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**Article title:** Ethics and ‘fracking’: A review of (the limited) moral thought on shale gas development

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## Abstract

Whilst claims about the ethicality of shale gas development via hydraulic fracturing (‘fracking’) are commonplace in everyday discourse, little scholarly attention has been afforded explicitly to this aspect of unconventional fossil fuel extraction. The limited research that speaks to ethical considerations largely describes ethical concerns associated with development – extremely few claims in research literature make an ethical case *for* development. The most common ethical concerns cited in research stem from issues of distributive justice, with procedural justice, the precautionary principle, exposure to involuntary risks, rights-based arguments, and changes in community character and way of life as next most common. Additional research hints implicitly at ethical dilemmas associated with shale gas development, but does not openly identify these issues as having moral implications. Many ethical considerations relate closely to concerns about water quality and the volume/supply of water available for other purposes. The limited scholarship in this area reveals the import of understanding the ways in which ethics permeate thoughts about shale gas development for designing policy that responds to constituent needs and concerns. Even more limited than research on ethical claims in association with shale gas development is well-reasoned scholarship that analyses the extent to which ethical claims about development are well justified and philosophically justifiable. A comprehensive and systematic analysis of the range of ethical claims potentially relevant to shale gas development and their usefulness for informing policy on this topic would contribute greatly to informed decision-making on this controversial issue – something that science alone cannot achieve.

## Introduction

When I began this review, I was aware of very little academic literature on the ethics of shale gas development. Whilst a few additional publications have come to my attention since then, this review focuses as much on the lacunae in our understanding of the relationship between ethical thought / moral discourse and shale gas development as it does on what extant research divulges on this topic. Indeed, a recent review has shown just how limited attention to ethics is in energy-related research broadly.<sup>1</sup>

The ethics of ‘fracking’ is intimately connected to concerns about water. Indeed, this review reveals that many ethical concerns about shale gas development are tied, at least in part, to potential impacts of development upon water resources. It is no secret that water quality and supply are major issues associated with shale gas development. For example, a survey colleagues and I conducted of a national US sample and a national UK sample revealed that US residents who associated shale gas development with water contamination were 5.6 times more likely to oppose development than those who did not; UK residents were 4.2 times more likely.<sup>2</sup> A survey of residents in the Marcellus Shale region of Pennsylvania and New York showed that 57% of the variation in support for / opposition to development could be explained by one variable – beliefs about the likelihood of development leading to a decrease in water quality.<sup>3</sup>

When considering ethics in relation to shale gas development<sup>a</sup>, or any other major environmental, energy, or technology issue, several questions could be asked, including:

1. What ethical claims exist on this issue?
2. To what extent have existing ethical claims been evaluated and/or subjected to scrutiny?
3. Are existing ethical claims philosophically defensible?
4. What do these ethical claims portend for policy on this issue?
5. What gaps exist in normative discourse on this topic?

Addressing all of these questions in depth is beyond the scope of this review. I tackle each question to the extent possible whilst introducing readers to the limited scholarship in this area to date. My review focuses mostly on peer-reviewed publications, but I do attend to scholarly work in non-academic sources (e.g., religious organisations making theological arguments). I allude to, but do not review, the copious amount of ethical claims about shale gas development on blogs, websites, listservs, and in mass media. I also mention, but do not review substantial research on shale gas development that implicitly suggests its findings might have ethical implications, but stops short of identifying specific ethical dilemmas or making definite ethical claims.

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<sup>a</sup> Note: I use the term ‘shale gas development’ throughout this article to refer to the set of processes and associated effects that attend this form of energy extraction/development. Whilst no term is perfect, social-psychological research into how this word is used provides nuanced discussions of why to avoid use of ‘fracking’.<sup>4,5</sup>

It is important to note that moral claims about shale gas development themselves are *not* limited. For example, in areas where development is occurring or is proposed to occur, one can readily spot bumper stickers that read ‘Fracking is ecocide’ or ‘Fracking is immoral’ (this latter claim was also spray-painted on the side of a building in my former hometown of Ithaca, NY). Numerous non-profit organisations make claims about rights to clean air and water that they assert are violated by allowing shale gas development. Conversations in communities exposed to shale gas development and mass media coverage in these regions have also regularly mentioned ethical commitments on this topic.<sup>6,7,8,9</sup> Whilst *claims* about the morality of ‘fracking’ are plentiful, research on these claims, evaluation of them, and consideration of how to account for them in the policy process on this contentious issues *is* limited.

