Marcellus Shale Calculations

The Marcellus shale

- covers an area of *246,000 km²* (95,000 mi²)
- ranges in thickness from *15 to 60 m* (50-200 ft); assume average thickness 30 m
- has a *porosity of ~10%;* could hold 350 scf/m³ methane at 100 bars (1 km) depth
- *in place resource = 1,500 TCF* suggests in place contained gas ~200scf/m³ =(1500 TCF)(1/30m)(1/246x10⁹ m²)
- *27 to 45 scf/m³* (60-100 scf/ton) of producible natural gas (~10 to 20% contained)
- I take total producible resource = *363 TCF* (Engelder estimates *262-489-876 TCF*)
- 363 TCF = 16 years of supply at current US consumption rate of *23 TCF/yr*
- 1475 scf can be produced, on average, from each square meter (plan) of the Marcellus shale = 363x10¹²/246x10⁹

At $5 per thousand scf ($5/kscf) the value of gas under one acre is $30,000:
($5/kscf)(1.475 kscf/m²) (4047 m²/acre)= $30,000.

A well tapping 80 acres would produce 0.477 billion cubic ft of gas with a sales value of $2.4 million (energy equivalent to 3million gallons of petrol)
(80 acres) (4047 m²/acre) (1475 scf/m²) = 4.77x10⁸ scf

(4.77x10⁸ scf)($5/kscf)/(1000scf/kscf)=$2.38x10⁶

6000 scf of gas is equivalent to 1 bbl of oil; 1 bbl oil = 42 gallons with energy ~ 42 gal petrol
(4.77x10⁸ scf)(1/6000 scf/bbl)(42 gal petrol/bbl) = 3.3x10⁶ gal petrol

Surface power density of Marcellus gas is ~1.6 W/m²
1 barrel of oil has an energy content of 6.12x10⁹ joule.
(1475 scf/m²)(1/6000 scf/bbl)(6.12x109 joules/bbl)= 1.5x10⁹ joules/m²
If produced over 30 years the power density =
(1.5x10⁹ joules/m²)(1/30 yrs)(1/3.15x10⁷ s/yr)=1.6 J/s/m² = 1.6 W/m²
Wind generation power density = 2 W/m²

If produced over 30 years and used for transportation import of 2 billion bbls/yr saving $200 billion/yr in import costs
(363x10¹² scf)(1/30 yrs)(1/6000 scf/bbl) =2x10⁹ bbl/yr
At $100/bbl, this is $200 billion savings per year

References (for numbers in italics):

Engelder, T., 2009, Marcellus, 2008: Report card on the breakout year for gas production in the Appalachian Basin: Fort Worth Basin Oil and Gas Magazine, August 2009, p. 19-22.

Soeder, D. J., and Kappel, W. M., 2009, Water resources and natural gas production from the Marcellus Shale, USGS Fact Sheet 2009-3032.