People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific

University of Kasdi Merbah Ouargla

Institute of Technology

Applied Engineering Department

Thesis of

Professional License

Domain : Science and technology

Field : Industrial Hygiene and Safety

Specialty : Health, Safety and Environment

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Theme

Study of risks applied on photovoltaic power plant of El-hadjira

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Discussed day : 11/06/2022

University year : 2021 – 2022

DEDICATIONS

I dedicate this work to my family especially

my father: SALI Abderrahman

and my mother: HAOULA Meryamma

I would like to thank them for every single thing they did for me since a was born until now, because I know how much they suffered to make me the person who I am today, and I thank God for making me their son.

I would like to dedicate this work to my teachers and schoolmates since the beginning of my school life until now.

Sali Nassim

DEDICATIONS

I want to dedicate this work to all of my family members especially my parents BENNOUNA Abd Errazak

NOUI Haffida

they sacrificed a lot and did all they can in order to make me the person that I have been and reach where I am now I want to thank them from all of my heart and to all of my brothers and sisters my back up in life and for each and every close person to me and to my heart I want to thank them for everything and special thanks to all of my friends the beloved ones and classmates and teachers during the whole of my studying career from the first day in the primary until the last minute at the university they are piece of my heart and they will never be forgotten. At the end praise be to Allah.

BENNOUNA Mohamed El Amine

ACKNOWLEDGEMENT

Alhamdulillah

First of all we would like to thank God for giving us the courage and patience to go through all the hardest and the most difficult moments in order to de this modest work, thanks Allah for showing us the way of success.

Our sincere thanks to Mr. MAHBOB Mohamed Abdelbasset for his help, advice and assistance during the work period. Thanks for giving us this chance to work with you.

We would like to thank the photovoltaic power plants "SKTM Elhadjira" director Mr. PETER Abdelkader for letting us do our studies in it.

We would like also to thank both of Mr. REBOUH Salah and Mr. RBIHA Amin for guide us during the internship and giving us all the information we come for.

We would like to thank all the institute's employees (administrators, teachers and workers), for helping us throughout our study period at the institute of Technology, whether with advice or providing good conditions for study.

Thank you all

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a-Si	Amorphous Silicon
AC	Alternative Current
BOS	Balance of System
CdTe	Cadmium Telluride
CIGS	Copper Indium Gallium Selenide
DC	Direct Current
GRTE	Société de Gestion du Réseau de Transport de l'Electricité
GRTG	Société de Gestion du Réseau de Transport Gaz
PPE	Personnel Protective Equipment
PV	Photovoltaic
SADEG	Société de Distribution de l'Electricité et du Gaz
SKTM	Sharikat Kahraba wa takat moutadjadida
SPE	Société de Production de l'Electricité
UPSE	Unité de Production Sud Est
UPSO	Unité de Production Sud Ouest

GENERAL INTRODUCTION

Electricity is one of the basics of life today and it cannot be abandoned, because stopping the production of electrical energy for a moment can cause many problems and perhaps financial losses for consumers. But at the same time, the production of electrical energy by using fossil energies (oil, coal, natural gas, etc.) has many bad effects on the environment as **(1)**

- Global warming.
- The atmospheric pollution.
- Acid rains.
- The black tides.

In order to avoid these effects, the world has turned towards the production of electrical energy by relying on renewable energy such as solar energy, wind energy, hydro energy, etc.

Algeria is one of the countries that relied on renewable energies in order to meet its needs of electrical energy by constructing photovoltaic power plants such as El-hadjira photovoltaic power plant.

The study of risks is an essential step in risk management at any industrial organization, so we did this thesis in order to study the risks at El-hadjira photovoltaic power plant.

Our thesis is divided into three (03) chapters:

In the first chapter we describe all the components needed in the photovoltaic power plant in general and also the different systems and technologies.

In the second chapter we present the company SKTM of production electrical energy by using the renewable energies especially El-hadjira photovoltaic power plant.

In the third chapter we explain all the risks related to the production of the electrical energy in a photovoltaic power plant. After that we do a study of risks on El-hadjira power plant and propose recommendations in order to eliminate or reduce the probability of occurring for this risks, and in the end we have a general conclusion.

CHAPTER 01 : General Description Of PV Power PLANTS

GENERAL DESCRIPTION OF PV POWER PLANTS

1.1. **Introduction :**

In this chapter we are going to introduce the different components, systems and technologies used in a PV power plant in order produce an electrical energy.

1.2. **Solar energy :**

It is an energy comes from the sun as light or heat. This energy converts into useful energies (electrical energy) by using some technologies. **(2)**

1.3. **Solar radiation :**

It is all the electromagnetic waves emitted by the sun, it can be **(3):**

- Direct radiation (comes directly from the sun without diffusion in the atmosphere).
- Diffuse radiation (the radiations that face obstacles in the atmosphere such as clouds and dust).
- Reflexive radiation (It is the part of solar illumination reflected by the ground and it is depend directly on the nature of the ground).
- Global radiation (it is the superposition of the three radiations direct, diffuse and reflexive radiation. This radiation used to determine the efficiency of the PV cells).

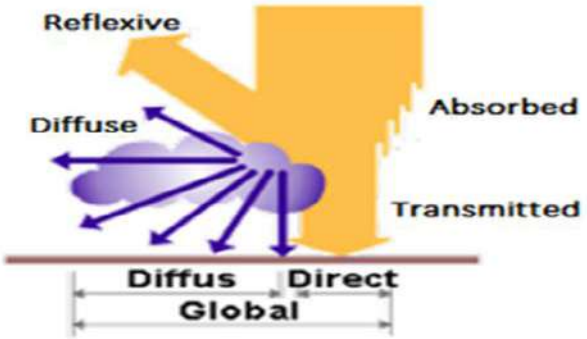

Figure 1.1. Solar radiation components

PV cell :

Also called a solar cell, is the basic component of a PV power system. A crystalline-based solar cell features a p-n junction , this junction has one positive side and the other side is negative. A single p-n junction form a DC voltage less than 1 volt. **(4)**

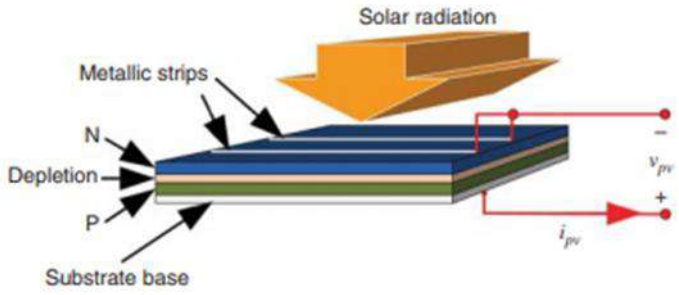

Figure 1.2. Typical crystalline PV cell construction

PV module :

