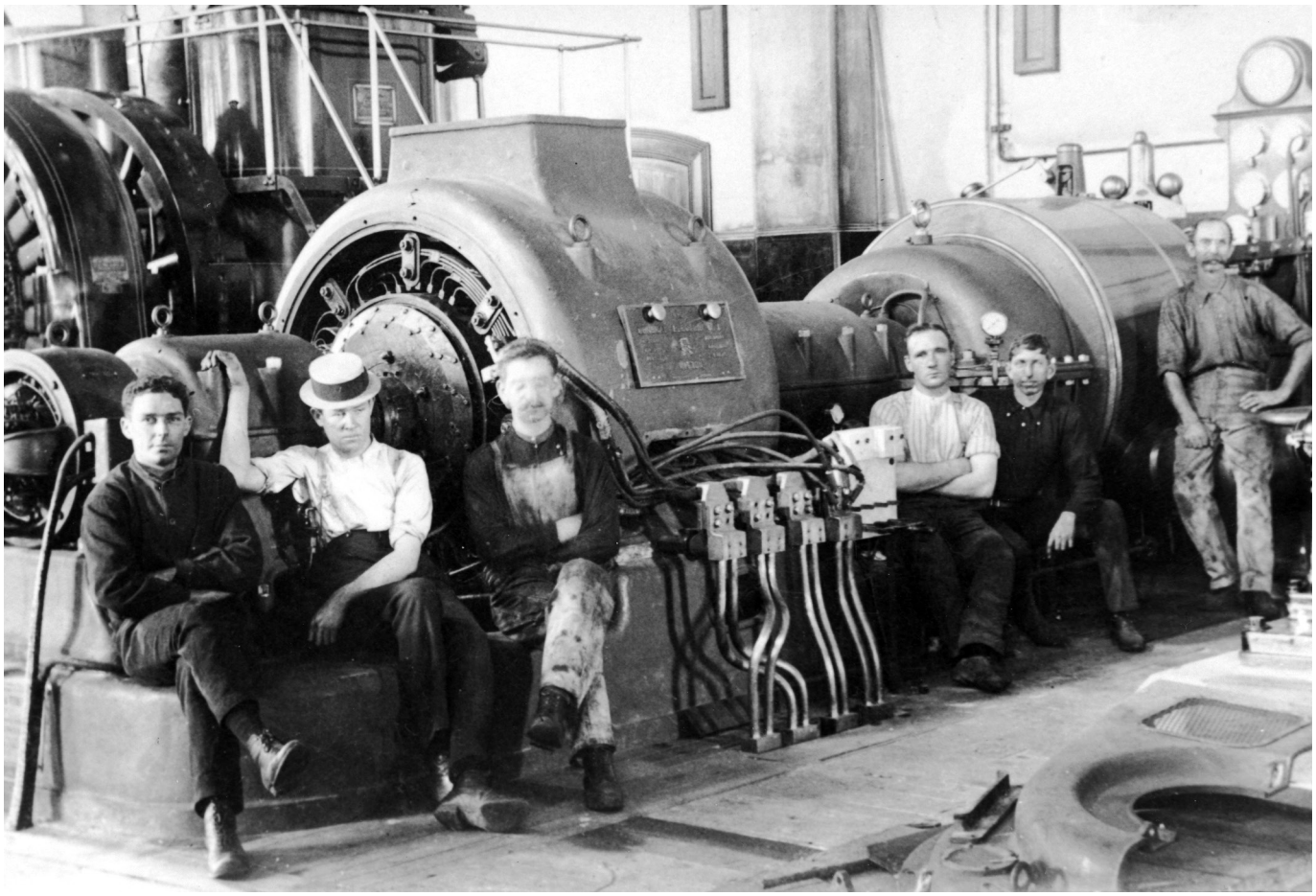

Turbo-Generators with Power House Employees. Source: Queensland Museum Network/Queensland Rail.

Generating Electricity: Past and Present

PHYSICS - ELECTRICAL ENERGY

QGC | FUTUREMAKERS | QUEENSLAND MUSEUM NETWORK | Queensland Government

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Need to know information

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC project aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

Australian Curriculum Links

While this resource has been developed to support the delivery of the Year 6 Science Curriculum, it is possible to connect learning with other year levels. You are encouraged to adapt the resource to meet your individual needs and learning context.

