4.7

To bring the 1st charge in to construct the dipole requires an energy of:

$-q\int_{\infty}^{0}\vec{E}\cdot d\vec{l}$. The bring the negative charge in requires $-q\int_{\infty}^{d}\vec{E}\cdot d\vec{l}$ from the field and

$\frac{-q^2}{4\pi\varepsilon_0}\frac{1}{d}$ from the 1st charge.

Putting this all together,

$$W=-q\int_{0}^{d}\vec{E}\cdot d\vec{l}-q\int_{d}^{\infty}\vec{E}\cdot d\vec{l}+q\int_{d}^{\infty}\vec{E}\cdot d\vec{l}-\frac{kq^2}{d}$$

However, in the limit $d\to 0$, q must increase such that $\vec{p}=q\vec{d}=$ constant.

This has the overall effect of causing $\frac{kq^2}{d}$ to vanish.

Then $W=-q\int_{0}^{d}\vec{E}\cdot d\vec{l}=-q\vec{d}\cdot\vec{E}=-\vec{p}\cdot\vec{E}$