It is called also PV panel and it's a group of PV cells (usually 36) connected in series and enclosed between a transparent cover (glass) and a weatherproof backing sheet (a thin polymer or glass). **(5)**

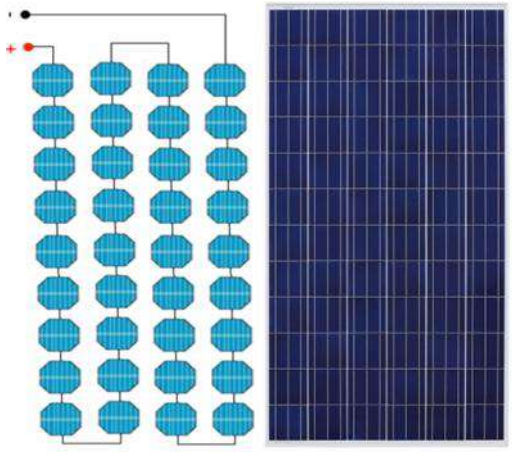

Figure 1.3. Typically of PV module

PV string :

It is a number of PV modules connected in series**. (5)**

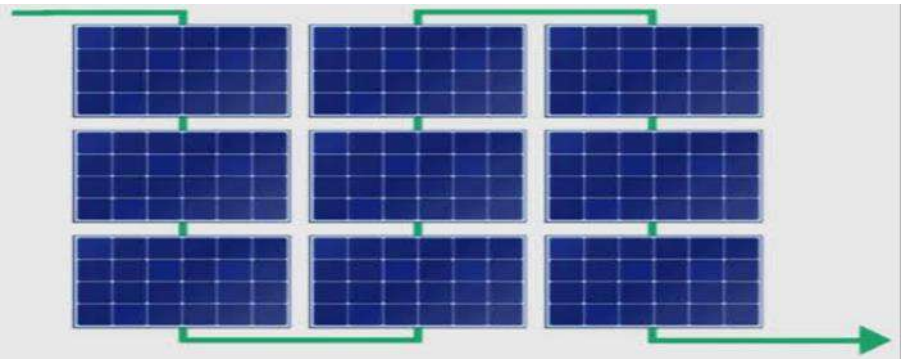

Figure 1.4. Typically of a PV string

PV array :

It is the connection in parallel between the strings, it measured by the electrical power it produces (watt, kilowatt, megawatt). **(5)**

Figure 1.5. A PV array

Junction box :

It is an enclosures used to protect the connections of cables that interconnect the PV strings and arrays. **(6)**

Figure 1.6. A junction box

Combiner box :

Wires that come from PV modules or PV strings run to a combiner box, this Wires can be a single conductor pigtails. The output of the combiner box is one larger two-wire conductor in conduit. The combiner box contains a safety fuse or breaker and also can include a surge protection. **(7)**

Inverter :

It used to convert the DC current that comes from the PV array or the batteries into AC current for the electrical appliances and/or to export the electrical energy to the AC grids. **(5)**

Transformer :

The role of the transformer is rising or lowering the value of the AC. **(3)**

Charge controller :

It is always be between the batteries and the PV array to protect the batteries from the overcharging or discharging, and it can provide information about the system state or metering the use of electricity. **(5)**

Batteries :

It used to store the electrical energy for the operations in the night time or during the prolonged days without sunshine (cloudy days). There is two most common used type of batteries **(5)** :

Lead-acid batteries.

Alkaline batteries.

NB: In a standalone PV system, the days of relying on batteries as a main source of electrical energy without any energy from the PV arrays are called “autonomy” days.

Figure 1.7. Battery bank

Balance of system (BOS) :

In addition to the above components there are another components called Balance of System (BOS) equipment. The most common components are mounting structures, tracking systems, electricity meters, cables, power optimizers, protection devices, switches, etc. **(5)**

1.4. PV systems :

There are two main PV systems: Grid-tied system and standalone system. **(5)**

- **Grid-tied :**

It also called grid-connected system. In this system there is no need to batteries, the PV arrays are connected directly to the inverter so if the consumption of power is less than the generating power, the excess will be exported into the energy utility grid.

Grid-tied system is mostly used in cities where the national power grid is available.

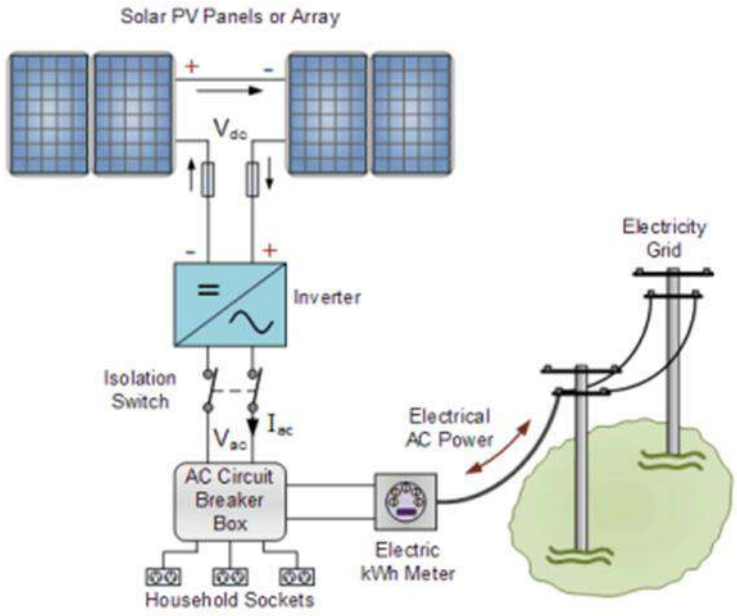

Figure 1.8. Typically of a grid-tied PV system

Grid-tied PV system benefits :

- A grid-connected system can be an effective way to reduce your dependence on utility power, increase renewable energy production, and improve the environment.
- System doesn't always require covering all electrical needs.
- Requires less surface area for panels and no batteries.
- Less expensive.

Grid-tied PV system drawbacks :

- Does not prevent grid power failures.
- Can be dealt with by small battery bank.

- **Standalone :**

Standalone or off-grid PV system has no connection to the electricity grid so is produce the electrical power to charge the batteries during the day for use it in the night because there is no solar energy in the night.

