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The CoalBed Methane Resource Potential of the Soutpansberg Basin, South Africa

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Whilst many of the coalfields in South Africa have been extensively explored and exploited, those in the north of the country particularly the Lephalale, Springbok Flats, Soutpansberg and Tuli basins have until recently received much less attention. These coalfields in particular have been the focus of recent exploration due to the presence of large coking and thermal coal resources, as well as for their coal bed methane potential. Petroleum Agency SA has successfully developed a model of estimating total gas-in-place calculated by indirect methods using deterministic and probabilistic techniques.

The Soutpansberg Basin was formed at about 1800 Ma [1] as an east-west trending asymmetrical rift or half-graben along the Palala Shear Belt between two major crustal blocks, the Kaapvaal craton in the south and the Limpopo Belt in the north. The Soutpansberg Basin has been delineated by exploration drilling over a period of years. The basin is sub-divided into three separate smaller sub-basins (also referred to as coalfields) namely the Pafuri (eastern), Tshipise (central) and Mopane (western) sub-basins. The sub-basins are fault bounded remnants of the Karoo sequence.

The coal seams are intensively disturbed by faults and dolerite intrusions [2]. The coal horizons, as much as 40 m thick in places, have been reported at depths between 100 and 400m below surface level. Coals occur in the sandstone-rich Madzaringwe and overlying Mikambeni Formations [3] which forms part of the Ecca Group in the basin. The rank of the coal tends to increase with increasing depth and the volatile content in the west is 35% and decreases to about 25% in the east [4]. The coal seams are similar in quality and formation to those that have been successfully developed in the nearby Lephalale Basin where 1 Tcf of technical recoverable resources has been estimated.

To date, there are several industry attempts to define discovered coal gas resources and establish commerciality for any of the prospective reservoirs. Generally exploration borehole locations, lithology descriptions and coal composition (proximate analysis) data are available for the Soutpansberg Basin. Other reservoir conditions that need to be quantified by exploration drilling and core sampling include direct-gas-content measurements, gas composition and gas-storage-capacity analyses, as well as reservoir volume and density measurements. The results of our evaluation with the assumption that coal is gas saturated suggests that coals in the Soutpansberg Basin have a gas storage capacity (gas-in-place) in the order of 0.9 – 1.9 Tcf. The ability to assess recoverability and production of the resource, though, remains constrained by the limited data available. Also, challenges to economic development of coalbed methane resources in frontier regions such as the Soutpansberg Basin include undeveloped markets, distance to markets and lack of infrastructure.

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