I begin by reviewing the most common types/categories of moral claims that exist on this issue, as revealed by social-psychological research in this area. In doing so, I examine the substantial connection between several claims and issues associated with water. Next, I summarise the more limited research that actually employs tools of philosophical analysis and moral reasoning to evaluate some of these ethical claims. At this time, I identify further needs in this area. I conclude by discussing what the review suggests for further research on ethics of shale gas development and for the relation of ethical claims to policy in this area.

## **TYPES OF ETHICAL CLAIMS**

Whilst the amount of research on ethical claims used to characterise shale gas development – or ethical claims that could be relevant to this issue – is limited, some claims have surfaced repeatedly, meriting attention. Of course, there may be (and almost certainly are) additional ethical approaches pertinent to this issue. Nevertheless, a review of the claims most commonly discussed in a range of social scientific and humanistic work on this topic at least provides a solid understanding of the ethical approaches most common in public discourse and the moral considerations that the few ethical thinkers working in this area have considered most germane.

### **Distributive justice**

The single most commonly mentioned ethical consideration I could locate in research on shale gas development was concerns about distributive justice. I conceptualise distributive justice here as consistent with the broad definition offered in the Stanford Encyclopedia of Philosophy: ‘the distribution of benefits and burdens of economic activity among individuals in society’.<sup>10</sup> In his analysis of some of the reasons for shale gas development being highly contentious, Cotton<sup>11</sup> explains, ‘distributive fairness concerns how positive and negative outcomes are shared between those who profit and those that bear the impacts’ and identifies distribution as a ‘key driver of public acceptability in energy project siting’ (p. 9).

Fry and colleagues<sup>12</sup> provide an economic and sociological case study analysis of a recent ban on shale gas development in Denton, Texas. Their research reveals that a primary factor motivating this ban was ‘a disproportionate distribution of [shale gas development’s] burdens and benefits in Denton, with resident non-mineral owners paying the environmental and health risks without receiving direct economic benefits and others reaping the benefits without being exposed to risks’ (p. 104). In another economic analysis, Hardy and Kelsey<sup>13</sup> cite ‘equity issues about the distribution of costs and benefits from [shale development]’ as a notable ethical issue arising from their research on residents’ income in the Marcellus Shale region of Pennsylvania (p. 329). In a review of research across nations on unconventional hydrocarbon development, Measham and colleagues<sup>14</sup> confirm that distributive concerns are a major issue associated with extraction, necessitating effective governance.

Willow and Wylie<sup>15</sup> review a selection of political ecology studies on shale gas development that suggest the dominant discourse surrounding development in Pennsylvania seeks to portray development as only an economic boon and creator of jobs, but that such focus masks important inequalities amongst residents. Malin’s research<sup>16</sup> with Pennsylvania farmers generated similar results.

My own research<sup>6</sup> on four regional newspapers in the Marcellus Shale region of southern New York and northern Pennsylvania reveals that distributive justice and procedural justice concerns are the most commonly cited ethical issues relevant to shale gas development in those news sources. Furthermore, interviews referenced in this study demonstrate that distributive justice concerns are common amongst residents in communities exposed to development or potential for development in New York, Pennsylvania, and the Canadian province of New Brunswick.

Hotaling<sup>17</sup> further offers evidence for the relevance of distributive justice and in doing so connects distributive justice explicitly to issues of water. She uses ‘Rawls’s<sup>[18]</sup> concept of social justice [to inform] the present discussion of environmental justice because he insists that the benefits and burdens of society should be fairly distributed’ (p. 5). On the basis of this definition, she asserts, ‘the most common way fracking is claimed to threaten environmental justice is because it has the potential to contaminate water and air’ (p. 7). Hotaling explains that if disproportionate harm can be expected to accrue to certain segments of the population, particularly those already disadvantaged socially/economically, this raises questions about the moral permissibility of the action generating the harm.

Sovacool and Dworkin<sup>1</sup> do not directly consider the issue of shale gas development, but more broadly consider ethical issues associated with energy systems and energy problems. They offer a concept that they term ‘energy justice’, which combines primarily a focus on distributive and procedural justice. They advance this concept as a means to ‘resolve energy related dilemmas’ (p. 441) by addressing policy issues that technical understanding cannot solve.