Off-grid system is the most ideal system for the electrification of rural areas or offshore sites, and most cost effective than pay costs to have a power lines from the local electricity company.

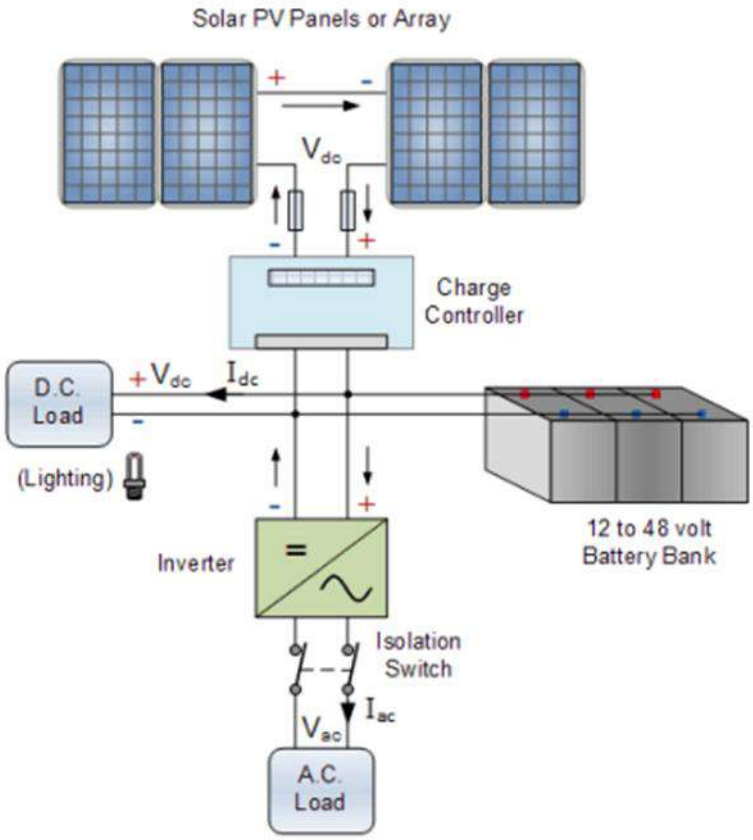

Figure 1.9. Typically of a standalone PV system

Standalone PV system benefits :

- System meets all electrical need for building.
- No connection to conventional power grid.
- Works in remote locations.
- Protection against power failures.

Standalone PV system drawbacks :

- Requires much more powerful system. It must produce more power than average consumption.
- Significantly more expensive.
- Could run out of power.

NB: There is a hybrid PV system called grid-tied with battery backup PV system. Grid-tied with battery backup PV system is used in the areas where there are frequent power outages either from the grid or due to the natural disasters.

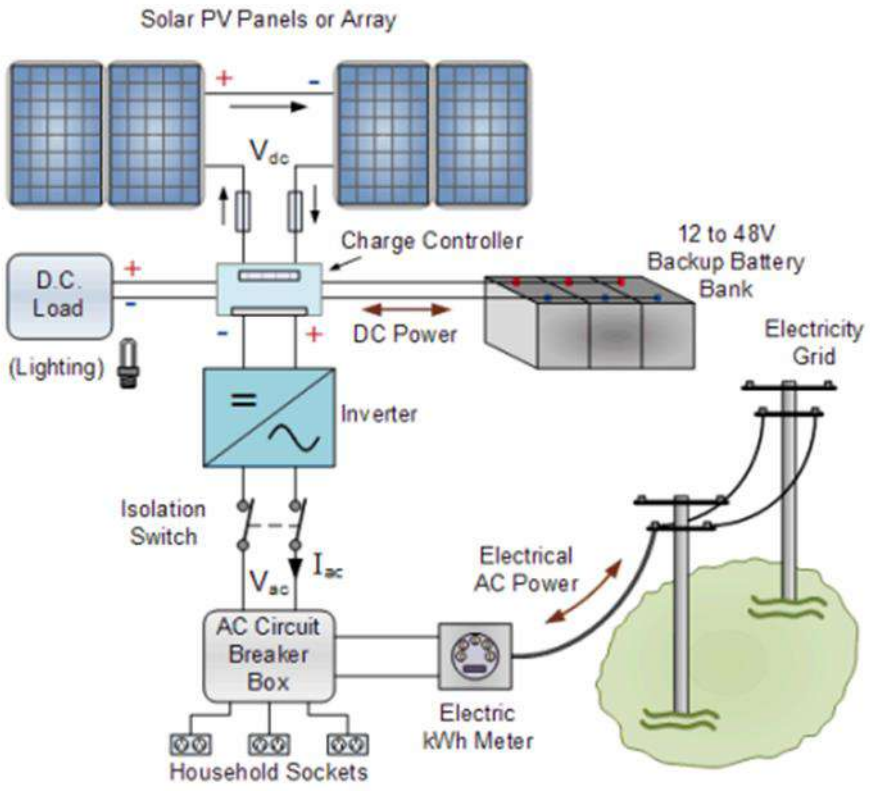

Figure 1.10. Typically of a grid-tied with battery backup PV system

- **Comparison :**

Table 1.1. Comparison between PV systems

	Stand Alone/ Off-Grid	Grid-Tied	Grid-Tied with Battery Backup
Complexity	**Introduction of batteries and backup generator increases complexity.**	**Less components in the system.**	**Introduction of batteries and backup generator increases complexity. Requires different inverter.**
Maintenance	**Batteries increase maintenance need. More than Grid-Tied but less than Grid-Tied with battery back-up.**	**Less than the other systems.**	**Depending on batteries. More than other systems.**
Life Span	**Decreased due to batteries.**	**Longer than other systems due to decreased complexity.**	**Decreased due to batteries.**
Energy/Economy	**No utility bills. Increased cost of system.**	**Net metering allows financial gains from the energy utility if feed-in tariffs are possible.**	**Net metering allows financial gains from the energy utility if feed-in tariffs are possible. Increased cost of system.**

Autonomy	**Autonomous System. If power from PV modules cannot produce enough power, batteries and backup generator cover the critical loads.**	**Relies upon grid. If grid fails, the system shuts down and energy produced is wasted.**	**Larger autonomy. If grid fails, backup power from batteries is used to cover critical loads.**

1.5. **PV technologies :**

There are two broad categories of technology used for PV cells **(6):**

- Crystalline silicon and it represents the majority of PV cells production.
- Thin film the newer technology and it is growing in popularity.

