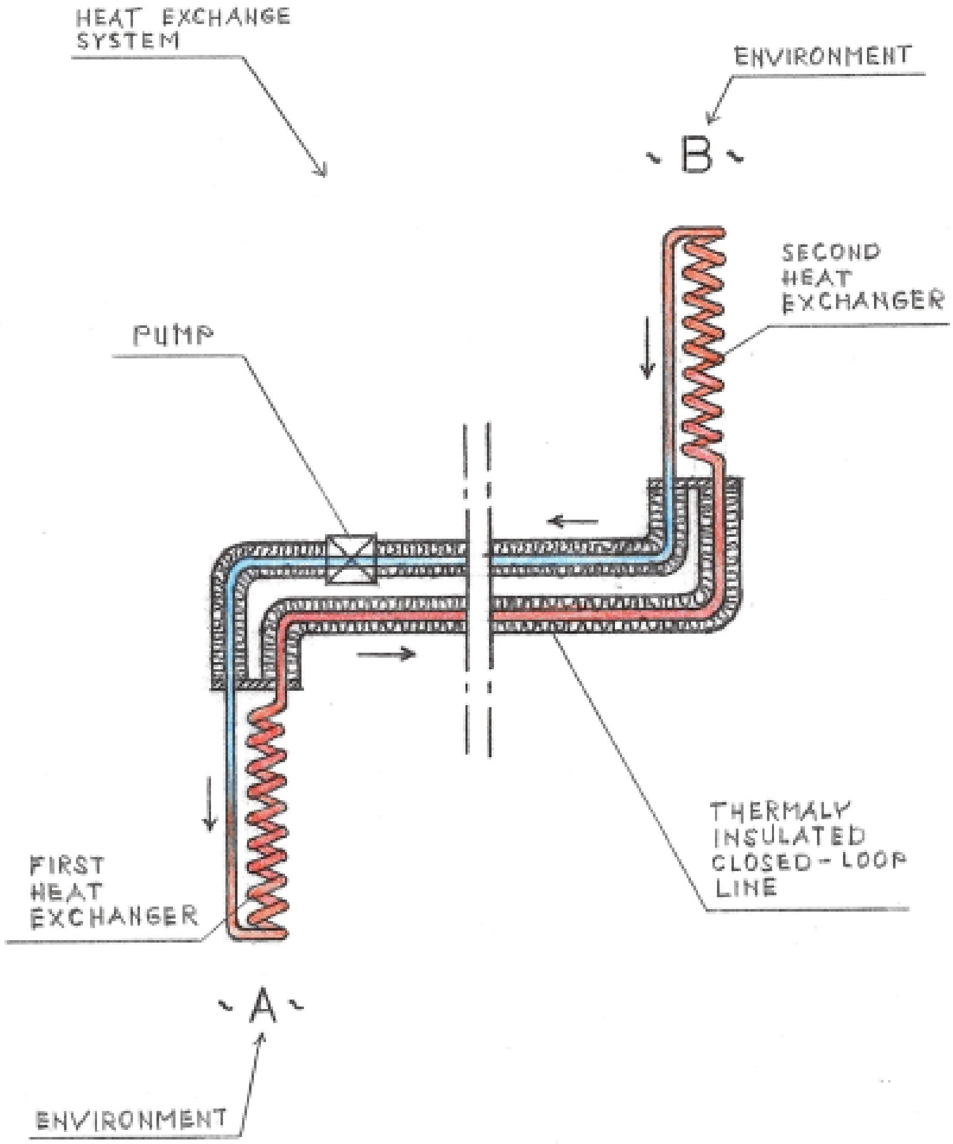

FIG. 4 – Schematic Diagram of an Universal Heat Exchange System

Segment (II)

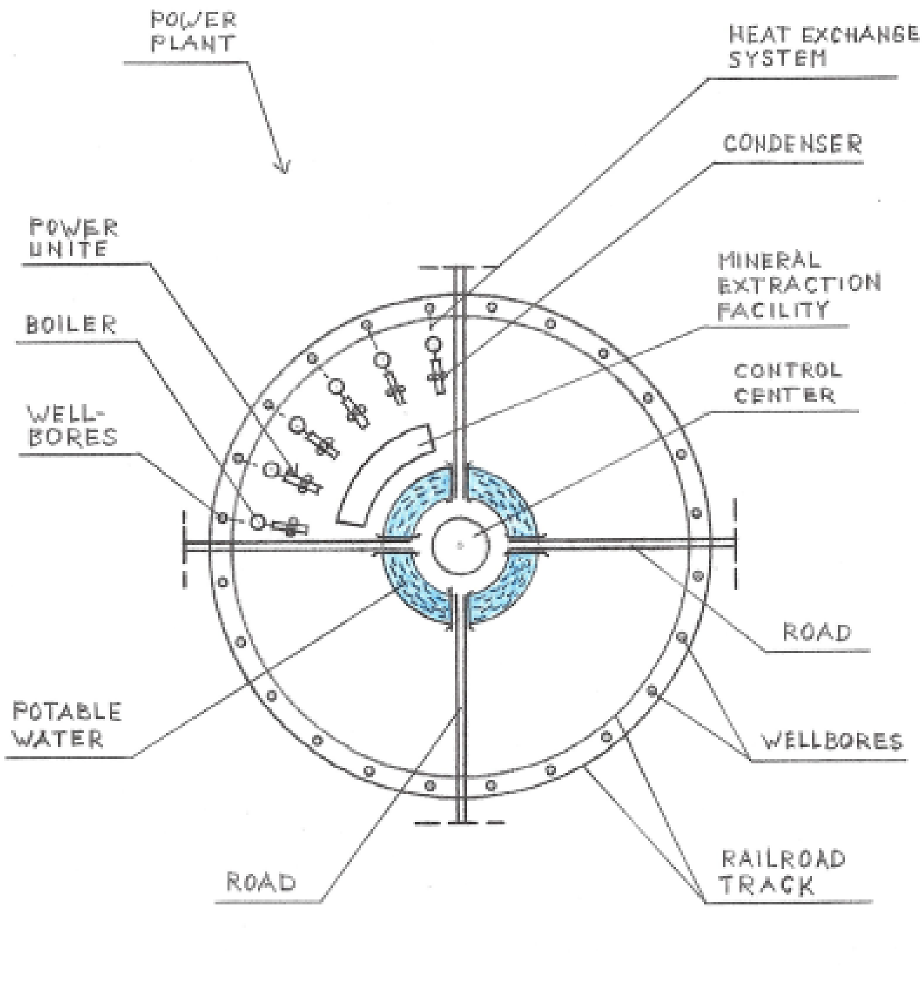

FIG. 5 – Plain View of a typical Power Plant

Segment (II)

