Energy Research & Social Science 14 (2016) 61–70

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Change, opportunity and grief: Understanding the complex social-ecological impacts of Liquefied Natural Gas development in the Australian coastal zone

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ARTICLE INFO

Article history:
Received 24 June 2015
Received in revised form 18 January 2016
Accepted 20 January 2016
Available online 3 February 2016

Keywords:
Impact assessment
Unconventional gas
LNG
Great Barrier Reef World Heritage Area
SIA
Social-ecological systems

ABSTRACT

Recent rapid growth in the natural gas industry has led to concerns about the potential impacts of development on local communities, and the capacity of current governance arrangements to manage those impacts. Although a growing body of research explores the impacts of 'boomtown' mining and energy development in inland communities, comparatively little work has examined the impacts of natural gas development on communities in the coastal zone. Coastal communities are part of complex social-ecological systems that are increasingly a focal point for Liquefied Natural Gas (LNG) development. Drawing on in-depth interviews and grey literature, this paper examines the direct, indirect and cumulative social-ecological impacts of LNG development in a coastal community in Australia, an emerging hub for the global gas industry. The research finds that the impacts of coastal LNG development share similarities with conventional mining, but also present new challenges for the governance of the industry.

1. Introduction

In recent years, the unprecedented development of unconventional gas resources, in combination with domestic concerns over energy security and the growth of key export markets in Asia and Europe, has prompted the expansion of Liquefied Natural Gas (LNG) infrastructure in many parts of the globe [1–3]. Twenty-four countries currently export gas or have plans to do so, and a further 45 countries import gas products, or are planning to build import facilities (Fig. 1).

LNG is a liquefied form of natural gas, usually methane (CH_4). In the past, it has been exclusively generated from conventional gas sources (reservoirs), but the liquefaction process is increasingly used to export unconventional fuels such as shale gas, coal seam gas and tight gas. Because LNG is used for export products, gas liquefaction infrastructure is generally located in coastal zones where access to shipping is readily available. As a result, LNG development is occurring in coastal zones throughout the world including in the Gulf of Mexico and the Great Barrier Reef World Heritage Area in Australia. These zones are complex social-ecological systems (SES) [4,5], home to many human communities as well as critically important ecosystems [6–9]. As gas developments proliferate in these and other areas, it is increasingly important that our understanding of their impacts and our ability to sustainably manage those impacts keeps pace with this rapidly developing sector.

1.1. Impacts of energy and mining development at the local scale

Energy and mining development is often characterised by cyclical periods of economic and demographic 'boom' and 'bust' that can bring localised economic growth and employment opportunities, but can also affect the socio-economic wellbeing of local communities [3,27–44]. Socio-economic impacts are defined in the literature as the effects of development as perceived and experienced by local residents [18–20,40,45]. In the context of mining and energy development, impacts can include social dislocation among the (often transient) workforce, rising costs of living and disparities in local incomes between the industry and other sectors, population health impacts, overburdening of essential services, increases in crime, and declining social capital and civic participation within the local community [29,31,34,35,39–43,46–53]. The impacts of development may be distributed unevenly across social groups: for example, women and low-income earners are known to experience specific financial, health and safety impacts associated with mining development [32,54]. Impacts may also manifest differently across the lifecycle of a development, even occurring before the

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http://dx.doi.org/10.1016/j.erss.2016.01.006
2214-6296/