Year 6 Curriculum focus

Science Understanding

Physical Sciences

Electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources.

(ACSSU097)

Science as Human Endeavour

Scientific knowledge is used to solve problems and inform personal and community decisions.

(ACSHE100)

Science Inquiry Skills

Communicating

Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts.

(ACSIS110)

Introduction

This learning resource has been designed to explore the past, present and future of electrical energy, including its generation and ability to power movement around our vast state. The Workshops Rail Museum has been used to contextualise learning due to the site's strong historical connections with the generation and use of electricity.

Primary and secondary sources of information from The Workshops Rail Museum are used throughout the resource to stimulate inquiry into, and facilitate discussion about, topics and concepts associated with electrical energy.

As this resource has been designed to complement classroom-based teaching and learning experiences, students are assumed to have developed knowledge about the following concepts:

- Energy is the capacity to do work and can exist in a variety of forms.
- Electrical energy can be transferred to objects and transformed into different energy forms.
- Electrical energy can be generated from a range of sources. A number of these sources use kinetic energy to drive the movement of a turbine within a power station. The turbine rotates a generator which is used to generate electricity.
- A generator is a device that spins a magnet between coils of wire to create a steady flow of electrons. This movement generates an electric current that can be used to power varied objects.

Visit The Workshops Rail Museum to make history come alive with hands-on exhibits, multi-media encounters and colourful stories. Please contact The Workshops Rail Museum to make a group booking and refer to the Teacher Guide for additional information about the museum.

It is recommended that students complete the following activities independently or in groups of four.

The Future of Rail: A Design Challenge may also be used to complement learning experiences explored within this resource

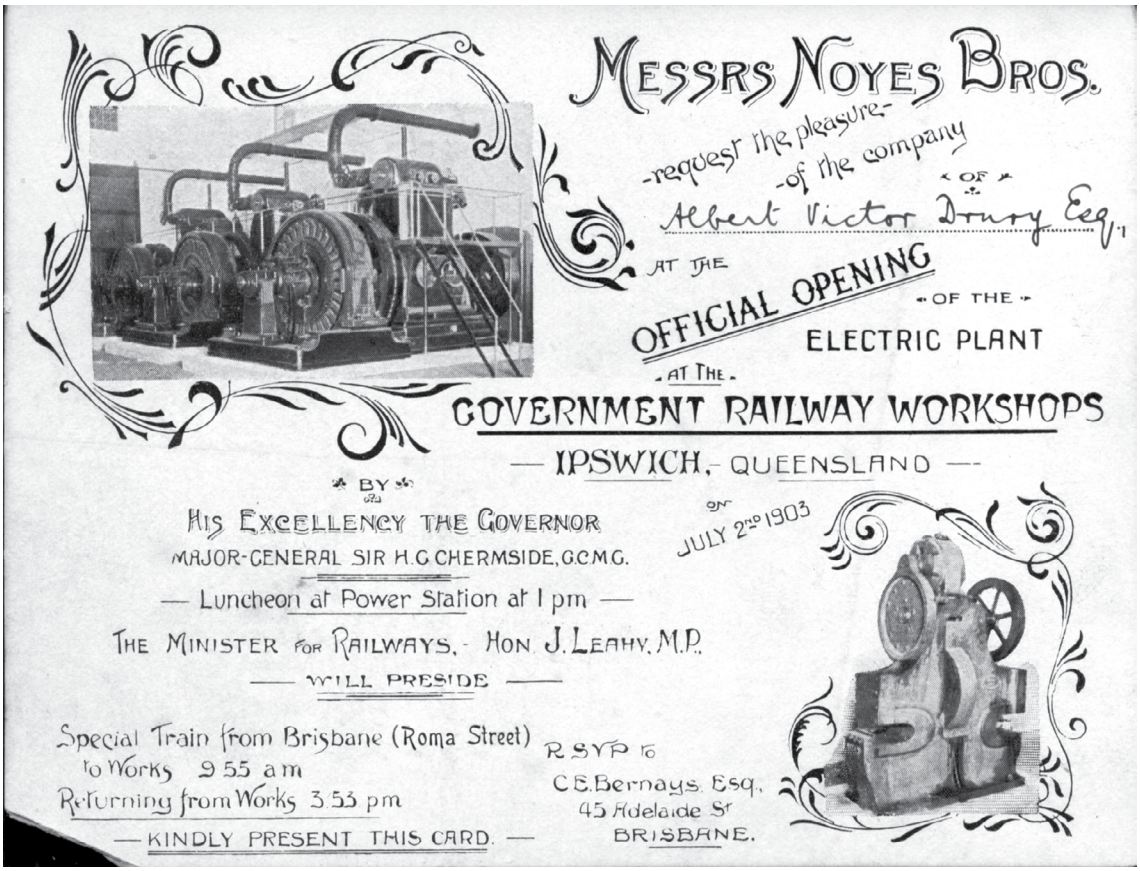
Part 1:
Develop Background Understandings