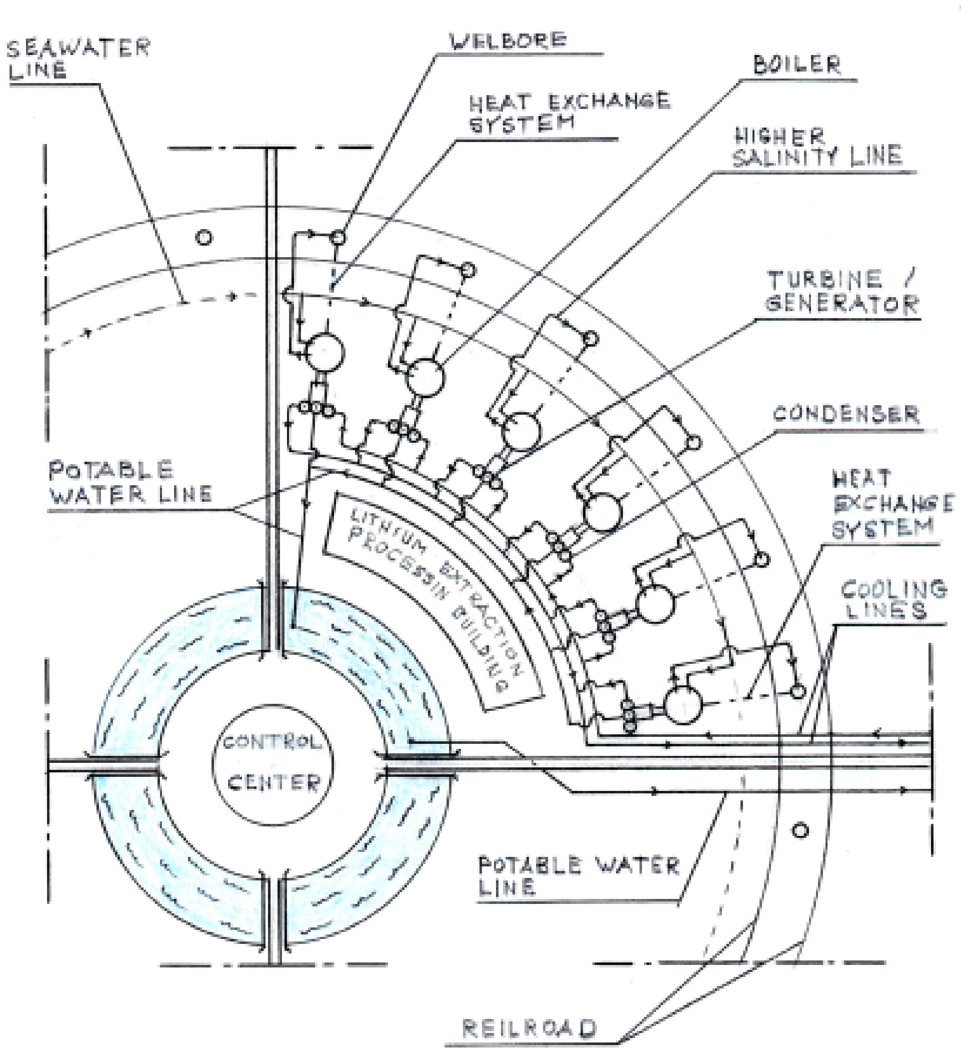

FIG. 6 – Plain View of a section of typical Power Plant

Segment (II)

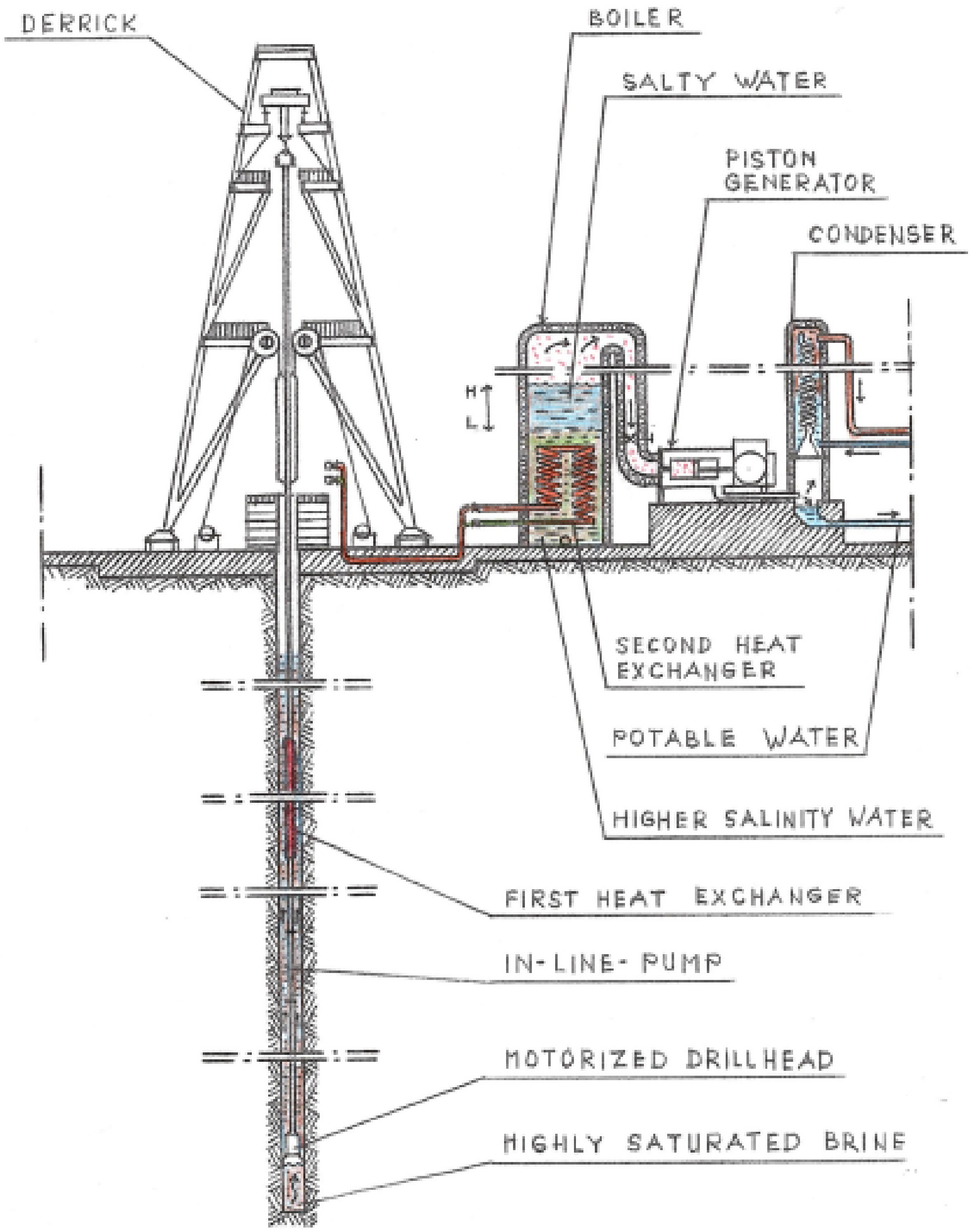

FIG. 7 – Schematic Cross-sectional View of a typical Power Plant

Segment (II)