Religious commentary on shale gas development takes up distributive justice explicitly, for example, through Pennsylvania Interfaith Power and Light's<sup>19</sup> assertion: 'We believe that we serve God through establishing justice – and economic gains that come at the expense of harming others are unjust' (p. 3). The Diocese of Blackburn (of the Church of England)<sup>20</sup> and the Upper Susquehanna Synod Assembly of the Evangelical Lutheran Church in America (in Pennsylvania)<sup>21</sup> also identify distributive justice as a key consideration when regulating shale development.

Concerns about water quality and supply of water are intimately linked with distributive justice. The most common way in which the aforementioned sources coupled water with distributive justice was through concerns about some people's water becoming contaminated and those individuals not benefiting from the development.<sup>6,11,12,17,21</sup> This could mean that other residents are benefiting or that financial benefits are accruing primarily to industry. Whilst less commonly cited, concern about substantial amounts of clean water being used for development and then being removed from the water cycle via deep injection wells also relates to distributive justice if industry's use of water limits availability for other purposes (as it could in water-strained areas such as California, or for wildlife during seasonal fluctuations in water in even the relatively water-rich Northeast US).<sup>3,20</sup>

Distributive justice, more rarely, is also applied to non-traditional actors such as future generations and non-human entities. Some research on distributive justice has argued that short-term gains with potential long-term harms (for water quality and otherwise) are unfair to future humans.<sup>6,19,21,22,23</sup> Others have advanced a biocentric view that moves beyond humans to consider the well-being of other living things (e.g., wildlife, fish, aquatic animals).<sup>21,37</sup>

## **Procedural justice**

The remaining categories of ethical claims in this section were all identified as applying to shale gas development in multiple scholarly publications, but none to the extent that distributive justice was mentioned. I survey only briefly the following claims.

Procedural justice was frequently cited in tandem with distributive justice as a pair of conditions necessary for decision making on shale gas development to proceed ethically.<sup>1,6,11,12</sup> Demonstrating the linkage between the two, Fry and colleagues<sup>12</sup> write, 'These results about distribution of costs and benefits raise important questions about power and participation in decision-making processes' (p. 98). Similarly, Cotton<sup>11</sup> explains, 'host communities seek both *procedural* and *distributive* fairness in the decision-making process' (emphasis original, p. 9). In speaking to decisions about energy development broadly, Sovacool and Dworkin<sup>1</sup> allege, 'the biggest challenge will be determining how we make this transition, and more specifically *who* gets to make it, and *who* has to pay for it. This is not a question that can ever be answered by economics or engineering alone' (emphasis original, p. 437). 'Who gets to make it' relates to procedural justice, whereas 'who has to pay for it' invokes questions of distributive justice.

For the purposes of discourse about shale gas development, it is worth clarifying that I conceptualise ‘procedural justice’ in line with Rawls’s<sup>18</sup> conception of ‘perfect procedural justice’, which is characterised by established criteria for what constitutes a fair/just outcome and procedures that ensure the fair outcome will materialise. This definition is consistent with the ways in which researchers have described residents’ procedural concerns. Not consistent with empirical research is Rawls’s ‘pure procedural justice’, which makes procedural considerations the *only* relevant moral factor in decision making (i.e., other normative considerations are not included, for example, the outcomes of an action or decision).

Water is a procedural justice concern to the extent that people feel disenfranchised by the ways in which water is used, transported, and disposed of – having no (or very little) say in this process. Lack of transparency about chemicals added to water for hydraulic fracturing also raises procedural concerns in that lack of access to full information prevents citizens from making well-informed decisions.<sup>19,22,23</sup> In these ways, procedural justice relates closely to three other types of ethical claims waged in relation to shale gas development: involuntary risks, the precautionary principle, and false negatives vs. false positives.

### **Involuntary risks**

Ethical thought in relation to risks has long distinguished between risks one undertakes of one’s own accord and risks to which one is exposed without knowledge or consent.<sup>24,25</sup> Cranor<sup>23</sup> explains, ‘There is a distinction between risks that it is *permissible* for individuals to take in their own lives and those that they are *required* to live with as a matter of public policy. When this is not done it confuses normative issues’ (p. 38). Lewens<sup>22</sup> directly relates this to the content we are considering, ‘A regulator might therefore decide that acceptable risks to health from, say, white-water rafting, should be much higher than acceptable risks to health from drinking tap water’ (p. 9).

