



جامعة الجميع الذكية  
EVERYONE'S SMART UNIVERSITY

## Everyone's Smart University

### Project (Spring 2021)

|              |                                  |               |
|--------------|----------------------------------|---------------|
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| Section |
| Course  |

Master  
(PMG506)

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| Code     |
| Thursday |

Date

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| 18 / 03 / 2021. |
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## Advanced project Management

### Instructions:

- اخر موعد للتسليم هو يوم الخميس 2021-05-~~820~~ في تمام الساعة 9 مساءً.
- الإجابة متاحة باللغة الإنجليزية أو اللغة العربية مع مراعاة أن تكون المصطلحات العلمية باللغة الانجليزية.
- يتم تسليم المشروع في صيغة ملف . pdf مع الالتزام نموذج الجامعة ولن تقبل أي مستندات أخرى.
- يجب مراعاة أقسام البحث الرئيسية (مقدمة Introduction، دراسات علمية سابقة Literature Review، طريقة البحث Methodology، النتائج والمناقشة Results and Discussion ، وأخيراً المراجع References . وان كان هناك ملحقات Appendices يتم إضافتها)
- يجب الالتزام بـ Theme موحد كما يلي:
- حجم الخط 12.
- نوع الخط Arial.
- لون الخط أسود.
- المسافة بين الأسطر 1.5 line spacing

## **Introduction:**

This project outlines how the harvesting energy project will address current business concerns, the benefits of the project, and justification of the project. The project also discusses detailed project goals, cost benefit analysis, SOWT analysis and hydraulic for the prototype system.

Vision 2030 "The Fourth Kingdom of Saudi Arabia" has an inspiring natural prospective for renewable energy. One of them is hydroelectric energy, and its local consumption in power will be increased to three-fold by 2030. At the moment, the Kingdom of Saudi Arabia is not exploring yet all opportunities in renewable energy area. This project can contribute to the development of renewable energy in form of hydroelectric option from water transmission system. In COMPANY, The sources of hydroelectric energy from a large pipeline, of about 8' to 100' with more than 5 MCM per day of water increase the potential energy of water and the amount of generated electricity. The project aims to surpass the operating conditions of the system by reducing its power consumption. It is expected to reduce the operation cost by harvesting energy from the water transmission system and using it efficiently.

## **Goals and Objectives**

The main objective of the project is to investigate the feasibility of incorporating energy recovery systems by using an in-line hydro turbine instead of throttle pressure by control valves in transmission systems. operating water transmission systems with minimum energy consumption, and low cost. To attain the significant purpose of this project, some specific objectives were structured to:

- Evaluate selected existing systems of water transmission, highlight their limitations, and then propose improvement schemes.
- Develop and implement the recovery devices to harvest energy.
- Evaluate the operating costs for the water transmission system.
- Study the improvement feasibility.
- implement the improvement.

## Project Methodology

The objectives of the Project were achieved through the following steps:

1. Collection of required data for water transmission systems as shown in Table 2.
2. Analysis of the data based on criteria given in Figure 1.
3. Performance analysis of the hydraulic system in selected transmutation pipeline systems.
4. Selection of stable turbine based on available “head” in selected transmissions pipeline systems.
5. Calculation of the power generated from the recovery devise system.
6. Development of an economic feasibility study.

The above phases of project were completed using latest technology as well as economic specifications of the system components.

## Collection of Water System Data

The required water system data are shown in the table below:

Table 1: The data of the collection of the water system

|                       |                              |                       |
|-----------------------|------------------------------|-----------------------|
| Length of Pipelines   | Type of Systems              | Profile of systems    |
| Wall Thicknesses      | Diameter                     | Flow Rates            |
| Water Quality         | Efficiency of Pumps          | No. of Pumps          |
| No. of Pumps Stations | Head of The Systems          | Operations Conditions |
| Type of Lining        | Control points and locations | Route of Pipelines    |