Museum Perspectives

In the earliest days of the Ipswich Railway Workshops, machinery used to construct railways and locomotives was driven by steam power. The site expanded rapidly in the late 19th century and electricity was seen as the key to its modernisation. The city of Ipswich had no electricity supply at this time, so the site built their own power station to meet increasing demands.

The Ipswich Power House officially opened on the 2nd of July, 1903. The site supplied electricity, compressed air and hydraulic pressure to power the machinery, tools and lights of the Ipswich Railway Workshops and was one of the first industrial complexes in Queensland to use electricity on a large scale. While the Power House is no longer operational, you can visit The Workshops Rail Museum or access Google Maps (search The Workshops Rail Museum) to view the building as it stands today.

Look closely at the invitation to the official opening of the Ipswich Power House.



Source: Image courtesy of Merv Volker

What can you infer about the invitee and the event based on the style and language used within the invitation?

Part 2:
Image Analysis

You will now take a closer look inside the Power House and examine a series of images taken of the site between 1902 and 1931.

Select one of the images on the following pages and use this image to think about, discuss and write down answers to the following questions:

1. Describe what you see:

2. When do you think this photo was taken? Why?

3. Identify the objects in your image. What role do you think the objects played in the generation of electricity at the Power House?

4. Can you identify any energy transfers or transformations that may be taking place within your image?

5a. Working at a power station can be dangerous. Identify and describe any potential safety issues or concerns you can see in your image.

5b. What could be done to reduce or eliminate these safety issues or concerns?

6. Write a caption for your image.

Share your image, caption and responses to the above questions with your class.

Compare and contrast your responses to the image information provided on the image analysis interpretation key.