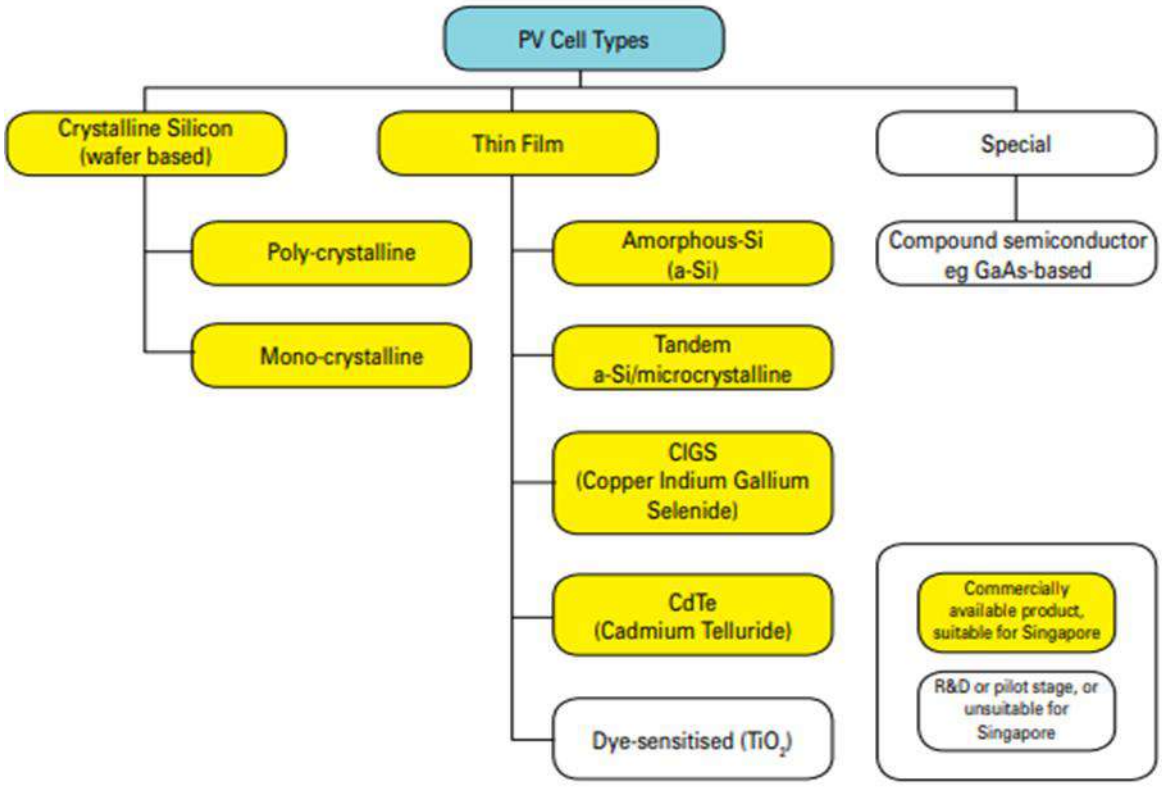

Figure 1.11. PV technology family tree

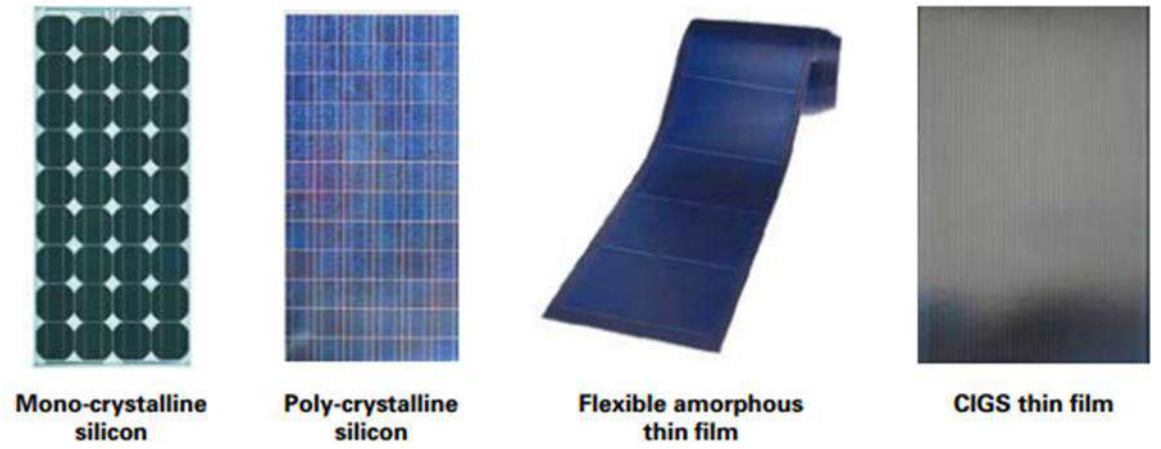

Figure 1.12. Common PV module technologies

1.6. **Conclusion :**

In this chapter we mentioned all the necessary equipment, systems and technologies for a photovoltaic power plant to produce the electrical energy.

CHAPTER 02 : PRESENTATION OF SKTM COMPANY & EL-HADJIRA PV POWER PLANT

PRESENTATION OF SKTM COMPANY & EL-HADJIRA PV POWER PLANT

2.1. **Introduction :**

Sonelgaz is now set up as an industrial group made up of 39 subsidiaries, its basic business subsidiaries ensure the production, transport and distribution of electricity as well as the transport and distribution of gas by pipeline.

The creation of the Sonelgaz group following a decision N°69 59 in July 1963 published in the Official Journal of the Algerian Republic on 08/01/1963

The basic subsidiaries of the group are:

- The Electricity Production Company (SPE).
- **Sharikat Kahraba wa takat moutadjadida (SKTM).**
- Electricity Transmission Network Management Company (GRTE).
- The Gas Transport Network Management Company (GRTG).
- The Algerian Company for the Distribution of Electricity and Gas (SADEG).

2.2. **Presentation of SKTM:**

Shariket Kahraba wa Taket Moutadjadida, SKTM.spa, is a conventional electricity production company for isolated networks in southern Algeria by renewable energies.

It is a 100% branch of Sonelgaz group. Created on April 7, 2013, by splitting the company SPE. Spa, its head office is based in Ghardaia.

SKTM divides into two production units:

- South west production unit (UPSO).
- South East production unit (UPSE).