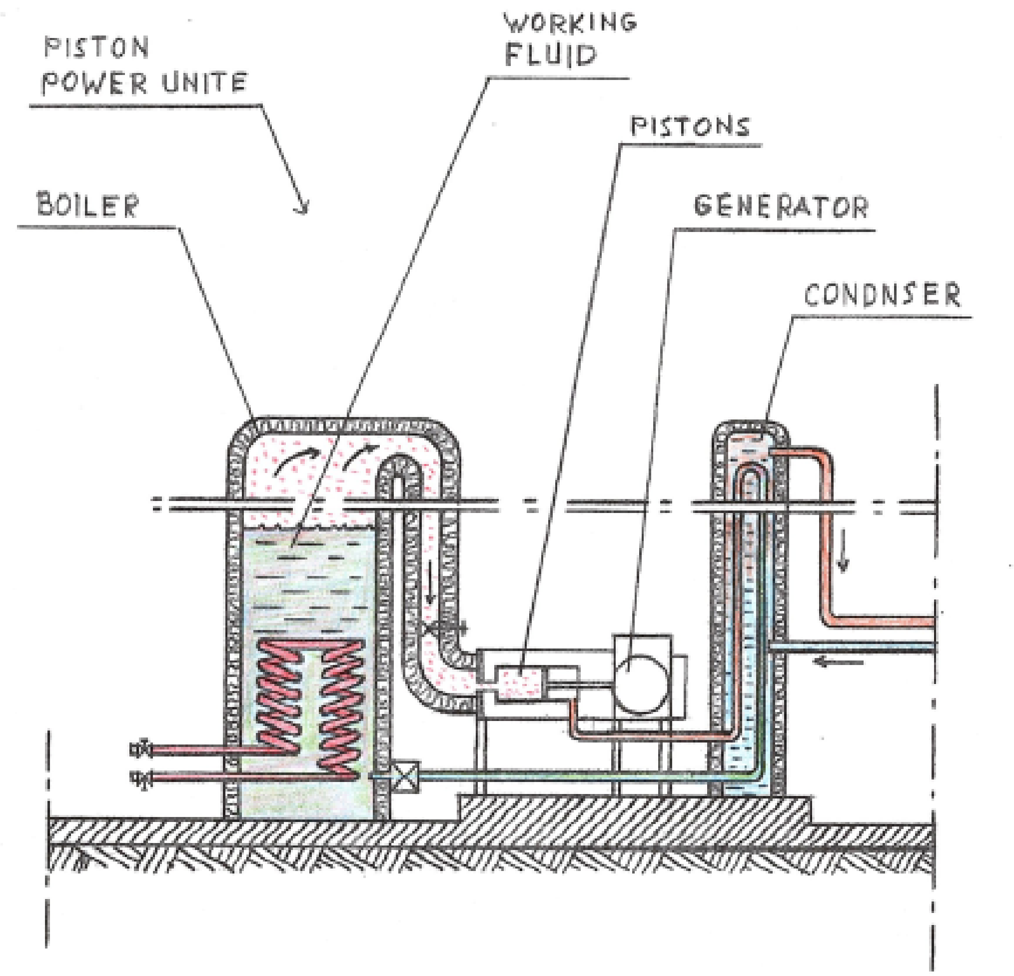

FIG. 8 – Schematic Cross-sectional View of the Piston Power Unit

Segment (II)

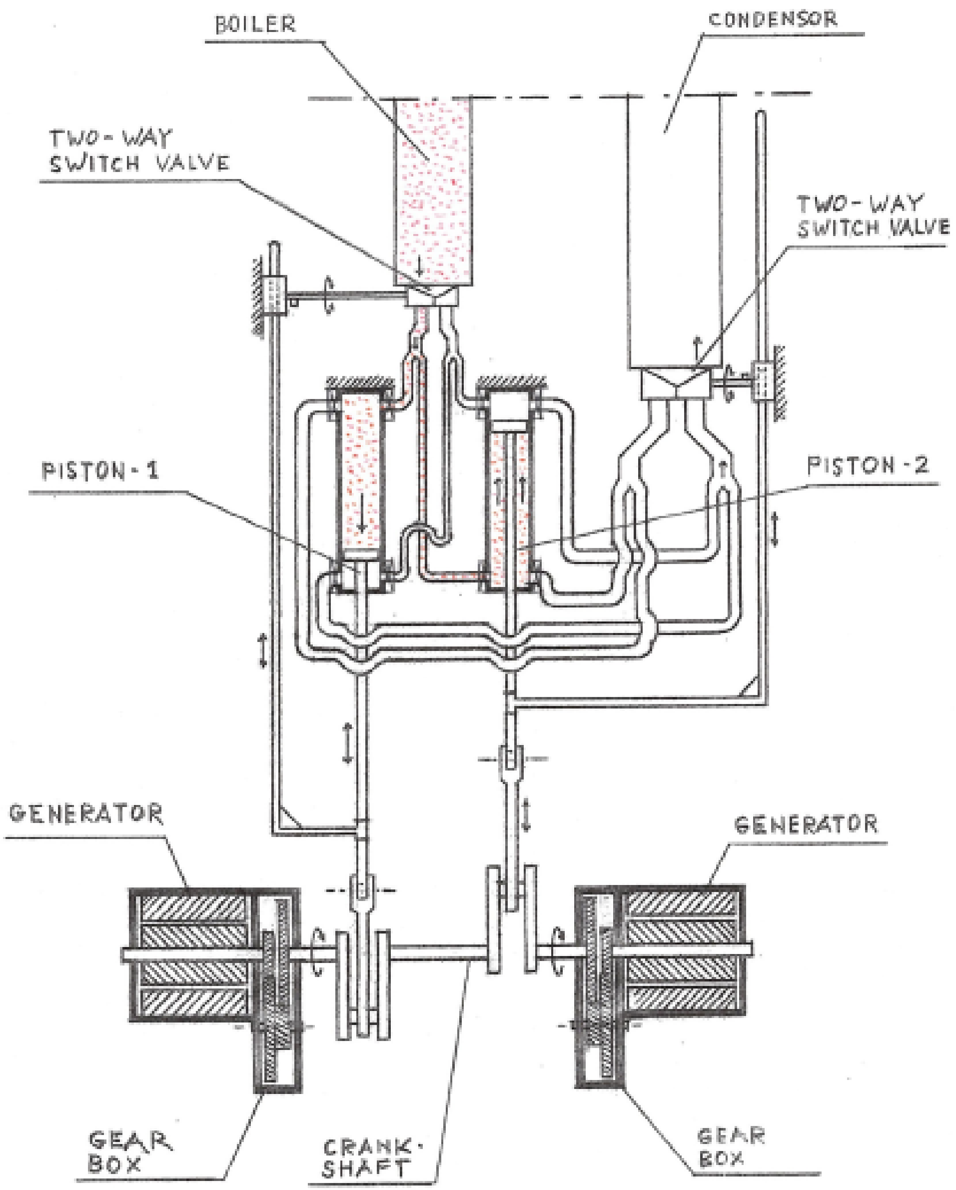

FIG. 9 – Schematic Diagram of a Piston Power Unit – stroke one

Segment (II)