Involuntary risks occur in relation to shale gas development when citizens have no say over exposure to potential harms from development (including water contamination and water withdrawals).<sup>12,26</sup> Such risks can occur because surface and ground waters do not adhere to property boundaries; if one’s neighbour leases land for development, contaminated water from spills or casing leakage could affect drinking and surface waters in the surrounding area. Additionally, the possibility of ‘split estates’, where one individual holds mineral rights whilst another owns the surface rights, could lead to development directly beneath one’s land (and the associated risks) without the surface owner’s consent.<sup>12</sup> Split estates are an issue in the US, where mineral rights are often privately owned, but there is even greater potential for this involuntary risk of drilling under one’s property in most other nations, where mineral rights are nationally owned and managed.

### **The ‘precautionary principle’**

The ‘precautionary principle’ can be understood as the assertion that a potentially dangerous action or process – often subject to scientific uncertainty (e.g., shale gas development) – should not be permitted until society can be certain that harm will not arise from the process, or until society can be certain that harm is outweighed by the benefits.<sup>27</sup> This could be seen as a strong form of the precautionary principle, which contrasts with a more nuanced form, for example, as put forth in the European Commission’s statement on the precautionary principle.<sup>28</sup> Löfstedt<sup>29</sup> appropriately points out, however, that invocation of the precautionary principle is more often in line with the strong version, as opposed to the nuanced version.

The precautionary principle has been invoked as an ethical approach relevant to shale gas development due to the substantial uncertainty surrounding effects of development and the potential for ‘harm’, predominantly in the form of negative impacts on human health.<sup>22,26,30,31,32</sup> Much of the scholarship in this area comes from a group of medical ethicists who understandably emphasise the precautionary principle due to its connection to the common and ancient medical admonition to first do no harm.<sup>33,34</sup> This focus for the precautionary principle also means that most use of this principle in association with shale gas development align with the prescriptive version – which states that if an uncertain threat exists, some form of action is necessary.<sup>35</sup> This is in contrast to the argumentative version of the precautionary principle that focuses on what types of arguments should inform decision making.

Whilst a range of ‘harms’ could be offered as a rationale for adhering to the precautionary principle (e.g., harm to roads, harm to wildlife, harm to community character), because most of the claims in this area derive from researchers in the area of human health, the most commonly cited potential harms stem from potential air and water contamination. A frequent claim associated with appeals to the precautionary principle is that additional research be conducted to reduce uncertainty about potential health impacts.

### **False negatives vs. false positives**

de Melo-Martín and colleagues<sup>26</sup> argue that in reference to shale gas development, ‘false negatives’ (situations where an effect or relationship exists, but is said not to exist) need to be limited more than ‘false positives’ (where no relationship exists, but one is said to exist). An example of a false negative would be asserting that development does not lead to water contamination or negative human health outcomes when in fact it does. Hansson<sup>36</sup> explains that scientists are often more cautious about false positives (also known as ‘Type I errors’) compared to false negatives (‘Type II errors’). This is due to a commitment in science to not state that an effect exists unless one can assert with a very high level of certainty that the demonstrated relationship is due to more than mere chance (similar to the legal standard of ‘beyond a reasonable doubt’). Hansson, however, contends that this scientific norm runs counter to how people make decisions in their own lives and that ethically, one should reverse the importance scientists assign to false negatives and false positives. I discuss the relationship between false negatives / false positives and the precautionary principle elsewhere.<sup>6</sup>



## Rights

In discourse on shale gas development, it is often unclear whence ethical claims about rights derive. Claims about rights are frequently little more than that – assertions. Nevertheless, some academic research on this ethical approach to evaluating shale gas development does seek to justify whence these rights supposedly come.

Claims about rights, notably rights to clean air and water, are some of the most common ethical claims about development in mass media and public discourse on this issue.<sup>6</sup> Sometimes these ostensible rights have a legal foundation, such as constitutionally-guaranteed rights to a clean and healthy environment in Pennsylvania<sup>19</sup> and South Africa<sup>37</sup>, but it is important to distinguish between legal and ethical obligations.