2.3. **Organizational chart of SKTM :**

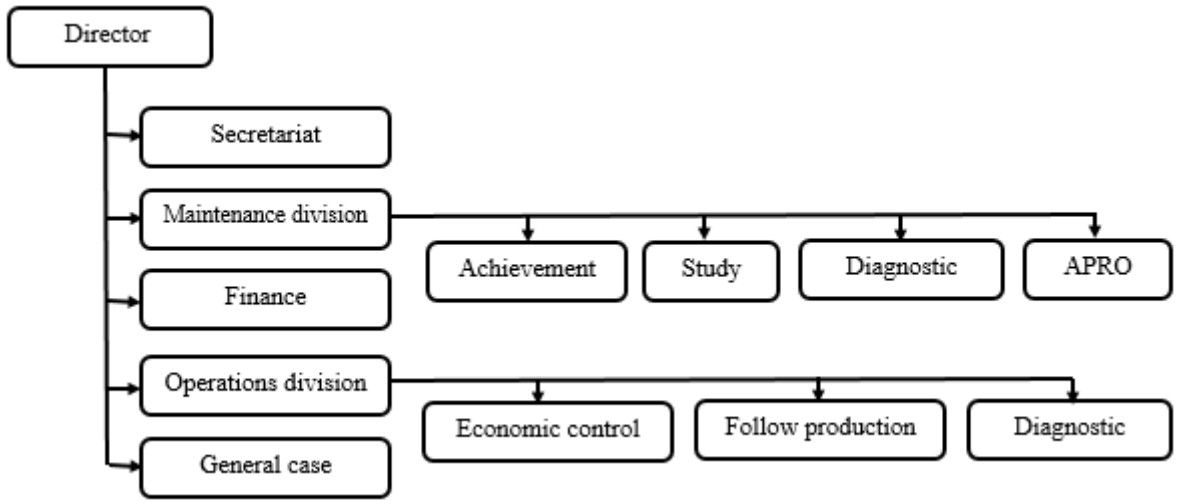

Figure 2.1. Administrative diagram of SKTM

Definition of South East Production Unit (UPSE):

The South East production unit was created in 2007 and located 160 Km from the capital of the wilaya of Ouargla, in the locality of Touggourt. It is domiciled at the headquarters of the national organization of the Mujahideen, November 1st road, downtown Touggourt,Algeria

2.4. **El hadjira PV power plant :**

2.4.1. Definition :

Electrical productive power plant that use renewable energy in the production process which is solar power with production capacity of 30MW.

Figure 2.2. Schematic of El-hadjira PV power plant

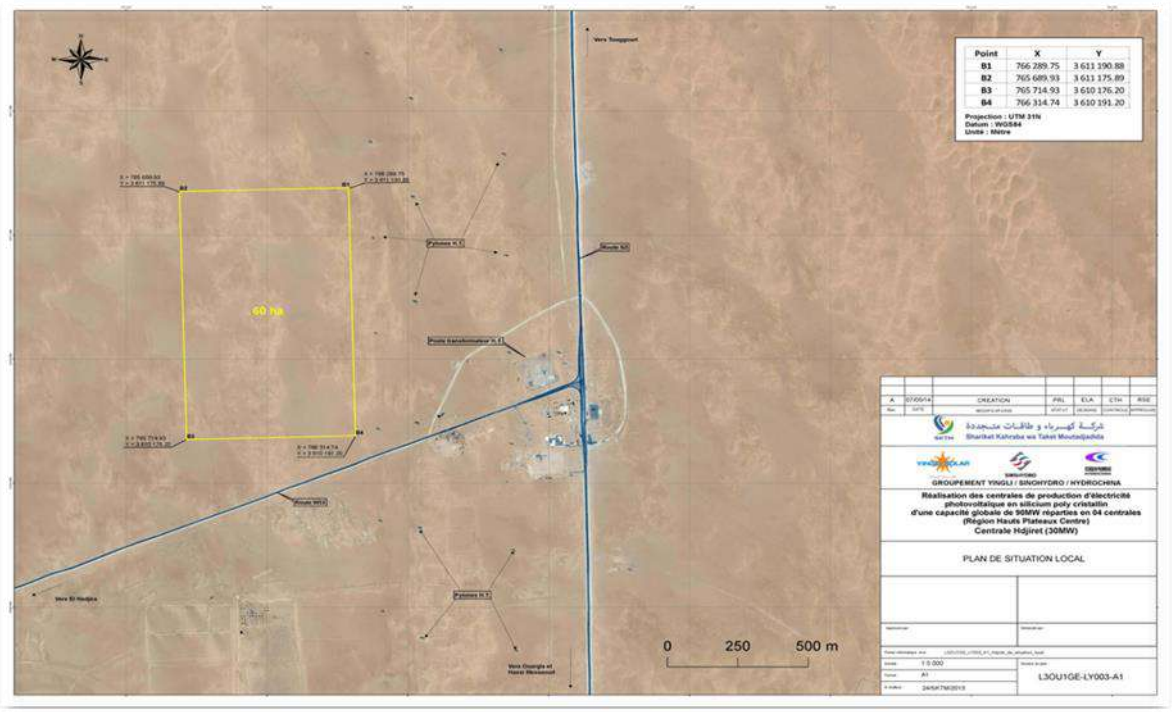

Figure 2.3. El-hadjira PV power plant localization

2.4.2. General information :

Table 2.1. General information of El-hadjira PV power plant

• Country	Algeria– W: Ouargla – local: El hadjira
• Geometric coordinates	32,35° N and 05,50° E
• Area	Sixty (60) Hectares
• Power Crete	30 000 KWc
• Injection voltage	30 kV
• Project manager and contracting authority	Shariket Khahraba wa Taket Moutadjadida -SKTM
• Builder	Group YINGLI/SINOHYDRO / HYDROCHINA
• Civil engineering	SARL HATEB Omar (Algerian company)
• Completion deadlines	Eight (08) months

Patterns of creation :

- Diversification of electricity production sources and development of means of production from renewable sources.
- Annual energy produced by the Photovoltaic plant is 52000 MWh / Year.
- Preservation of primary resources: saving fossil fuels; (approximately 9200 Tons/year of gas).
- Protection of the environment by reducing global warming gas emissions (30,000 Tons/year of reduction of CO_2 emissions).

2.4.3. Technology used in El-hadjira PV power plant :

Polycrystalline silicon panels

Polycrystalline cells are made from a block of crystallized silicon in the form of multiple crystals.