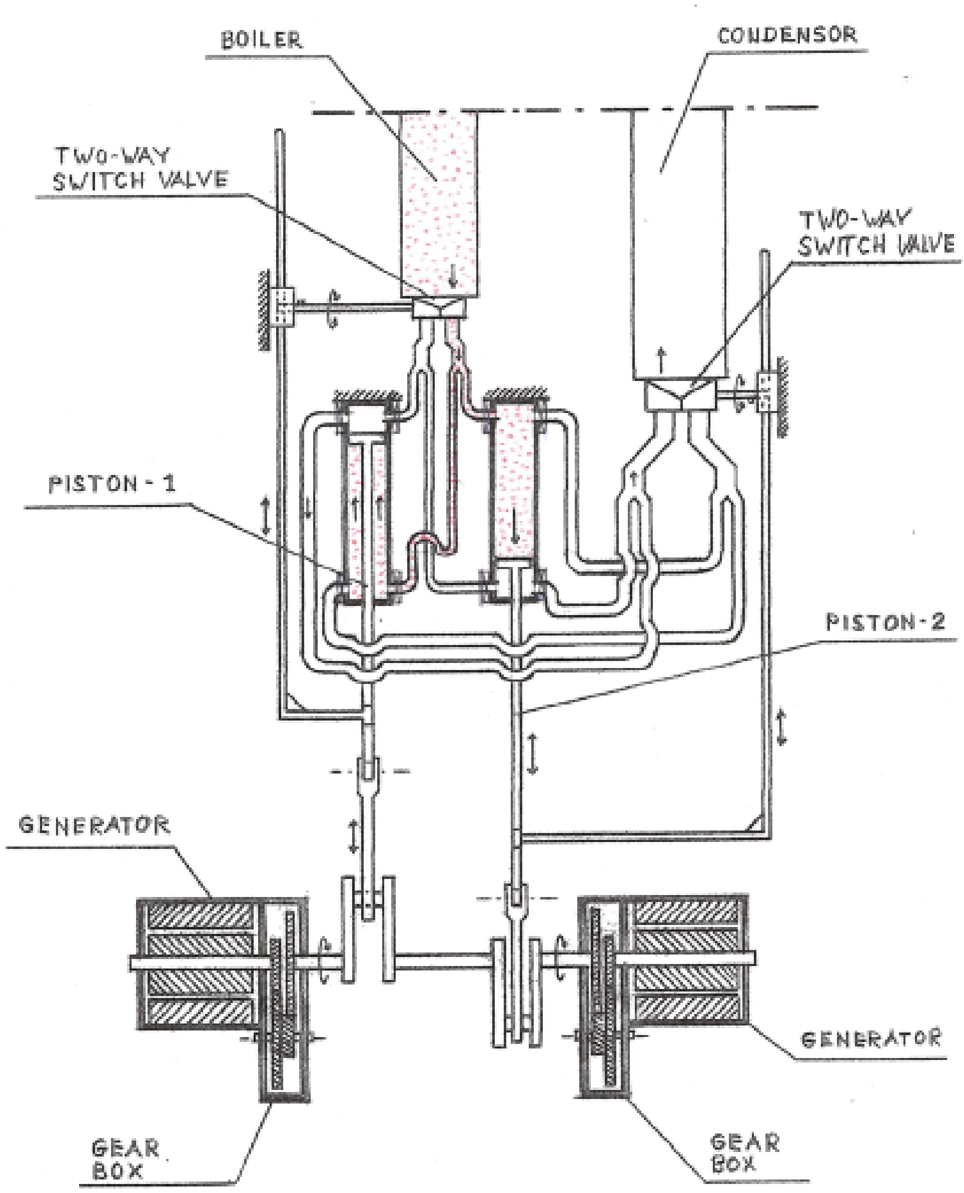

FIG. 10 – Schematic Diagram of a Piston Power Unit – stroke two

3. CONCLUSION:

The essence of the presented technology - the SCI-GGG system - is using several completely closed-loop systems and generating electricity at the source of heat and transmitting electricity to the grid surface by using an electric cable.

Also, the essence of the presented technology - the SCI-GHE system - is transferring heat from heat sources to the power units with completely closed-loop systems.

Although the presented system is a part of a geothermal power plant designed to incorporate the local condition of the Salton Sea area to generate electricity, to generate potable water, desalinate the Lake, and to generate the brine which can be used for the extraction of lithium - the presented system is not limited to this particular application.

4. REFERENCES

U.S. Patent No. 7,849,690; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on Dec.14, 2010;

U.S. Patent No. 8,281,591; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on October 9, 2012;

U.S. Patent No. 8,713,940; Entitled: “Self-Contained In-Ground Geothermal Generators”; Issued on May 6, 2014;

U.S. Patent No. 9,206,650; Entitled: “Apparatus for Drilling Faster and Wider Wellbore; Issued on December 8, 2015;

U.S. Patent No. 9,978,466; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump; Issued on May 22, 2018;

U.S. Patent No. 9,982,513; Entitled: “Apparatus for Drilling Faster and Wider Wellbore with Casing; Issued on: May 29, 2018;

U.S. Patent No. 9,995,286; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump and Several Alternative Applications; Issued on: June 12, 2018;

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System for Drilling Deeper and Wider Wellbores

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Keywords: drilling wellbores, motorized drill-head, geothermal energy, closed-loop system, heat exchange, electricity, clean environment

ABSTRACT

Contemporary drilling systems for wellbores have serious limitations on how wide and deep wellbore can be drilled. In conventional systems, mud is injected through the pipe and exit through several orifices at drill-bit and circulates up between the pipe and wall of the wellbore providing a necessary stream for cutting to be excavated. By increasing the size of the drill-bit (wellbore) and/or by increasing the depth of the wellbore it requires a tremendous increase of pressure inside the pipe to form a sufficient stream of fluid up for cuttings to be excavated. Also, the wellbore has a gradually smaller diameter with each subsequent section because of the casing.

