Fiche analytique – Mémoire de Master MUSE

A rendre au secrétariat lors de l'inscription à la soutenance du mémoire

* champs obligatoires

AUTEUR*	NOM : HASSAN	PRENOM : Aymane	
TITRE MEMOIRE*	How future gas should be powered ? A techno-economic assessment of the impact of electricity supply on Power-to-Gas		
NUMERO MEMOIRE	(à remplir par le secrétariat)		
DATE SOUTENANCE		Salle:	Heure:
THEMATIQUE* (AFFILIATION)	Energie		
VOLEE MUSE*	2015-2017		
TITRE ACADEMIQUE* (par ex.: licencié en biologie)	Maîtrise universitaire en sciences de l'environnement		
DIRECTION* / EVALUATION	Directeur de mémoire* Martin K. Patel	Co-directeur de mémoire* David Parra	Nom(s) du ou des juré(s)* - Mahbod Heidari - -
STAGE (éventuel)	Organisme d'accueil	Maître de stage	
Projet de l'ISE (éventuel) auquel le mémoire est rattaché			
Bourse (éventuelle) reçue par l'étudiant			
COLLATION*	Nb de pages* 61	Nb de figures* 25	Nb de tableaux* 17
TERRAIN D'ETUDE OU D'APPLICATION			
MOTS-CLES* (entre 5 et 10)	Power-to-Gas, Electricity supply, Techno-economic assessment, System scale, Economic profitability		
RESUME* (max 1500 car)			
SUMMARY* (en anglais)	Climate change mitigation policies and Swiss energy transition strategies lead to a growing diffusion of intermittent renewable energy technologies. This calls for significant long-term energy storage capacity which can be provided by Power-to-Gas (P2G) technologies. This paper investigates the role of electricity supply on economic and environmental performance of P2G systems. Electricity supply is the parameter with largest impacts on both levelised cost and environmental emissions of P2G systems (e.g. 70% of life cycle costs and 90% of total environmental impacts according to previous studies). We therefore propose a systematic comparison of techno-economic and environmental impacts of various types of electricity supplies under the Swiss context, namely solar PV electricity, wind electricity, hydropower, a wholesale-based supply and combinations among individual options. The impacts of the system scale, the dynamic behaviour of various conversion processes and geographic location are evaluated. In addition, the sensitivity of the economic attractiveness of P2G to future investment costs and efficiency improvements is assessed. This methodology aims to inform utility companies, policy-makers and consumers about the best P2G configurations to power the future gas. Our findings suggest that the nature of operation (i.e. stochastic renewable generation or full-load operation (wholesale and hydropower)) is a critical parameter regarding economic attractiveness of P2G since lifecycle system costs need to be amortised. Due to the constrained availability of renewable		

	resources and significant investment costs of RE generators and P2G installation, economic profitability is not achievable for a system directly connected to a PV or a wind power plant regardless of the system scale in Switzerland. Lifecycle costs are only recovered if the systems are connected to the grid in addition to the RE generator for Power-to-Hydrogen and Power-to-Methane (with CO2 from a biogas plant) systems in the MW scale. The situation differs in Germany where a direct connection to a wind power system leads to a positive economic case. The pace of improvement of capital costs of RE technologies in a prospected mature P2G market is promising to reach economic viability for Power-to-Hydrogen directly connected to stand-alone RE systems but still not feasible for Power-to-Methane due to its significant capital costs and lower efficiency compared to Power-to-Hydrogen.
REMARQUES	