Short and colleagues<sup>38</sup> seek to support the difficult claim that shale gas development presents a potential violation of human rights. They define ‘human rights’, in line with Nickel’s<sup>39</sup> strict definition, as ‘justified moral and legal claims “universally held” by all persons...in order for [citizens] to lead a “minimally good life”’ (reference 39, p. 1). Whilst it seems that a right to clean air and water might be universally held, it is by no means clear *how* clean the air and water must be to lead a *minimally* good life, or that shale gas development has the potential to realistically cause contamination to this level (see Cotton and colleagues<sup>40</sup> for a discussion on this point). Hotaling’s<sup>17</sup> argument that ‘the good life’ and ‘human flourishing’ are under threat by development seems to be a more plausible assertion.

Whilst not speaking to shale gas development particularly, His Holiness Pope Francis explicitly identifies clean water as a right and condemns environmental degradation that impairs its availability. In his recent encyclical *Laudato Si’*, the Holy Father writes<sup>41</sup>, ‘Yet access to safe drinkable water is a basic and universal human right, since it is essential to human survival and, as such, is a condition for the exercise of other human rights. Our world has a grave social debt to the poor who lack access to drinking water...’ (pp. 23-24, emphasis original). The second sentence of this quote explicitly links the ethical concept of rights with thoughts about distributive justice. A 2010 United Nations resolution<sup>42</sup> expresses a very similar sentiment when it identifies ‘the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights’ (p. 2).

It is worth reflecting that the foregoing claims to rights generally speak to rights of individuals (as opposed to rights of a group or community), but that these are universal rights endowed on all people (either by virtue of being human or the product of a Creator). Another form of rights associated with shale gas development are private property rights – again, individual rights; yet, they are different in that they do not come from virtue of being a human but from certain legal provisions. Whilst legally based, these rights are connected to moral claims through ties to liberalism and ideas of freedom.

Pearson<sup>43</sup>, in a study of community responses to mining of silica sand that is used in hydraulic fracturing operations, identifies property rights as potentially violated by shale gas development. He elucidates, 'Frac sand has also stoked a broader debate about property rights, with some arguing that people can do whatever they want with their land, even if it creates problems for neighbors' (p. 35). These claims of 'rights' obviously bring into contrast rights to avoid annoyance and harm with rights to exercise personal liberties. This contrast and conflict is also manifest in discourse about shale gas drilling itself.<sup>6</sup>

### **Perfectionism and 'the good life'**

Claims about the ability of shale gas development to impede perfectionist aims, whilst not as easily identifiable as, for example, claims about rights or distributive justice, are another category of common ethical assertions on this topic.<sup>6,11,14,17,37,43</sup> Perfectionism writ large is a philosophical approach that identifies the components of a meaningful, complete, and virtuous life; living ethically is then viewed as dedicating oneself to the pursuit of such an existence.<sup>44</sup> There are two general forms of perfectionism: human nature perfectionism and objective goods perfectionism<sup>45</sup>; the latter applies to representations of shale gas development. This concept (objective goods perfectionism) is consistent with Rawls's<sup>18</sup> and Parfit's<sup>46</sup> characterisations of perfectionism, which state that the moral life—the life worth leading—is defined by achieving/realising things that are objectively good.

Whilst some actions that detract from the good life are entirely personal actions (e.g., sitting on the couch, eating junk food, and watching television rather than seeking self-improvement), scholars of perfectionism argue that perfectionism is outward looking as well.<sup>47,48,49</sup> For example, Cavell writes that perfectionism highlights 'the possibility or necessity of the transforming of oneself and *of one's society*' (reference 50, p. 3, emphasis added). It is in this respect – advocating for the ability of society to pursue perfectionist aims – that most perfectionist claims about shale gas development emerge.

Hotaling's<sup>13</sup> ethical argument against shale gas development is predicated on such threats to perfectionist aims. She maintains, 'the disproportionate threat to public health is an injustice. But this violation of justice also inhibits human flourishing. Others have recognised the necessity of clean air and water in the pursuit of the good life' (p. 36). Hotaling continues, 'the material context that fracking engenders impedes flourishing and thus, the current practice should be abandoned' (p. 40). Cotton<sup>11</sup> describes how energy development can 'change the character of the place in which [rural residents] live. Rural places become industrial places—affecting not only how individuals perceive the landscape and the local environs, but also their own identify as rural people. This can cause a type of "moral shock"' (p. 9). The 'moral shock' is due to impediments to pursuing perfectionist goals which can include aesthetic appreciation and a slow-paced, intentional lifestyle. Therefore, threats to water resources (via contamination or reduction in supply) can affect perfectionist aims by limiting a resource necessary for physical survival *and/or* by diminishing a resource necessary for cultural/spiritual survival (e.g., a polluted landscape is lessened aesthetically).