The presented system provides a solution for drilling deeper and wider wellbores with a constant diameter. The presented system consists of a motorized drill head; separate excavation line; separate fluid delivery line, and a separate closed-loop cooling line engaged with Binary Power Unit on the ground surface. The presented drilling apparatus has retractable bits on the motorized drill head. The casing of the wellbore can be built during the drilling process. The drilling apparatus consists of the elevator sliding over the drilling/excavation/heat exchange apparatus delivering and installing casing sheets and concrete. The elevator also has an expendable chamber, and containers for delivering air, and concrete. The containers with air also can be used for providing buoyancy thus minimizing the weight issue during the disassembling process. The diameter of the excavation line and rate of flow of mud and cuttings through it and the diameter of the fluid delivery line and rate of fluid flow through it are in balance requiring only a limited fluid column at the bottom of the wellbore. The fluid column may exist through the whole wellbore to sustain the wellbore during the drilling process, and later for better conduction of the heat, but not for the excavation purpose. The excavation process continues regardless of the diameter of the drill head (wellbore); therefore, this method eliminates well-known drilling limitations relative to the depth and diameter of the wellbore.

1. INTRODUCTION

1.1 Note

Presented paper with the title “System for Drilling Deeper and Wider Wellbores” is a segment of the comprehensive design for the long-term solution for the restoration of the Salton Sea (Lake in California). The solution for the restoration of the Salton Sea includes an architectural element that harmoniously implements several breakthrough technologies into a self-sustaining organism. There are five phases (segments) of the project including harnessing solar and hydro energy which are excluded for this occasion as not relevant to the geothermal issue. Each of the phases (segments) is essential for the final result of the project. The presented “System for Drilling Deeper and Wider Wellbores” is a fundamental segment of the comprehensive design on which the function of other segments depends.

For this occasion, the paper “System for Drilling Deeper and Wider Wellbores” is marked as a (Segment III). For a complete understanding of this segment it is necessary to review the other two integral parts of the comprehensive design with titles “Harnessing Energy and Water in the Salton Sea” as a (Segment I), and “Harnessing Geothermal Energy with the Self Contained In-Ground Geothermal Generator and Self Contained In-Ground Geothermal Heat Exchanger” as a (Segment II).

1.2 Overview of the contemporary drilling system

Contemporary drilling systems for wellbores have serious limitations on how wide and deep wellbore can be drilled. Mud is injected through the pipe and exit through several orifices at drill-bit and circulates up between the pipe and wall of the wellbore providing a necessary stream for cutting to be excavated. By increasing the size of the drill bit (diameter of the wellbore) and/or by increasing the depth of the wellbore it requires a tremendous increase of pressure inside the pipe to form a corresponding stream up for cuttings to be excavated. Also, wellbores have a gradually smaller diameter with each subsequent section because of the casing.

Relevant to the presented proposal for the restoration of the Salton Sea which includes many power plants using a completely closed-loop system for harnessing geothermal energy and each of those power plants having 24 wellbores there is a need for a system for drilling faster, deeper and wider wellbores.

1.3 Summary of the new system for drilling faster, deeper, and wider wellbores

Presented system for drilling faster, deeper and wider wellbore consist of motorized drill head; separate excavation line; separate fluid delivery line; and separate closed-loop cooling line engaged with the Binary Power Unit on the ground surface which generates electric energy. The presented drilling apparatus has retractable bits on the motorized drill head (See FIG. 8). The apparatus also consists of the elevator sliding over the drilling/excavation/heat exchange apparatus (line) delivering and installing casing sheets and concrete during the drilling process (See FIG. 2-3).

The motorized drill head cuts and shred ground material and suck into the excavation line for transporting it to the ground surface. The whole excavation line consists of multiple segments of the electric motor, the “In-Line Pump, with a continuous spiral blade inside the rotor.

The separate fluid delivery line delivers filtered fluid into the bottom of the wellbore for easier cutting and partially cooling the drill head (See Fig. 1 and 8). Separate closed-loop cooling line function as a closed-loop heat exchange system taking heat from the motorized drill head and transporting it into a binary power unit on the surface which can produce electricity which can be used to supplements energy needed for powering the motorized drill head. The drill head can be powered by an electric motor or hydraulic motor.

The circular cage slides up and down over the excavation line delivering and installing casings (See Figs. 2, 3, and 7). The circular cage has an expandable compartment with a bladder on which is attached rolled adjustable metal sheets although does not need to be metal. The bladder is made of heat resistant material and expands when air from the air containers is injected into the bladder and the metal sheet is inserted in needed location. Concrete from the concrete containers is injected between the metal sheet and rough wall of the wellbore forming the casing. The bladder can stay inflated as needed until the curing of concrete is completed. This process can be repeated as needed. The drilling process can continue except for a short interruption during positioning metal sheets for the casing. The circular cage has a motor compartment with gears that are synchronized with a cable system for sliding the cage up and down. The cage also has a locking system. Several cages, with air containers when locked to the excavation line, can provide buoyancy for the whole apparatus controlling the drilling force and eliminating difficulties caused by the weight of the apparatus during the disassembling process.

The diameter of the excavation line and rate of flow of mud and cuttings through it and the diameter of the fluid delivery line and rate of fluid flow through it are in balance requiring only a limited fluid column at the bottom of the wellbore. The fluid column may exist through the whole wellbore to sustain the wellbore during the drilling process and for better conduction of heat but is not necessary for the excavation purpose. The excavation process continues regardless of the diameter of the drill head (wellbore); therefore, this method eliminates well-known drilling limitations relative to the depth and diameter of the wellbore (See FIG. 1-8).

2. DISCLOSURE - ILLUSTRATIONS OF THE SYSTEM FOR DRILLING DEEPER, AND WIDER WELLBORES. (SEGMENT III)

Segment (III)

