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The optimisation of technically recoverable reserves from shale gas production: optimum lateral length and well pad size as constrained by surface and subsurface carrying capacity

Sarah Clancy (1), Fred Worrall (1), Richard Davies (2), and Jon Gluyas (1)

(1) Earth Sciences Department, Durham University, Durham, UK (sarah.a.clancy@durham.ac.uk), (2) Earth and Environmental Science, Newcastle University, Newcastle, UK

With the success of shale gas in the US, other more densely populated countries, including several countries in Europe, for example the UK, have begun exploration for shale gas. Within these countries the carrying capacity of the land and competition for land with other uses are important factors to consider as they restrict the amount of gas that could be extracted. We have determined how existing infrastructure (buildings, houses, ponds etc) and the subsurface footprint of the shale gas sites limits the amount of technically recoverable gas reserves that can be extracted from the Bowland Shale (UK). This analysis was performed by examining the number of well sites, with suitable setbacks of varying distances and laterals of varying lengths, that could be located within 20 of the 100 km2 UK license blocks. The amount of gas that could then be extracted was calculated.

The number of well sites that can be located within a block is largely dependent on the individual license block. Blocks that include large cities and towns have more existing infrastructure limiting the space available for well pads and their associated setbacks. Generally, license blocks with higher carrying capacities show that multi-well pads with longer laterals are more efficient in terms of footprint size to extracted gas. However, as each block differs increasing the number of well pads and extending lateral lengths does not always result in optimal gas recovery. In certain cases a multi-well pad with lateral extending 750 m would potentially yield more gas than laterals of 1.25 km. Our results highlight that generally longer laterals reduce the cumulative surface footprint and generate more gas reserves, however, this is not always the case and licensed blocks need to be assessed on an individual basis.