2.4.4. El-hadjira PV power plant equipment :

Photovoltaic generators :

- PV modules
- Supports
- Combiner box
- Electrical panels
- Wiring

DC/AC converters and transformation stations :

- Inverters
- Transformers
- Cells
- Electrical panels
- Wiring

Auxiliary systems :

- Emergency groups

- Battery charger rectifiers lightning
- Remote monitoring and anti-intrusion
- Detection and fire fighting

2.4.5. General description of the contents of El-hadjira PV power plant :

Table 2.2. The contents of El-hadjira PV power plant

Subfield Number	Module Type	Power of subfield	Number of modules/ subfield	Number of strings/ subfield	Number of modules/ chain	Module power	Module performance
30	Poly crystalline silicon	1MWc	4004	91	44	250W	15%

2.5. Conclusion :

We presented SKTM in this chapter and El-hadjira PV power plant and its affiliations, location, components, systems and the technology used in this PV power plant.

CHAPTER 03 : RISKS STUDY RELATED TO THE PV POWER PLANTS

RISKS STUDY RELATED TO THE PV POWER PLANTS

3.1. **Introduction :**

In this chapter we will define the general risks related to the PV power plant, and the risks we found in El-hadjira PV power plant, in the end we will propose a recommendations in order to addressing the company's safety shortcomings.

3.2. **Electrical risk :**

Accidental risks caused by direct or indirect contact with an electrical source and\or installation.

And there are three major paths of the electricity through the body (represented in the figure.16).

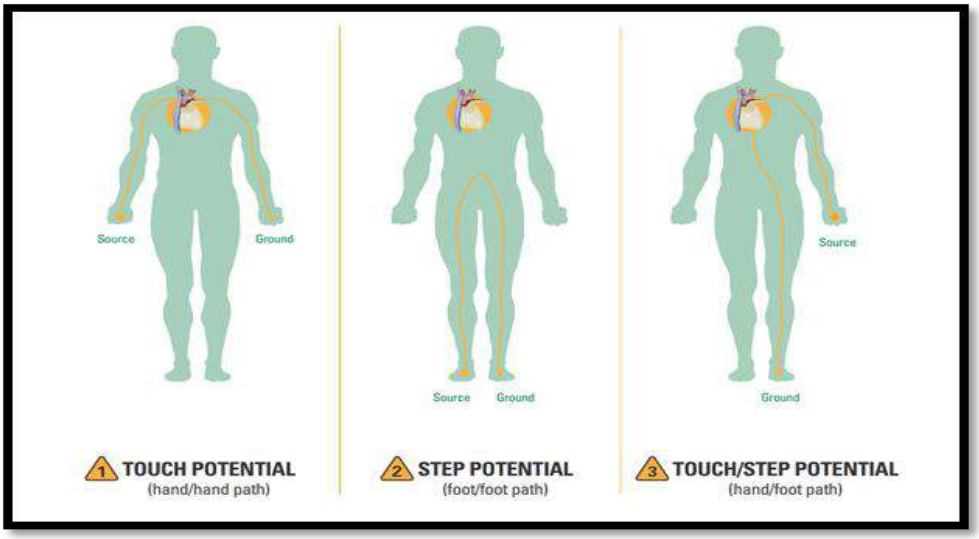

Figure 3.1. Electrical potential paths

3.2.1. Electrical injuries :

Electrocution : It is direct or indirect contact with the electrical source.

Electric choc : A contact with an electrical field which can cause **(8):**

- Severe burns.
- Convulsions leading to ventricular fibrillation and internal or fall-related injury.
- Numbness, tingling, paralysis.
- Vision, hearing, or speech problems.

Table 3.1. The electrical intensity level and their injuries

Electrical intensity (mA)	Exposition effects
0.5 – 3	▪ Tingling sensations
3 – 10	▪ Muscle contractions and pain.
10 – 40	▪ "let-go" threshold.
30 – 75	▪ Respiratory paralysis.
100 – 200	▪ Ventricular fibrillation.
200 – 500	▪ Heart clamps tight.
1500+	▪ Tissue and organs start to burn.

- **Exhibition modalities : (8)**

  - Electrical systems and tools that are not grounded or double-insulated.
  - Overloaded circuits.
  - Ladders that conduct electricity.
  - Wet equipment, location or worker.

3.3. **Explosion and fire risks :**

The ability of a product or subject that can be explode due to an over charge, and in PV power plants this charge is in shape of high tensions of electricity, the augmentation of temperature within the cables is the main source of fire that will lead to create an explosion. (8)

3.3.1. The characteristics of explosion risks :

Contains three main elements which are:

- Combustible: it's O2 of the air the element that triggers fire.
- Oxidizer: the element that react with fire here it's the electric cables.
- Energy source: in PV unlike the petrochemical companies electrical energy is the energy source of heat that allows this reaction.

And only under conditions which are:

- High tension circuits that produce over presser (A).
- Extremely high temperature levels (B).

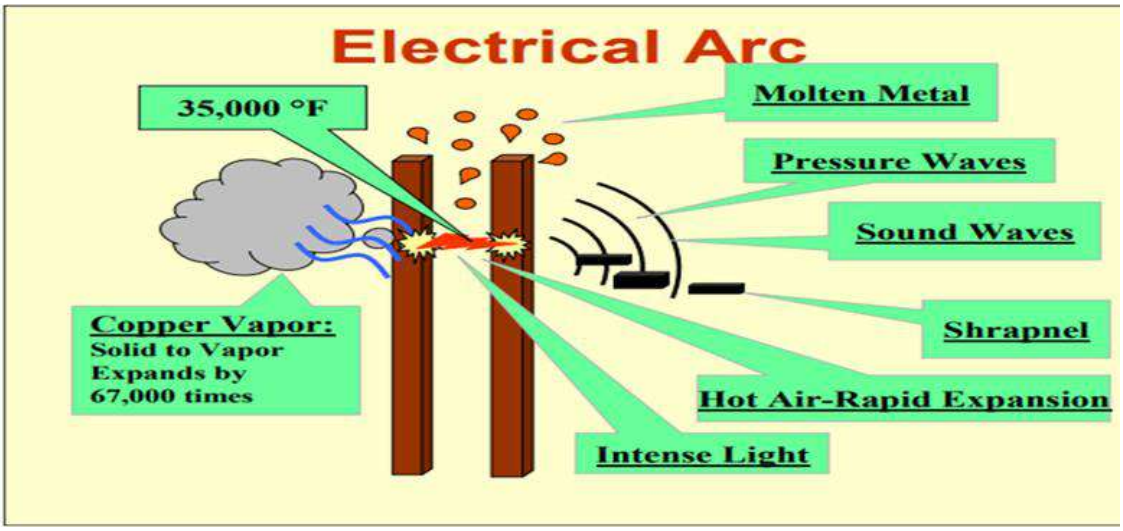

Figure 3.2. The effects of the electrical explosion

3.3.2. Exhibition modalities :

In PV explosion can happen over two cases:

- If electrical cables are up-to-date or poor quality.
- Overheated cables.
- Return of the electrical tension from the external lines into the circuit.