Elsewhere I discuss in further detail – and offer interview and survey data – on how claims of moral perfectionism relate to shale gas development.<sup>51</sup>

### **Ethical arguments supporting development**

It is likely evident by now that the vast majority of ethical claims offered in relation to shale gas development lead their proponents to oppose development (or at least to argue for much stricter regulation). A few scholars, however, have offered claims that support development. de Wit<sup>23</sup> highlights the potential role development has in alleviating poverty (thus improving overall welfare and potentially distributive justice) and combating climate change. It is unclear, however, whether wealth generated by development actually accrues to individuals low in socio-economic status, and Sovacool<sup>52</sup> offers a convincing argument that due to continued use of coal worldwide, even if shale gas displaces other more polluting fossil fuels within a given nation, it will not likely reduce carbon emissions globally.

Brock<sup>53</sup> reasons that because energy broadly is a commodity and resource that improves quality of life, and that we cannot cease all energy use or immediately transition away from using all fossil fuels, ‘ethically we need this energy’ (p. 5). Whilst he recognises water contamination and volume of water used as potential risks, he offers some evidence to suggest these are not truly problems. It is beyond the scope of this paper to review the scientific research on the extent to which shale gas development poses threats to water quality and supply; indeed, many questions in this area are still unanswered.<sup>54</sup> The contention that ‘we need this energy’, however, seems weak in that energy is certainly needed<sup>55</sup>, but until one discusses in depth the viability of and trade-offs between a range of energy sources, it is premature to state that *this* energy is needed.

### **An ethical argument rarely mentioned – cost/benefit approach**

Just as interesting as the ethical claims offered against and in favour of development are the ones that were not highlighted in the extant literature in this area. Most notably, only two research articles highlighted consequentialist claims via cost-benefit analyses<sup>6,37</sup>, and both articles did so whilst identifying the weakness of such an approach to evaluate shale gas development ethically. Ingle and Atkinson<sup>37</sup> write, ‘An intractable problem that has hobbled utilitarianism from its outset is the impossibility of deriving a universally agreed metric that quantifies human happiness’ (p. 549). Several additional articles comment on the inappropriateness of neoliberal economic valuation for making decision on shale gas development (i.e., assuming the superiority of economic value under free market capitalism over other valuation methods) – for example, only relying on cost-benefit analyses.<sup>15,16,56,57,58</sup> Elsewhere<sup>6</sup>, I show that consequentialist ethical claims are common in scientific research on shale gas development, but less so in public discourse.

### **Implicit ethical arguments**

Two of my goals in conducting this review were to synthesise the ethical claims that exist on the topic of shale gas development and then to identify gaps in normative reasoning on this issue. One way to join those goals is to examine research that highlights potential ethical dilemmas associated with development, but that never actually classifies these issues as ethical/moral/normative. By surveying such research, we can begin to recognise additional ethical considerations that might be relevant.

Research that investigates the global climate change effects of shale gas development could have ethical implications – for example, for distributive justice across the world or in relation to future generations. Discussions of human rights could also be invoked in associated with the effects of climate change. I must note that most research in this area leaves the ethical relevance of its findings undiscussed and implicit at most.<sup>52,59,60,61,62,63,64,65</sup> Another area of inquiry with potential ethical connections is research on the effects of shale gas development on sense of place and place attachment. This research explores the ways in which physical space and social interactions change due to shale gas development, with effects on how residents connect with and value the locations in which they live. This research illustrates the potential for the types of perfectionist considerations discussed above, but again, stops short of exploring the moral implications.<sup>66,67,68,69,70,71,72,73,74,75</sup>