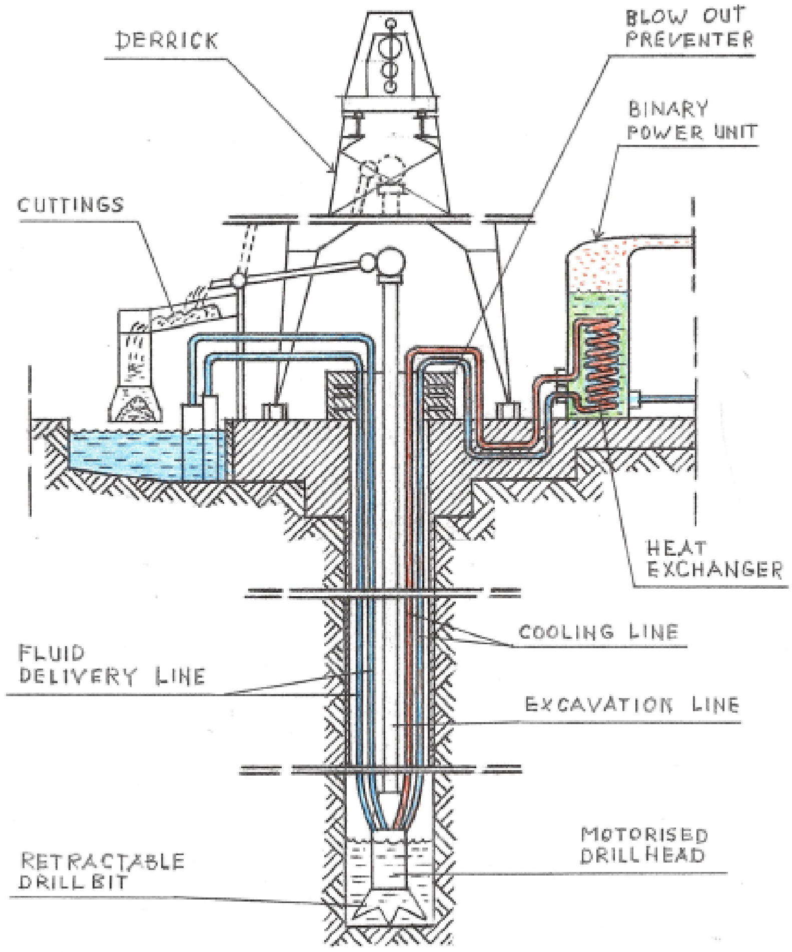

Figure 1: Schematic view of an apparatus for drilling faster, deeper and wider wellbore.

Segment (III)

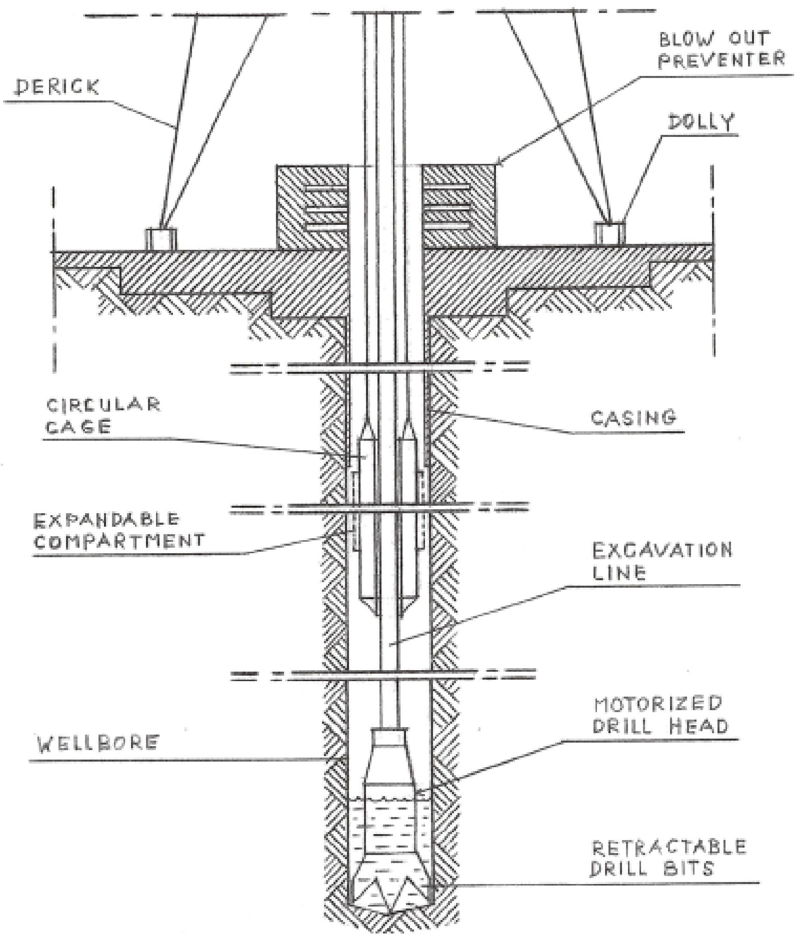

Figure 2: Schematic view of an apparatus for drilling faster, deeper and wider wellbore with cage for casing.

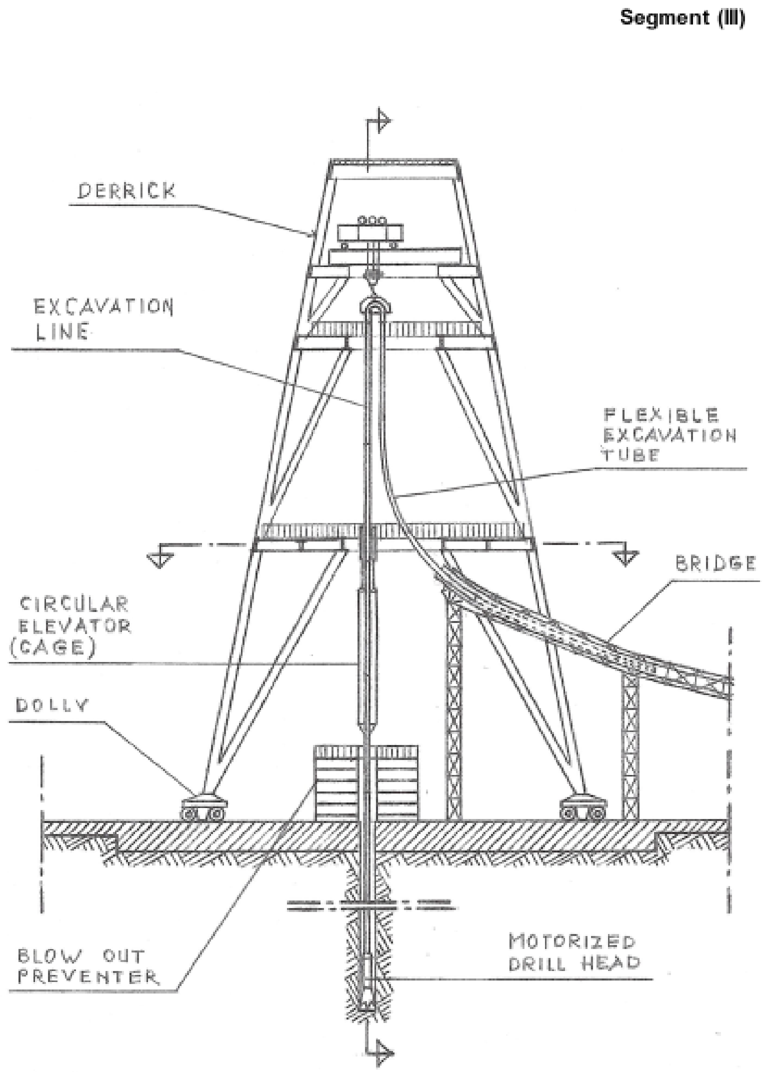

Figure 3: Another schematic view of an apparatus for drilling faster, deeper and wider wellbore with cage for casing.