▪ **Explosion injuries :**

- In explosions any near person from the explosion zone will face the risk of death.
- Probability of death due to explosion around or equals 1.

3.4. Chemical risks :

It's the risk of being attached to a chemical product that have properties to cause severe damages to the organism or the skin. **(8)**

3.4.1. Chemical injuries :

- Allergies.
- Intoxications.
- Infections.

3.4.2. Exhibition modalities :

- The accumulation of gases that came from batteries in the chamber of batteries store without aeration.
- Dealing directly with PV panels that produce the amount of … from …

3.5. Manuel handling risk :

A risk related to the nature of the load (weight, volume, form…) in works that requires using bare hands. (8)

- **Manuel handling injuries :**

- Back pain.
- Paralysis (improbable and rarely happens).
- Abrasions.
- Fractures.

- **Exhibition modalities :**

  - Repetitive works of lifting loads.
  - Lifting load that is more than the capacity of the worker.
  - Working in non-helpful environment (ground condition, noise, non-stable ground…).
  - Working in bad vibe site (windy hot or very cold atmosphere, wet ground, poor lightning…).
  - Changing postures during lifting.

3.6. Environmental issues :

The external agents that related to the environment that can affect the production of the PV power plant. **(9)**

3.6.1. Exhibition modalities :

- **Plants:** plants can guard some of sunlight which reduce the absorption quantity for the cells.
- **Heat:** heat can effects in two ways:
  - PV cells requires an appropriate temperature if it decreased or increased it will affect the productivity efficiency of the panels.
  - Very hot temperatures can decrease life span of the cables that leads to the risk of facing an explosion.
- **Cloudy weather:** basically cloudy weathers interrupt the absorption of sun lights from PV cells.
- **Wind:** it may drive the captors to give a false detection because of dust.

Table 3.2. Safety measures

PV risks	Exhibition modalities	Preventive measures	Protective measures
	• Electrical systems and tools that are not grounded or double-insulated.	**- Formation and information of the workers about the tasks.**	**- Grounding arrangement of the electrical equipment and installations.**

Electrical risks		- **Limited access to certain sites.** - **Use non conductible equipment.** - **Signalization of danger sites.** - **Periodic inspection of sites.** - **Consignment and signalize it.** - **Respect the 5 roles.**	- **Use double insulated materials.** - **Using the required PPE for the job.**
	• **Overloaded circuits.**		
	• **Ladders that conduct electricity.**		
	• **Wet equipment, location or worker.**		
	Non-consignment installation.		
Explosion risks	• **If electrical cables are up-to-date or poor quality.**	- **Organize the alert and emergency response.** - **Check and control the power cables quality.** - **Add a cooling systems around the cables and installations.** - **Install airing system.**	- **Auto high tension interrupters.** - **Charge regulations.** - **Make a proper evacuation plan.**
	• **Overheated cables.**		
	•**Return of the electrical tension from the external lines into the circuit.**		
	• **The accumulation of H_2 that came from batteries.**		
Chemical risks	• **The accumulation of the batteries gases (H_2).**	- **Signalize the place.** - **Limit the access.** - **Install airing system** - **Wash your hands after u get out from the chamber.**	- **Wear mask when entering the chamber.**

manual handling	• **Repetitive works of lifting loads.** • **Lifting load that is more than the capacity of the worker.** • **Working in non-helpful environment (ground condition, noise, non-stable ground…).** • **Working in bad vibe site (windy hot or very cold atmosphere, wet ground, poor lightning…).** • **Changing postures during lifting.**	- **Reduce work duration.** - **Make the loads as the standards (25kg for men & 15kg for women).** - **Test the load before lifting it.** - **Investigate the place before lifting.** - **Inform the worker on the right gestures and lifting methods.** - **Periodical medical check**	**Use movable lifting machines in** - **Horizontal movements (wheelbarrows, fixed wheel skates…)** - **Vertical movements (elevator, forklifts…)**
Environmental issues	• **Plants.** • **Heat.** • **Cloudy weather.** • **False detection of captors.**	- **Eliminate all the unwanted species including plants and insects that came from them.** - **Replace the loss of cloudy weather with the batteries storage.** - **Install captors less sensitive and insure to be cleaned.**	- **Install auto regulation systems of heat and auto switch for batteries storage.**