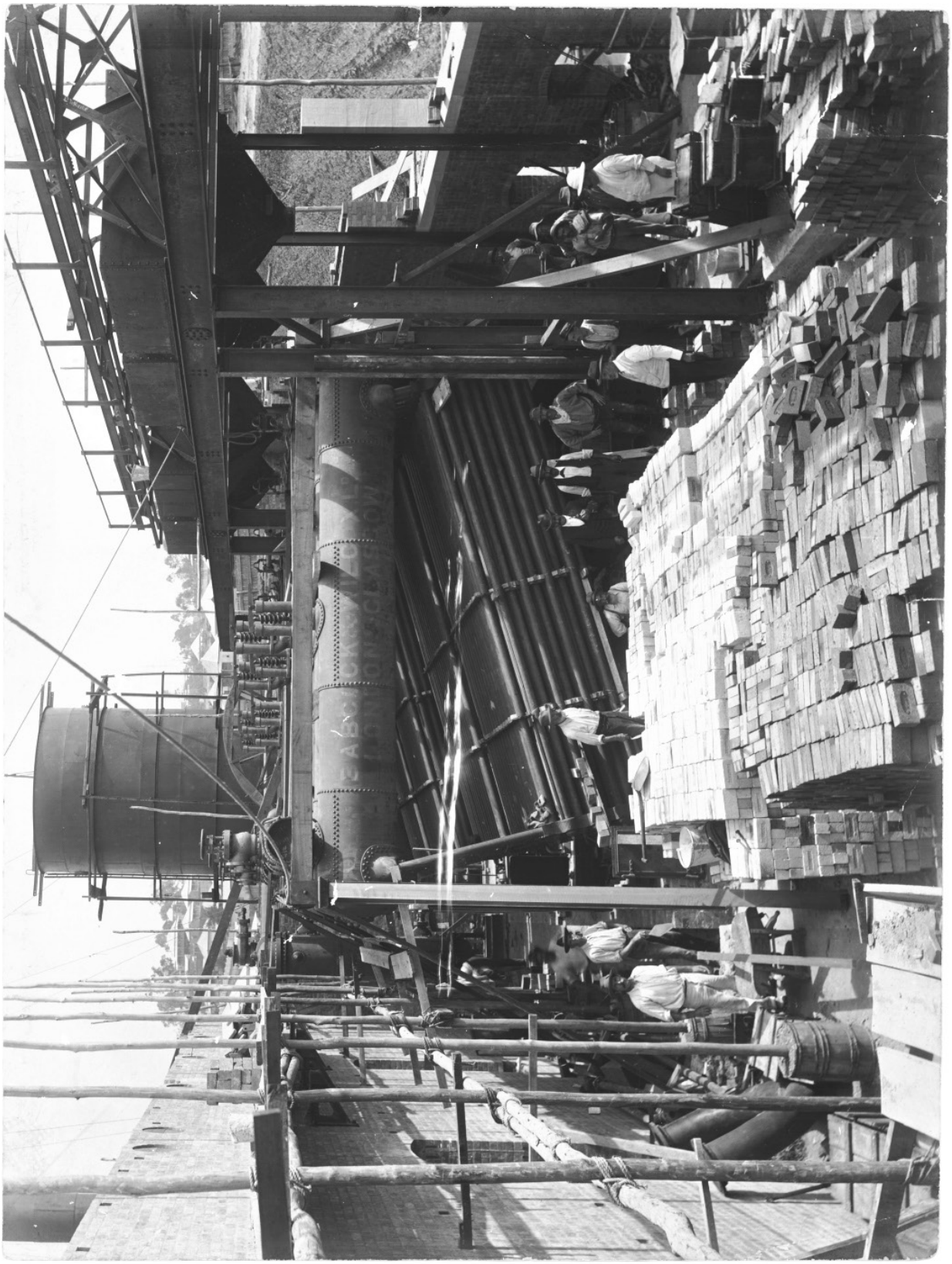


Image One *Source: Queensland Rail*

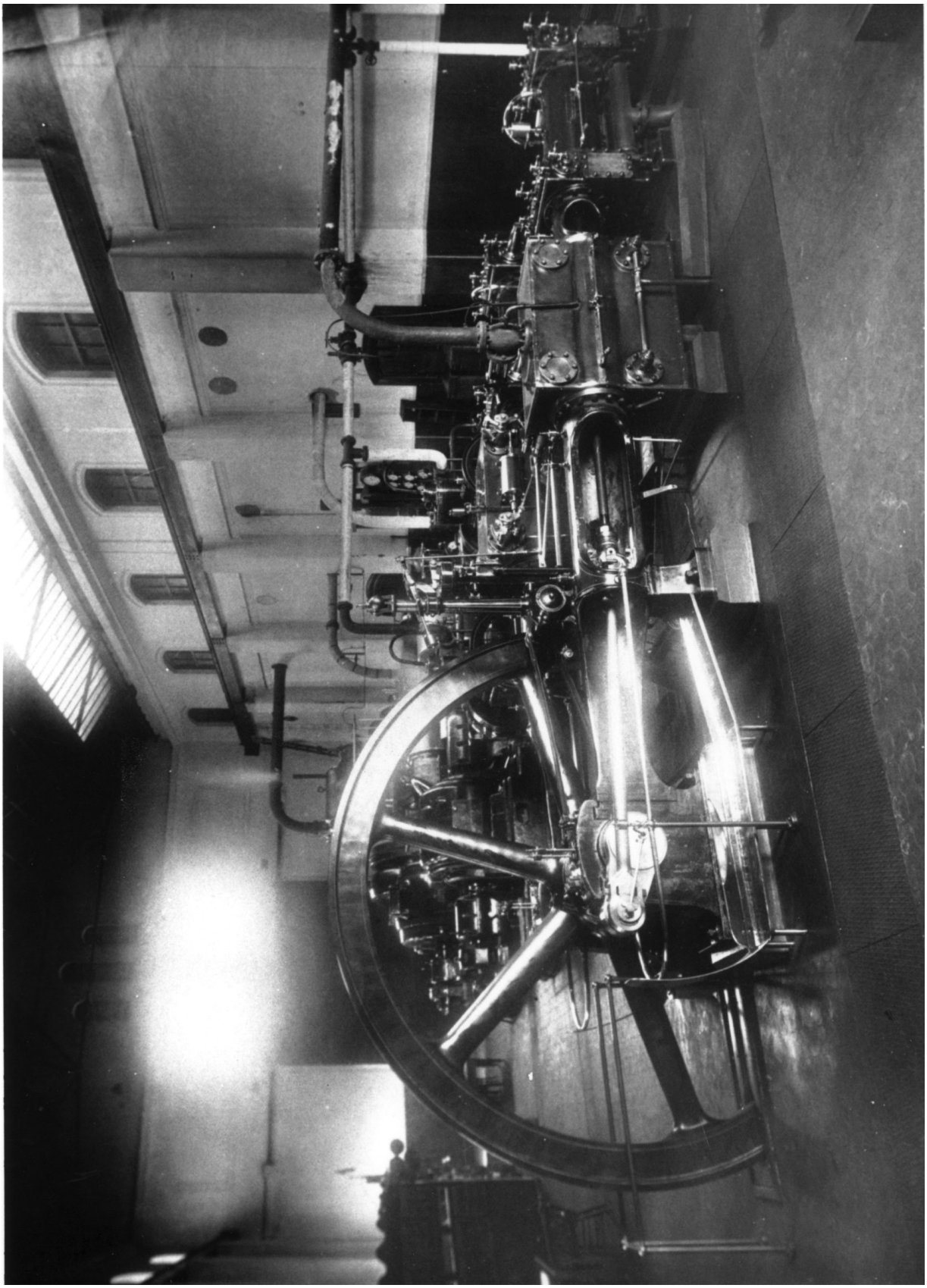


Image Two *Source: Queensland Museum Network/Queensland Rail*

Image Three *Source: Queensland Museum Network/Queensland Rail*

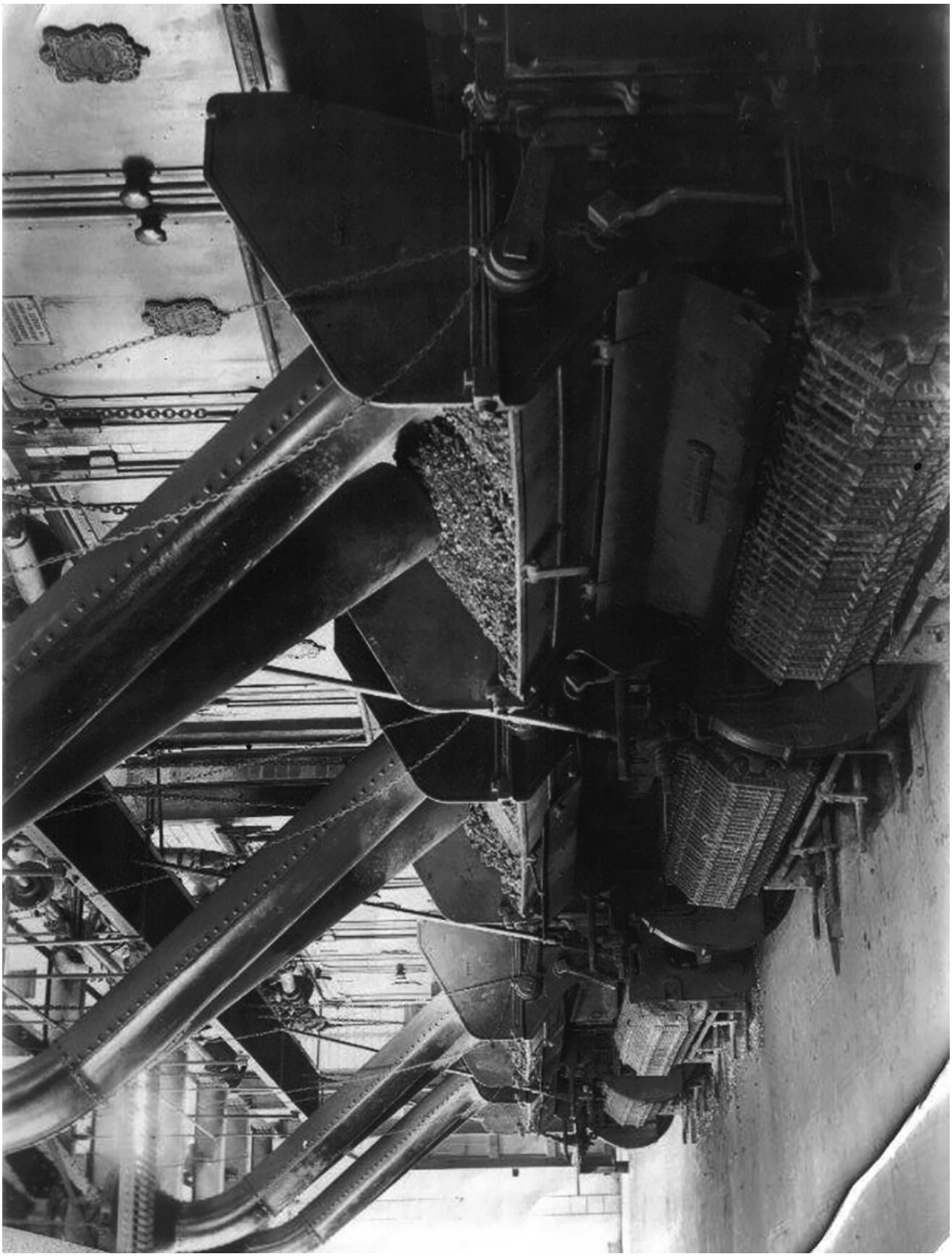


Image Four *Source: Queensland Rail*

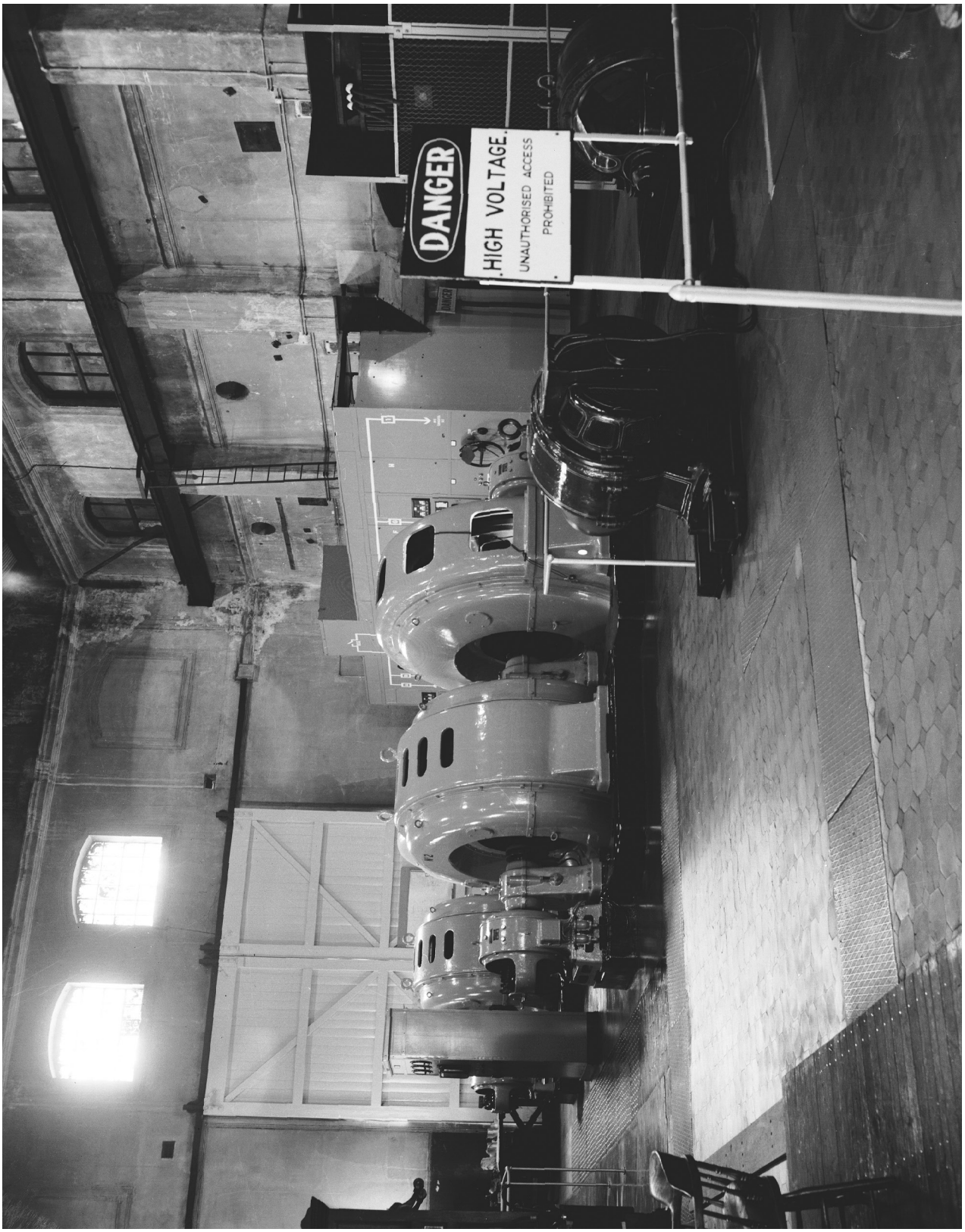


Image Five *Source: Queensland Museum Network/Queensland Rail*

Image Analysis Interpretation Key

Image One

Ipswich Power House Under Construction

- The Power House under construction in 1902.
- Babcock and Wilcox Ltd supplied the steam equipment for the site, including:
  - Four boilers (horizontal cylindrical shape in middle of image)
  - Cooling tower (vertical cylindrical shape in background of image)
  - Steel chimney (upper left corner of image)
- Four coal hoppers can also be seen in the upper right hand corner of the image.
- Brick walls were built above the hoppers and cooling tower. These walls, along with a roof, completely enclosed this section of the Power House after its completion.