Segment (III)

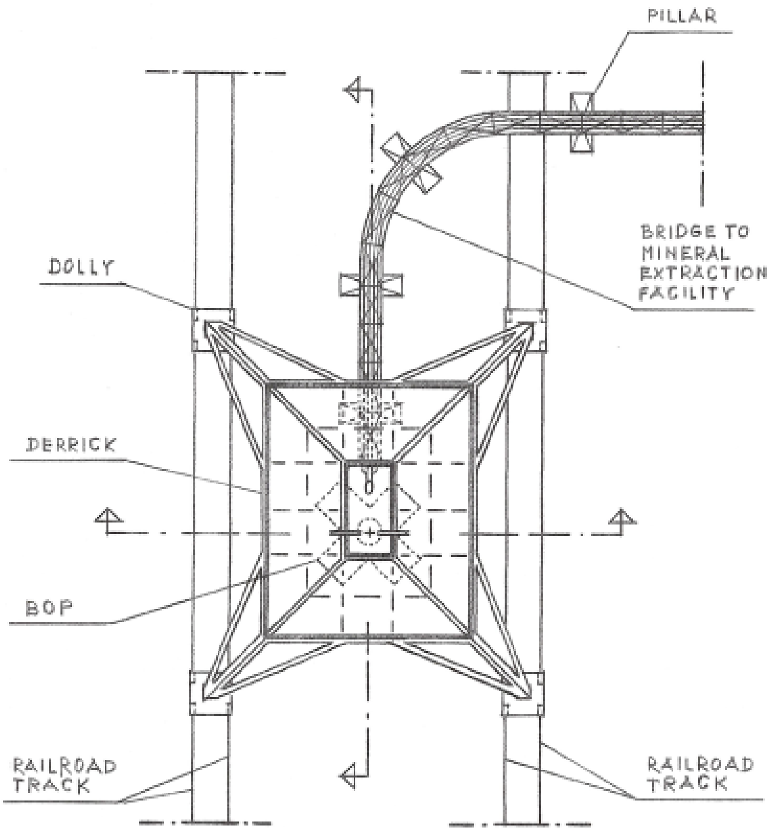

Figure 4: Plain cross-sectional view of an apparatus for drilling faster, deeper and wider wellbore.

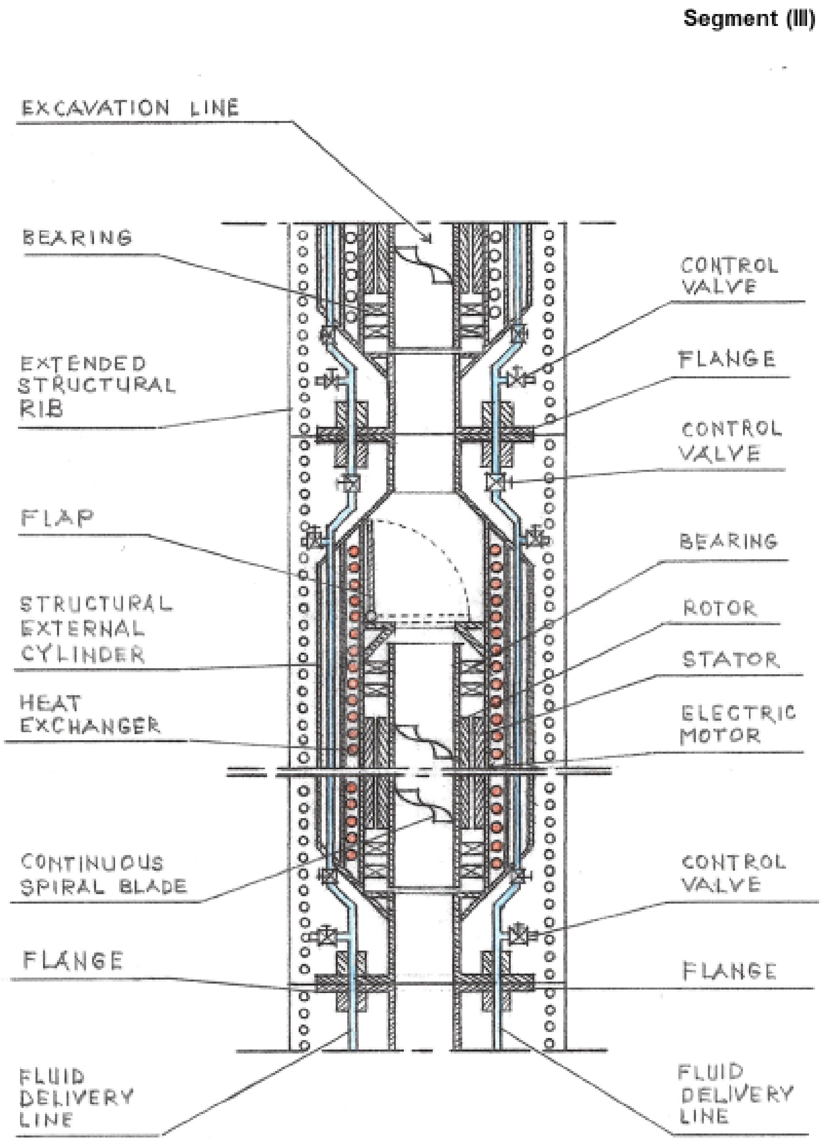

Figure 5: Cross-sectional view of an excavation line of the apparatus for drilling faster, deeper and wider wellbore.

Segment (III)

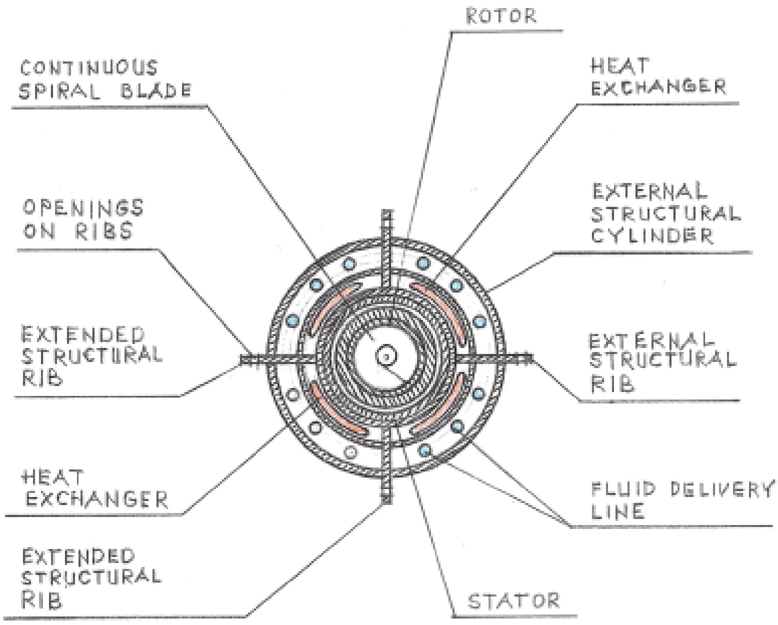

Figure 6: Cross-sectional view of an excavation line of the apparatus for drilling faster, deeper and wider wellbore.