3.7. Risk zones in El-hadjira PV power plant :

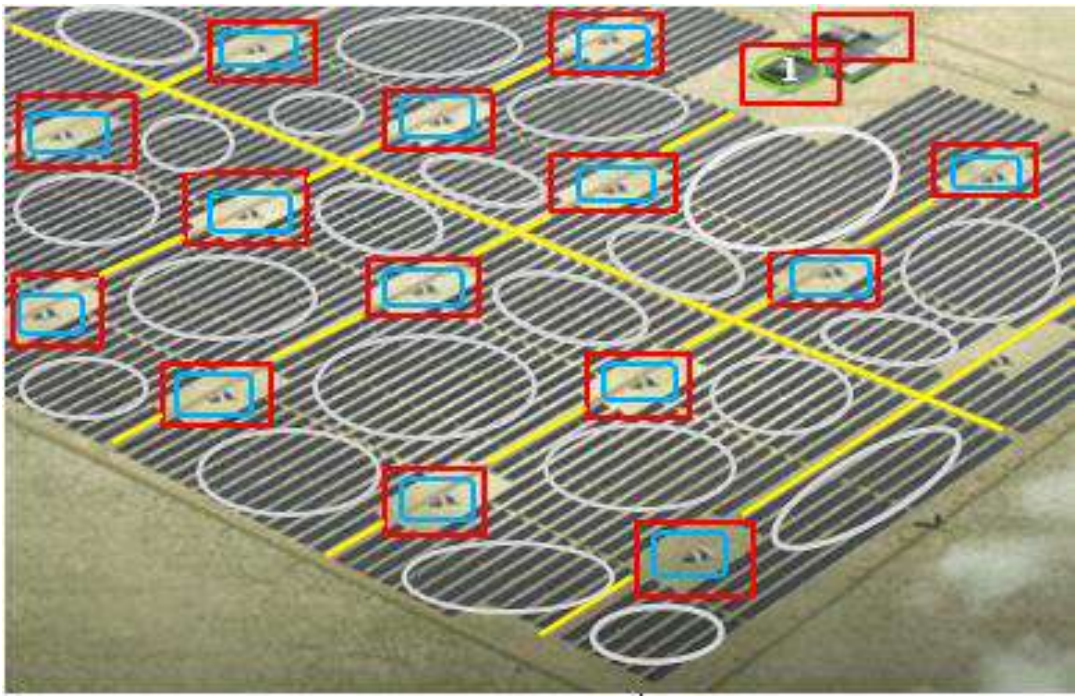

Figure 3.3. Risks zones

3.8. The existent safety measures of El-hadjira PV power plant :

Table 3.3. Zones, risks and safety of El-hadjira PV power plant

Risk zone	The nature of the risk	The exhibition modalities	Preventive measures	Protective measures
	Explosion risks	Augmentation of cables' temperatures.	• **Auto regulation system.** • **Ventilation systems.**	• **Auto interruption system (evacuation post).** • **Fire fighting.**
		Voltage return.		
		The existence of battery gases (H_2).		
	Electrical risks	Equipment maintenance.	• **Habilitation.**	• **Providing PPE.**

		Entering guests. False detection.	• **Consignation.** • **Limited access zones.**	• **Auto regulation system.**
	Circulation risks	Circulation of the lifting vehicles in the power plant.	/	/
	Manuel handling	Cleaning the surrounded are of the panels from dust.	• **Workers formation.**	• **Using trucks for moving loads.**
	Chemical risks	The accumulation of battery gases	• **Ventilation system.**	• **Wearing masks for entering the chamber of batteries storage.**
1	Ergonomic risks	Working using computers. Wrong postures.	• **Limiting the exposition duration to the computer.** • **Making two engineers for continuously check.** • **Formation about the safe use of lifting equipment and trucks.**	/

3.9. **Recommendations :**

Table 3.4. Corrective actions to El-hadjira PV power plant

Risks	Corrective actions
Electrical risks	- HSE induction. - Signalization of high voltage zones. - Respect the 5 roles.

Explosion risks	- Install a cooling system. - Sustainable quality check for the cables.
Chemical risks	- Signalization of the place. - Install of auto airing system.
manual handling risks	- Limiting work duration. - Inform the workers on the safest way to work.
Ergonomic risks	- Limiting exposition time to the computer. - Inform and sensibilise the workers.
Circulation risks	- Make a road for truck and another one for the workers.
Environmental issues	- Install cooling system. - Eliminate the unwanted plants that leads to the presence of the insects. - Reduce the sensitivity of the captors.

3.10. **Conclusion:**

In this chapter we identified the risks associated in PV power plants and what's related to PV El hdjira from them and where its located with mentioning the existent safety measures and some recommendations to improve the safety efficiency in the power plant.

GENERAL CONCLUSION

In this study project, we used all what we gained from skills and formations in order to apply it in reality with the cooperation of SKTM Company that allowed us to examine our studies in El-hadjira power plant to stand on the safety system of the PV power plant.

El-hadjira PV power plant is the responsible of local electricity for civilization or the near apartments power plants. PV power plants considered as the least dangerous power plants compared to the others and least vulnerable to risks so that more projects can be made in area of Touggourt-Ouargla because of the less harm that it can cause and more benefits that it can provide.

In 1st chapter we made a general definition of PV power plants with mentioning the equipment of their system, in the 2nd chapter we defined all of SKTM UPSE and PV power plant of El-hadjira, after that we moved to the 3rd chapter that contains general determination of the common risks in PV power plants and specialize the ones that related to the power plant that we were study and lastly we finished with safety measures of the power plant leaving some recommendations to improve the safety of the system.

At the end of it we hope that we could help the company first to notice some deficiencies that might not been taken in consider to approve the safety system of the power plant and to help the following students to take this project as reference for them.

ABSTRACT , RÉSUMÉ , ملخص

Abstract :

This study targets to identify the risks related to El-hadjira photovoltaic power plant in order to check the efficiency of power plants based on renewable energies to achieve the satisfaction and to improve safety within the power plant.

Firstly we made a general introduction to PV systems and system components

Secondly we defined Sonelgaz group and SKTM company following with El-hadjira PV power plant where our study has been made.

And then we defined the common risks PV power plants and specifying the risks that we witnessed in our internship specifically with a determination of risks zones.

At the end we finished our work with putting the existed safety measures and make some recommendations to improve theme.

Résumé :

Cette étude cible pour identifier les risques liés à la centrale électrique photovoltaïque d'El-hadjira afin de vérifier l'efficacité des centrales électriques basées sur des énergies renouvelables pour assurer la satisfaction et améliorer la sécurité dans la centrale électrique.

Premièrement, nous avons fait une introduction générale aux systèmes PV et composants du système.

Deuxièmement, nous avons défini le groupe Sonelgaz et la société SKTM, en suivant la centrale PV d'El-hadjira où notre étude a été réalisée.

Et puis nous définissons les risques communs aux centrales photovoltaïques et précisions les risques dont nous avons été témoins dans notre stage avec notamment une détermination des zones à risques.

A la fin, nous avons terminé notre travail en mettant les mesures de sécurité existantes et en faisant quelques recommandations pour améliorer le thème.

ملخـص :

تهدف هذه الدراسة الى التعرف على المخاطر المتعلقة بالمحطة الكهروضوئية بالحجيرة للتحقق من كفاءة محطات توليد الكهرباء القائمة على الطاقات المتجددة لتحقيق رضا السكان و تحسين مدى السلامة المهنية داخل المحطة.

أولا، أعددنا مقدمة عامة لأنظمة محطات الطاقة الكهروضوئية ومكونات النظام.

ثانيا، قمنا بتعريف مجموعة سونلغاز و شركة SKTM و ختاما المحطة الكهروضوئية بالحجيرة حيث تم اجراء دراستنا.

ثالثا، قمنا بتحديد المخاطر المرتبطة بالمحطات الكهروضوئية مع تحديد المخاطر المحتواة في محطة الحجيرة منها.

اخيرا، قمنا بانهاء العمل بذكر تدابير السلامة المتبعة في محطة الحجيرة و تقديم بعض النصائح و التوصيات لتحسين السلامة و مردودية المحطة.

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