- The cooling tower and chimney are no longer standing.

Image Two

Power House Machine Room Interior

- Image circa 1912 - 1916.
- Interior of machine room featuring:
  - Air compressor with its large fly-wheel (circular object towards image left)
  - Generators (box objects at the rear of the air compressor)
- The compressed air produced by the machine was used to operate tools such as hammers, drills and riveters.
- The air compressor no longer remains inside the Power House.

Image Three

Turbo Generators with Power House Employees

- Image circa 1912 - 1916.
- Power House employees are pictured with a new generator.
- The Power House reached its generation limits by June 1910; all three generators and four boilers were operating at full capacity to cope with increased power demands. This posed a serious problem: if a breakdown occurred there were no backup generators to continue the production of electricity.
- To cope with demand, a new 750 kW turbo-generator set was ordered in 1911 (pictured). The old generators were kept at the Power House as backup. A 1000kW turbo-generator was installed in 1915, allowing the Power House to meet its supply needs for several more years.

Image Four

Chain Grate and Boilers

- Image circa 1911.
- Coal was delivered by train and dropped into a large concrete trough. The trough had a number of openings inside it which could be opened and closed as required. The coal passed through the openings and into a continuous filler.
- The continuous filler directed the coal into a series of buckets, which were carried high across the boiler room floor. The coal was then dropped into a series of large chutes and deposited into steel bunkers. Eight chutes and four bunkers can be seen in the image.
- From here, the coal was fed through the bunkers into the chain grate stokers and then into the boilers (located behind the doors in background of image).

Image Five

New Power House Electrical Equipment

- Image circa 1931.
- As the electrical industry developed, the Workshops became out of step with newly standardised power levels in use across Australia.
- Two convertor sets were installed in 1931 to deal with this change (large round objects in middle of image). The sets consisted of a motor and alternator.
- The new equipment converted the 3-phase power now supplied from Brisbane to the 2-phase 60 cycle power used by the Workshops equipment.
- These convertor sets remain in place.

Source: Buchanan Architects. (2005). The Power House at The Workshops Rail Museum North Ipswich: A Conservation Management Plan. (n.p.).

Part 3:
Explore Further

Examine how Sarah Gallegos, an electrical engineer, and Mark Land, a production technician, work with electricity on a daily basis at the Curtis Island Liquefied Natural Gas (LNG) Plant.

Investigate and evaluate the sustainability and/or environmental impacts of electricity generation methods used at this site.