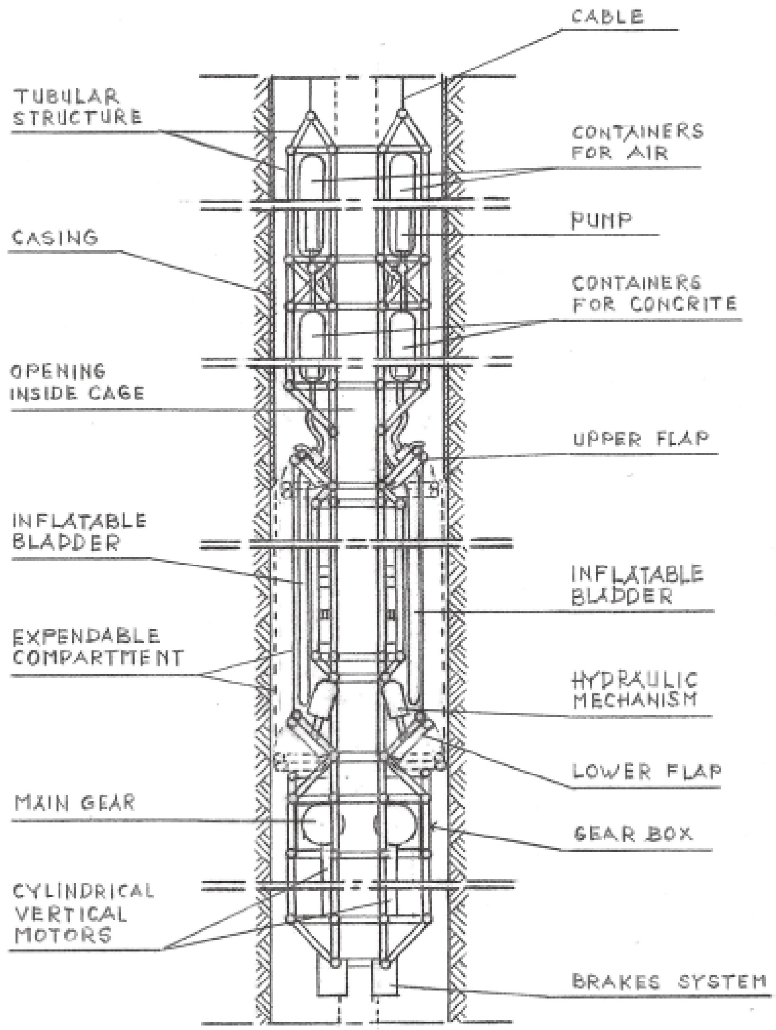

Figure 7: Cross-sectional view of a circular cage to be assembled on the excavation line of the apparatus for drilling faster, deeper and wider wellbore.

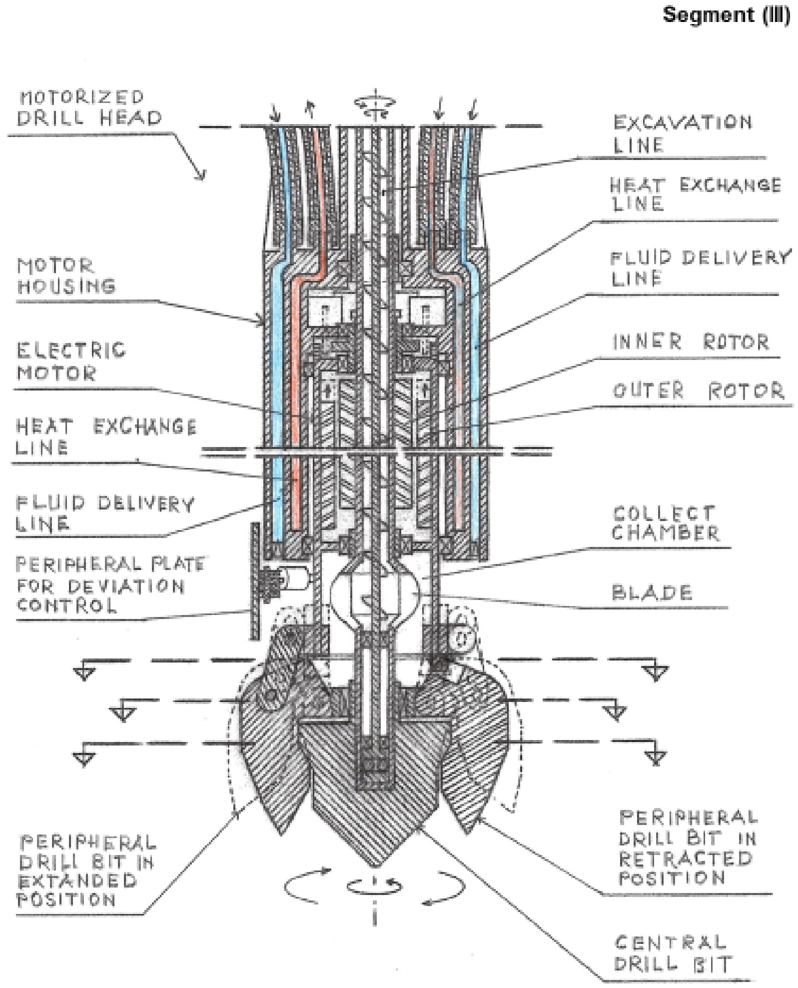

Figure 8: Cross-sectional view of the motorized drill for drilling faster, deeper and wider wellbore.

3. CONCLUSION

The essence of the presented methodology is that the presented proposal provides a solution for drilling deeper and wider wellbores. Also, the system provides a solution for drilling wellbores and building the casing at the same time. Also, the system provides a solution for drilling wellbores with constant diameter without having a reduction of the diameter.

Also, the essence of the presented methodology is having permanent motorized drill-head with retractable drill-bits at the bottom of the drilling apparatus moving whole apparatus deeper, as needed, in search for higher temperatures and transferring heat from heat sources to the power units on the ground surface with completely closed-loop systems.

Also, the essence of the presented methodology is having motorized excavation line.

Although the presented system is a part of geothermal power plant designed to include the local condition of the Salton Sea area to generate electricity, to generate potable water and to generate the brine which can be used for the extraction of lithium the presented system is not limited to this particular application.

REFERENCES

U.S. Patent No. 7,849,690; Entitled: “Self-Contained In-Ground Geothermal Generators” (SCI-GGG); Issued on Dec.14, 2010;

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U.S. Patent No. 9,995,286; Entitled: “Self-Contained In-Ground Geothermal Generator and Heat Exchanger with In-Line Pump and Several Alternative Applications; Issued on: June 12, 2018;