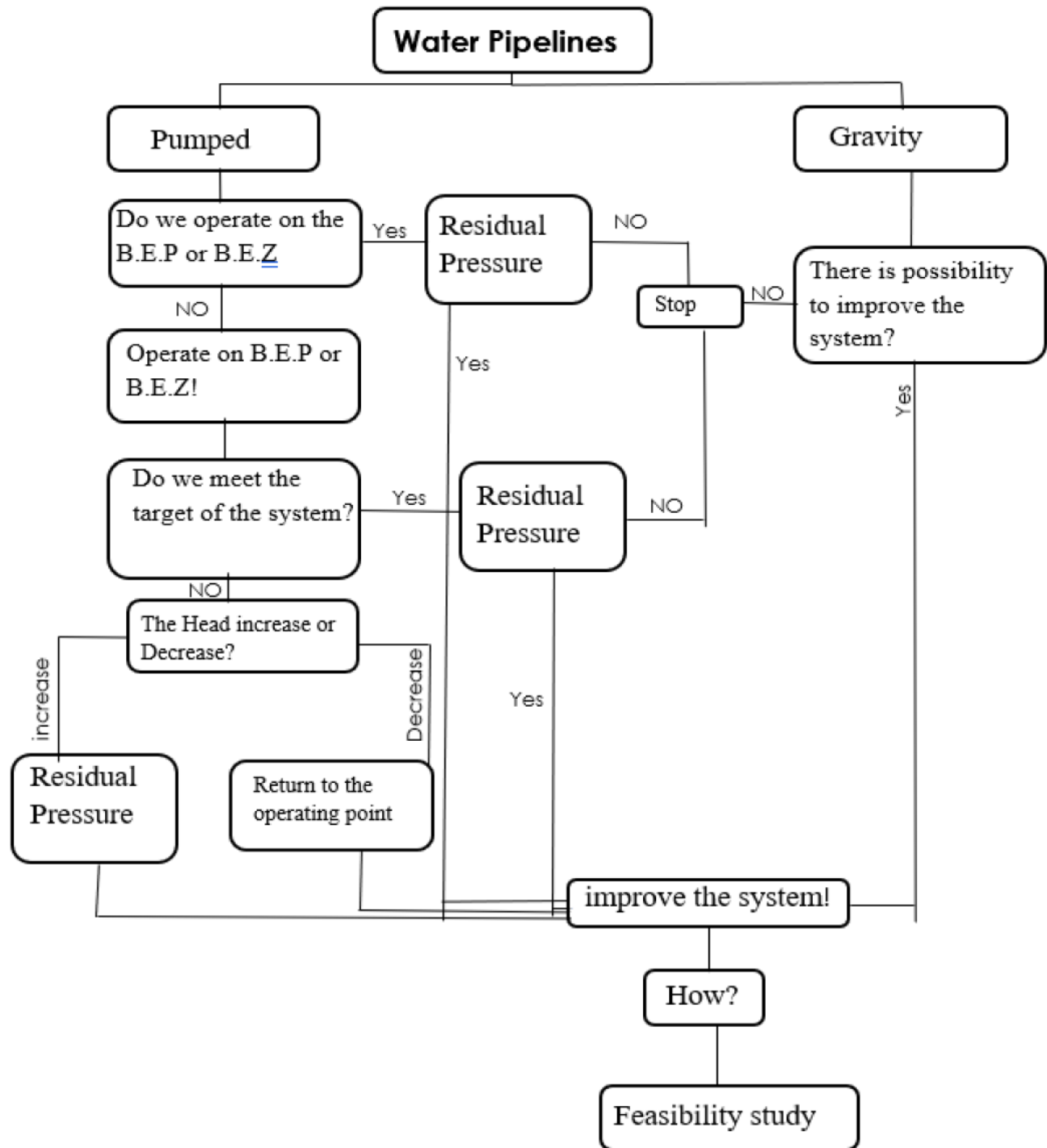


Figure 1: Flow chart for data analysis

## Description of Water Transmission systems for Energy Harvesting (Prototype)

The CF2A Transmission System supplies the existing Terminal Groups with water from the existing storage area. The starting point of all CF2A will be a new outlet manifold at the reservoir area of high point. The operation for the CF2A is carried out by gravity flow. The Line CM2A with a length of approximately 50 km from HPT-AB at 700 mals to station TG-S at 630 mals with 80" and 2032 mm steel pipes and maximum design flow 482,000 m<sup>3</sup>/day. The pressure requirement at TG-S is 2 bar inlet pressure. Figure 2 shows layout of Water Transmission Systems for Energy harvesting.



Figure 2: Layout of Water Transmission Systems for Energy harvesting.

### Hydraulic Analysis:

hydraulic and power analysis is applied for CF2A pipeline. According to the gathered data, the daily pattern of consumption for flow and pressure gravity system CM2A is presented in Table 3

Table 3 Reading for flow and pressure for CF2A

| OUTLET STATION |                      |                         |                         | INLET STATION         |                         |                         |
|----------------|----------------------|-------------------------|-------------------------|-----------------------|-------------------------|-------------------------|
|                | Inlet pressure (bar) | Flow(m <sup>3</sup> /h) | Flow(m <sup>3</sup> /s) | outlet pressure (bar) | Flow(m <sup>3</sup> /h) | Flow(m <sup>3</sup> /s) |
| Average        | 0.56                 | 12431.50                | 3.45                    | 4.74                  | 12197.97                | 3.39                    |
| Max            | 0.90                 | 15700.00                | 4.36                    | 5.30                  | 13790.00                | 3.83                    |
| Min            | 0.50                 | 9707.00                 | 2.70                    | 4.00                  | 9530.00                 | 2.65                    |

In the hydraulic analysis, the calculations of friction loss and maximum flow rate are considered.

### Results of the hydraulic analysis for CM2A

The total head losses between the HPT reservoirs and the inlet of TG-S, showing the design flow of 5.3 m<sup>3</sup>/s, the maximum operation flow 4.36 m<sup>3</sup>/s with HPT reservoirs full and the pipe roughness.

$K_s = 0.1$  mm.

