Encouraging Sustainable Development: Redefining Beneficial Use of Produced Water

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Drake Engineering Inc.'s CBNG onsite water treatment system engineering process unit in Johnson County, Wyoming. Photo courtesy of Drake Engineering.

Trillions of gallons of water will be produced as a byproduct of coal bed natural gas (CBNG) development in the Powder River Basin and similar areas of the intermountain western United States during the coming years. Industry and public interest groups have been clashing over this development in regards to the ultimate fate of the water. While "beneficial use" has been used in the past to justify different discharge methods, many would argue that the use or disposal of CBNG-produced water should be considered in light of sustainable development.

Numerous definitions of sustainable development are currently in use, with the most often cited definition from the Brundtland Report (WCED, 1987), which defines it as "…development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs."

CBNG companies, if they are serious about their future, must move beyond merely complying with regulations and address produced-water disposal within a framework of sustainable development.

Sustainability can be particularly difficult to apply when dealing with natural resources extraction issues such as CBNG. First, the concept itself is an oxymoron when dealing with a finite resource since it cannot be indefinitely sustainable. Second, in some situations, such as where produced water is used for crop water, some might benefit (farmers), while others might lose (ranchers who own land above the CBNG resource and end up with a lowered water table). Sustainable development implies that society must recognize future limitations and remain flexible to change.

Presently the CBNG industry appears to primarily design operations with little thought given to post-operation impacts. Other industries such as mining have seriously grappled with closure and post-closure implications for water quality, quantity, and other issues. Mining companies have been faced with questions about their social license to operate in light of the problems they have historically created. This suggests that CBNG companies, if they are serious about their future, must move beyond merely complying with regulations and address produced-water disposal within a framework of sustainable development.

Seven Questions for Addressing Sustainability

A list of seven questions (below) developed by the International Institute for Environment and Development (IIED) and the World Business Council for Sustainable Development (WBCSD) provides a set of practical principles for considering CBNG-produced water disposal. These principles can be employed during the exploration, development, and post-development stages when considering the compatibility of various produced-water disposal methods with the concept of sustainable development.

Seven Questions for Assessing Sustainability

1. Are engagement processes in place and working effectively?
2. Will people's well-being be maintained or improved?
3. Is the integrity of the environment assured over the long term?
4. Is the economic viability of the project or operation assured, and will the economy of the community and beyond be better as a result?
5. Are traditional and non-market activities in the community and surrounding area accounted for in a way that is acceptable to the local people?
6. Are rules, incentives, programs, and capacities in place to address project or operational consequences?
7. Does a full synthesis show that the net result will be positive or negative in the long term, and will there be periodic reassessments?

(IIED and WBCSD 2002)

	RECEPTORS OF PRODUCED WATER			
	Groundwater	Surface Water	Soils, Native Plants, and Agriculture	Others
Disposal Method	Reinjection into coal aquifer Injection into aquifer Percolation into aquifer	Direct discharge Indirect discharge via groundwater	Crop irrigation Land application disposal	Evaporation Other uses
Potential Benefits	Aquifer recharge (shallow and deep aquifer)	Improved surface flows Increased water to downstream users Constructed wetlands	Increased irrigation water and crop yields Increased native plant pasture	Wildlife and livestock watering Municipal uses Recreational opportunities Industrial uses
Potential Impacts	Aquifer depletion Aquifer contamination	Spring and seep dewatering Surface water contamination Surface water flow alteration	Increased salinity and sodicity Increased erosion Reduced crop yields Loss of native species	Loss of aquatic species Reduced/ altered wildlife habitat Loss of aesthetics Loss of recreation

Least Sustainable Practices
Evaporation of water resulting in loss of resource
Injection or percolation into aquifers where water quality is deteriorated and negative hydrologic impacts can occur
Land applications that create negative impacts on soils and water quality
Direct discharges that degrade water quality and negatively impact downstream users or result in loss of resource
Most Sustainable Practices
Reinjection to original formation
Injection or percolation into depleted aquifers with water treatment as required to protect or enhance water quality
Crop, livestock, municipal, or industrial uses with water treatment and other mitigations as required to prevent negative impacts
Surface discharges with water treatment as required, resulting in improved stream flows with adequate mitigations against negative impacts

Produced Water Benefits and Impacts

CBNG-produced water can be disposed to groundwater, surface water, land or by other means. Depending on the method, various potential benefits and impacts may result, as identified in the table above.

Although many of the uses may be in some way beneficial, negative impacts can still occur. Using water that contains a high sodicity or sodium adsorption ratio (SAR) for irrigating crops may bring short-term benefits, but long-term irrigation will damage the soil structure by deflocculating the clays within the soil, thereby reducing the soil's capacity to absorb water.

Sustainability and Produced Water

What is the most sustainable practice for CBNG-produced water? From the perspective of produced water alone, the primary questions deal with benefits versus impacts to agriculture. As a result, neighboring farmers and ranchers are often pitted against each other. Sustainable development will require cooperation among the various parties to ensure that those enjoying short-term benefits do not do so at the expense of future users whose water rights may be impacted. The most and least sustainable practices listed above right are based on human and environmental values.

However, it should be noted that CBNG development currently lacks engagement processes, economic viability measures (such as financial assurance), and rules, incentives, and capacities (governance) to steer the industry in the direction of sustainable development. Until the industry itself embraces the concept of sustainable development and is willing to recognize the concerns of legitimate parties, it cannot expect widespread support for its activities.

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References

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