## EVALUATION OF ETHICAL CLAIMS

Whilst it is beyond the scope of this review to provide a thoughtful articulation of the ways in which ethical claims about shale gas development are justifiable / philosophically defensible (indeed, such an appraisal is sorely needed), it is still worthwhile to review the extent to which extant ethical claims have been defended or refuted by their proponents. Much of the research cited above sought merely to chronicle ethical claims and was descriptive in nature; other studies offer their own ethical analysis. Perhaps the most notable in this respect is Hotelling<sup>13</sup>, who integrates scholarship from a variety of philosophers, ranging from concepts of justice to virtue ethics.<sup>18,76,77,78,79</sup>

I located only three additional publications that offer actual analyses of ethical thought on the topic of shale gas development. de Melo-Martín and colleagues<sup>26</sup> rely on a range of ethicists and political theorists to substantiate their claim that ‘protecting the public from serious harm usually takes precedence over enhancing its welfare’ (p. 1115).<sup>80,81,82,83</sup> Sovacool and Dworkin<sup>1</sup> develop their concept of ‘energy justice’ through consulting a panoply of philosophical traditions ranging from Plato and Aristotle to John Rawls, Peter Singer, and Jürgen Habermas. Finally, Ingle and Atkinson<sup>37</sup> use arguments from a host of philosophers, ethicists, and religious leaders to highlight the problems with all sorts of ethical claims forwarded in relation to shale gas development, including: religious moral absolutism, cost-benefit approaches, and intrinsic vs. instrumental goods.

Whilst not specifically engaging in analysis of ethical claims, a few other authors do give reasonable attention to ethical and normative thought when processing moral claims about

shale gas development. Fry and colleagues<sup>12</sup> rely on Shrader-Frechette<sup>84</sup> and others to support the relevance of distributive and procedural justice to reactions to shale gas development. Cotton<sup>11</sup> invokes scholarship on procedural and distributive justice as well as perfectionism and supererogation.<sup>85,86,87</sup>

In a slightly different form of ethical analysis, several of the religiously-inspired ethical commentaries on shale gas development are well-reasoned and defended with theological thought and references. The Upper Susquehanna Synod of the Lutheran church<sup>21</sup> cites numerous Biblical passages and central guiding documents of the church. Pennsylvania Interfaith Power and Light<sup>19</sup> references the Bible, Torah (Pentateuch), Qur'an, and teachings from historical religious leaders.

### **Gaps in ethical analysis**

Perhaps one of the largest gaps in understanding how ethical thought relates to the range of issues surrounding shale gas development is in the area of ethical analysis. This is not a failing of research to date per se; many of the studies cited here achieved their goal of seeking to describe ethical claims about development or to show how research designed to generate scientific understanding revealed findings with ethical implications. Nevertheless, what is now most needed to further ethical understanding of shale gas development is a thorough and systematic analysis of which ethical claims can be most defensibly brought to bear on this topic and which ethical claims are, at best, weak for conceptualising how to make decisions on this controversial issue. Ingle and Atkinson<sup>37</sup> and I<sup>6</sup> have started this evaluation by looking at the justification for using certain ethical approaches to inform policy and regulation of development, but a holistic and systematic analysis is necessary to guide the policy process as it grapples with how to incorporate ethical claims. Policy makers would benefit from guidance in distinguishing justified and justifiable ethical claims from faulty claims that are philosophically tenuous.

Types of ethical claims – used to make arguments about how development should be regulated – in most need of attention are: rights-based claims, the precautionary principle, and perfectionism claims. What rights are most relevant to shale gas development? From where do these rights come? What happens when different types of rights conflict? If one has a right to clean air and water, how clean is 'clean'? If contaminated water is replaced by above-ground tanks of trucked-in water, has the right to clean water been violated or not? In terms of the precautionary principle, how do we devise a principled and non-arbitrary threshold for how much knowledge we must have before making a decision? Knowledge of potential harms and benefits from shale gas development will never be certain. Finally, how do we compare radically divergent conceptions of the 'good life' to make decisions on development? What role, in any, do perfectionist considerations and virtue ethics have in policy on development? How do we account for and offer moral consideration to fundamental transformations in residents' way of life and place identities (for good or ill)?