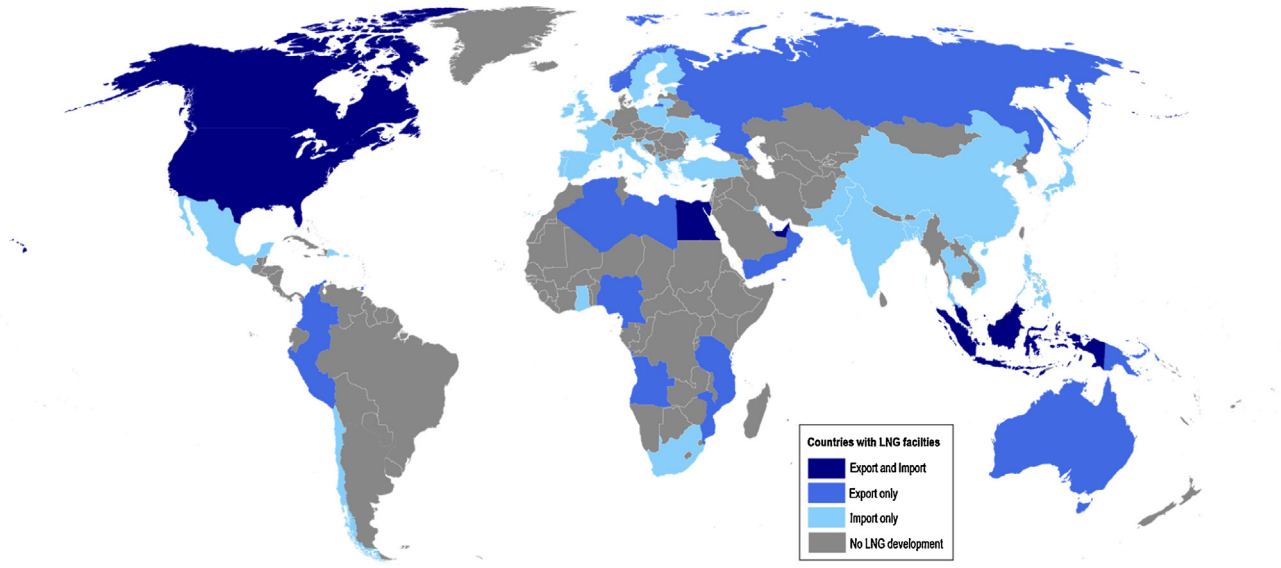

Fig. 1. Global map of countries with LNG import and/or export facilities, current as of October 2015 [26].

development commences as communities begin to anticipate coming changes [45].

In recent decades, the expansion of energy and mining developments, coupled with changes in the way that developments are resourced and operated, has substantially altered interactions between the industry and local communities, and consequently the impacts of these activities [34]. Mining and energy developments are increasingly staffed by a FIFO (Fly-In-Fly-Out) or DIDO (Drive-In-Drive-Out) workforce, housed mainly in camps, who work extended block rosters of up to three weeks at a time [40]. This work pattern can lead to large, transient and male-dominated workforces in regional and remote areas, often with low populations and few services [34]. Research has suggested that the beneficial impacts of mining for the local employment market may be less than anticipated due to the need for specialised labour which is often brought in from outside the local community [55,56]. In addition to direct socio-economic impacts, mining and energy development is associated with substantial environmental change which can indirectly affect local communities [3,18,20,38]. Coastal and marine environments make vital contributions to ecosystem services and declining ecosystem health in these environments is known to impact on human wellbeing [6,57,58].

1.2. Understanding complex impacts: a role for integrated social-ecological research

Over several decades, a growing body of social sciences research has explored the impacts of mining development on communities near production sites. As a result, understanding of the localised socio-economic impacts of mining is well developed. However, there remain several critical gaps in our understanding of the impacts of new developments, such as LNG facilities. Most studies of resource development focus on social impacts within communities near the inland production site (mine or gas field), while the majority of research into coastal port development examines environmental or livelihood impacts. Moreover, although analytical approaches that explicitly recognise socio-ecological interdependencies are becoming increasingly common across a range of research areas and disciplines, including integrated coastal zone management (ICZM) [10–15], these approaches have not featured as strongly in the energy literature. The practice of impact assessment – a key mechanism for assessing and mitigating the impacts of development – also treats social and environmental impacts separately. Thus, while previous research has yielded critical insights on the impacts of energy development at the source, there is an urgent need for qualitative research that explores the complex human and environmental dimensions of energy development along the entire production chain – including in the coastal zone – and for integration of these learnings into regulation and management practice [16].

1.3. Purpose of this paper

This paper applies a social-ecological lens to understanding the impacts of three co-located gas liquefaction plants in Gladstone, a small industrial city located in north-eastern Australia, adjacent to the Great Barrier Reef. Using empirical, mixed-methods data, the paper provides a broad overview of the socio-economic impacts of LNG development in Gladstone during the early stages of the recent LNG boom (2010–2014), focusing on the following key areas: impacts linked to demographic change, rising costs of living, impacts on social capital and community safety, socio-economic impacts related to changes in the local environment, and impacts on government service delivery. In structuring its analysis, the paper draws on two SES frameworks: an early impact assessment framework developed by Slootweg et al. [17–20] and the Driver-Pressure-State-Welfare-Response (DPSWR) framework, a policy framework designed to model changes in social-ecological systems [21–23]. DPSWR is a recent iteration of the DPSIR (Driver-Pressure-State-Impact-Response) framework, a widely used policy framework which traces the environmental and social impacts of change, with a focus on impact pathways and governance responses [12,24]. Both frameworks conceive of impacts as the result of social and biophysical change processes caused by the interaction between a driver (in this case, LNG development), and external factors [19–21,25]. The paper compares and contrasts the impacts of LNG and conventional inland mining, to draw out key lessons for researchers and decision makers seeking to understand and manage this new industry.

2. Case study

Australia is currently the world's third largest gas producer, and is expected to become the largest gas exporter in the world by 2020