Figure 3 shows the hydraulic gradient line for CM2A with the average flow operations; any further calculation for maximum flow operations is considered.

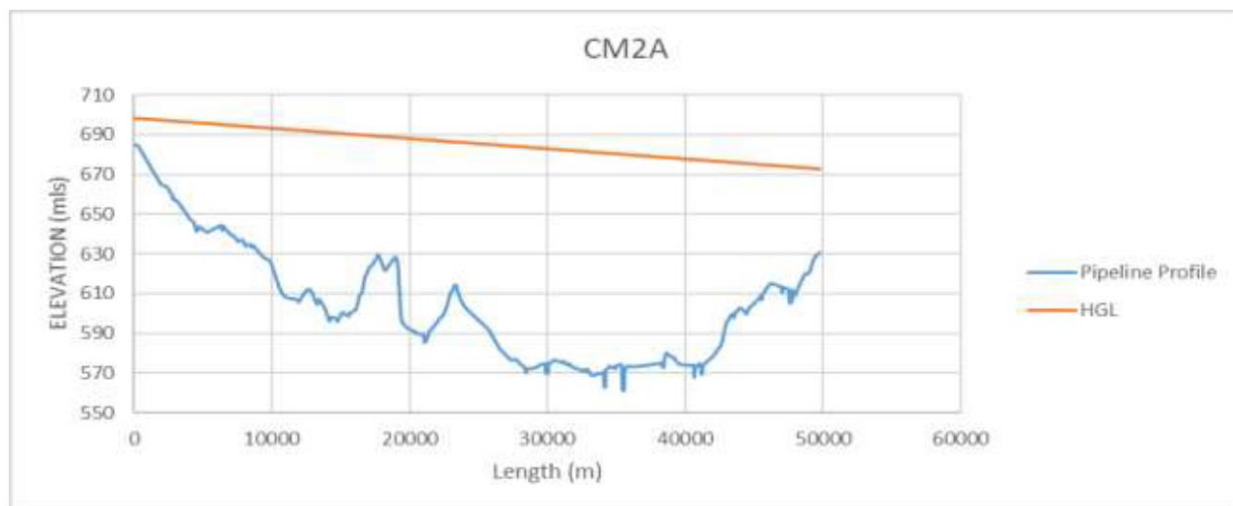


Figure 3: hydraulic gradient line for CF2A.

## COST BENEFIT ANALYSIS

In this section, the Net Present Value method is used for the economic analysis and the input parameters are given in Table 4:

Table 4: Parameters for the economic analysis

|                            |          |
|----------------------------|----------|
| Cost of power per kW       | 0.27 SR  |
| inflation rate for Turbine | 7.5 %    |
| inflation rate of Power    | 2 %      |
| Life Time (n)              | 30 Years |

Summary of cost-Benefit analysis:

| Flow (m3/s)            | Power (KW) | OPAX (SR/Year) = 0.27 (IN-Come) | CAPX (SR)    | NPV (SR) (30 Years) | Payback Period (years) |
|------------------------|------------|---------------------------------|--------------|---------------------|------------------------|
| Design = 5.3 m3/s      | 1037       | 1,684,304.02                    | 3,800,000.00 | 50,529,120.65       | 2.2                    |
| Average = 4.24 m3/s    | 893        | 1,321,814.32                    | 3,800,000.00 | 39,654,429.51       | 2.9                    |
| Economical = 3.71 m3/s | 731        | 1,140,569.46                    | 3,800,000.00 | 34,217,083.93       | 3.3                    |

## Major Project Milestones

The following are the major project milestones identified at this time. As the project planning moves forward and the schedule is developed, the milestones and their target completion dates will be modified, adjusted, and finalized as necessary to establish the baseline schedule.

| Milestones/Deliverables              | Target Date |
|--------------------------------------|-------------|
| Project Charter                      | 01/03/2020  |
| Project Plan Review and Completion   | 01/03/2020  |
| Gather requirement                   | 03/03/20xx  |
| Study Stage                          | 04/04/20xx  |
| Mobilization                         | 06/06/20xx  |
| Site Construction                    | 08/09/20xx  |
| Start of Supervision of Installation | 11/03/20xx  |
| Start of Commissioning               | 12/23/20xx  |
| Handover                             | 12/23/20xx  |

## SWOT ANALYSIS

| SWOT Analysis                                     |                                    |
|---------------------------------------------------|------------------------------------|
| Strengths (Internal)                              | Weaknesses (Internal)              |
| Aline with strategic plan of COMPNY               | No internal software for modeling  |
| Provide Cheap energy                              | Lack of data                       |
| Operate systems in high effectiveness             | Funding                            |
| Environmentally Friendly                          |                                    |
|                                                   |                                    |
| Opportunity (External)                            | Threats (External)                 |
| Lead the market in Hydro-power                    | Cost of instrumentation            |
| Increases profit income                           | Cost of operations and maintenance |
| Self-Power systems                                | Coordination for Project           |
| Encourage research of hydro-power in Saudi Arabia | Time of procurement                |