### **ROADS FORWARD**

Several scholars writing on ethics in relation to shale gas development offer that one method of addressing ethical concerns with development – and perhaps the best method for doing so – is to devise better regulation or to shore up the (often gaping) holes in current regulation.<sup>19,22,30,31,32,53,88,89,90</sup> For example, regulation can increase transparency and include members of the general public more concertedly via two-way communication in decision-making processes, addressing concerns about procedural justice.<sup>91,92</sup> Distributive justice concerns between industry and local communities can be remedied at least in part through taxes and impact fees that return an equitable share of wealth to the affected communities.<sup>14</sup> Neither I nor the authors I cite here mean to imply that regulation can easily or entirely ameliorate ethical concerns, but the various authors maintain that thoughtfully-crafted policy can respond to some of the largest ethical issues.

Other scholars argue for increased attention to ‘soft’ social impacts of development.<sup>6,11,51,93</sup> Examples of such impacts are threats to way to life, the ‘good life’, place identities, place meaning, community character, rural character, and aesthetic appreciation. These impacts lead to ethical claims related to philosophical perfectionism and virtue ethics. By affording increased attention in policy and planning to these impacts that are less tangible than, for example, direct material effects on ecosystems, economics, or human health, regulators could better address the range of values and ethical commitments at stake due to shale gas development.<sup>94</sup>

Some researchers, particularly those who favour appeals to the precautionary principle, contend that the preferred way to address many ethical concerns is to collect more<sup>22,26,30,31,93</sup> and/or different forms of data<sup>15</sup> on shale gas development. Spence<sup>93</sup> asserts that ‘any normative analysis of fracking (or fracking regulation) must be based upon the identification and measurement of the impacts of shale gas production’ (p. 145), and that this is not always or frequently the case in practice. He, thus, advocates for better collection and use of data when evaluating ethical claims. Willow and Wylie<sup>15</sup> recognise the value of much existing research on shale gas development but allege if we are to truly understand how development affects people on a fundamental level, more in-depth ethnographic research is needed.

Whilst only a few authors state it explicitly,<sup>1,6,26,51</sup> all research reviewed here proffers the implicit argument that there can – and should – be an increased role for ethical consideration and moral thought in policy and regulatory decision making on shale gas development. Affording a specific space in the formation of policy to intentional consideration of ethical issues could ensure that policies on shale gas development (whether allowing it broadly, heavily regulating, or banning development): (1) respond better to the needs of constituents and (2) lead those constituents to increasingly support/accept the resulting decisions.

## **Conclusion:**

Research on ethical considerations associated with shale gas development – whether describing others’ ethical claims or offering an ethical analysis of one’s own – is limited.

Nevertheless, the extant scholarship highlights a range of ethical concepts that deserve careful thought when deliberating on policy and regulation on this issue. Issues of distributive justice, procedural justice, harm / the precautionary principle, involuntary risks, avoiding false negatives over false positives, rights, and threats to or enhancement of perfectionist considerations all should receive explicit attention in policy discussions on this topic. (Other ethical approaches, of course, may be relevant as well.) Policy-making and regulatory decisions on this topic could benefit from a comprehensive and systematic review of the ethical approaches that have been applied to shale gas development and that could be brought to bear on this topic.

A review that thoroughly considers the relevance and usefulness of myriad ethical approaches for policy, and critiques the strengths and weaknesses of each approach, would facilitate the integration of ethical thought and moral reasoning into policy on and regulation of development. Currently, natural and physical scientific findings are heavily preferred in policy development on this issue.<sup>6,51</sup> Over half a century ago, Nobel Laureate Lord Bertrand Russell<sup>95</sup> presciently proclaimed, ‘Almost all the questions of most interest to speculative minds are such as science cannot answer’ (p. xiii). His conviction applies well to decision-making on shale gas development. Whilst little research exists on any aspect of ethical thought in relation to shale gas development, the most necessary work in this area right now is a detailed analysis of which ethical considerations are most relevant to this issue (and which ethical claims applied to this issue are philosophically weak and should be dismissed). Any such analysis must be rigorous and, at the same time, accessible to policy makers and lay audiences engaged in this contentious topic.

As a social scientist who has studied conversation on shale gas development for the better portion of a decade across three nations, I have found discourse on this issue often to be painfully vitriolic. Better understanding of scientific ‘facts’ on, for example, water contamination rates and reduction in water supply will do little to ease tensions on this issue. Better understanding the ways in which potential water contamination and diminished water supplies matter to various people (i.e., their values and ethical concerns in this area), however, might at least afford an appreciation of where differently-minded people are coming from on this issue, even if one chooses to disagree with them.

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