

Table of Contents

1.	INTRODUCTION: THE ENERGY SYSTEM’S EFFECT ON THE ENVIRONMENT	1
1.1.	Objectives	2
1.2.	Scopes	2
2.	THE SOLUTION: THE H2 AS AN ENERGY VECTOR AND ITS DEVELOPMENT IN GLOBAL MARKET	4
2.1.	H2: The Current Market	6
2.2.	H2 sources and production methods: past and present	7
2.3.	The rise of electrolysis technology	7
2.4.	H2 use of Fuel Cells: How H2 conversion technology works	8
3.	GLOBAL MARKET: A BRIEF FUEL CELL STAKEHOLDERS’ RUNDOWN	10
3.1.	Market growth promoted by the power generation demand.....	10
3.2.	Key Performance Indicators (KPI) of the PEMFC Market	11
3.3.	Production capacity and performance of market players	12
4.	H2 REFUELING STATION (HRS) INFRASTRUCTURE	16
5.	APPLICATIONS: H2 TECHNOLOGIES	17
5.1.	Mobility	17
5.2.	Feedstock	17
5.3.	Stationary applications.....	17
6.	NATIONAL ENERGY CONSUMPTION IN CHILEAN COPPER MINING SECTOR	20
6.1.	The Copper Mining Energy Consumption’s Participation in the National Energy Consumption	20
6.1.1.	Aggregate fuel energy consumption.....	21
6.2.	GHG national situation	21
6.2.1.	GHG emissions in Chilean Copper mining sector.....	23
7.	STUDY OF MINING TRUCKS	25
7.1.	Types of Trucks in Chilean open-pit mines.....	25
7.2.	Electric and Mechanical power train systems in Haul Trucks.....	26
8.	ELECTRIC DRIVE TRUCKS INVENTORY AND MINING TRUCK RETROFITTING	27
9.	ESTIMATION OF THE OWNING AND OPERATING COSTS	29
9.2.	Truck Trip Methodology for Retrofitted and Conventional Technology	30
9.2.1.	Power Train configurations for Retrofitted and Conventional Technology....	31
9.2.2.	Truck Operational Parameters and Fuel Cost Calculation	31
9.2.3.	Truck Power Calculation.....	37

9.2.4. Regenerative Braking Energy System	37
9.3. Total Cost of Ownership and Operation Calculation: Comparative Scenarios	38
9.3.1. Trucks Trip Results for Retrofitted Technology Scenario	38
9.3.2. Trucks Trip Results for Conventional Technology Scenario	44
9.4. Results	47
10. CONCLUSIONS: HYPOTHESIS AND APPROACHES	49
11. GLOSSARY	51
12. BIBLIOGRAPHY	53