Supplemental Fig. S1. Structures of all EbDH substrates reported in the study. Substrate numbering is according to table 1 in the manuscript.
Supplemental Fig. S2: Structures of all EbDH inhibitors reported in the study. Substrate numbering is according to table 1 in the manuscript.

Supplemental Fig. S3: Bar chart of relative apparent $k_{\text{cat}}$ values (left axis) and catalytic efficiencies (right axis) of EbDH substrates with ethyl and propyl side chains.
**Supplemental Fig. S4**: Bar chart of relative apparent $k_{cat}$ values (left axis) and catalytic efficiencies (right axis) of EbDH substrates with multiple bonds in the substituent in comparison to ethylbenzene.

**Supplemental Fig. S5**: Bar chart of relative apparent $k_{cat}$ values (left axis) and catalytic efficiencies (right axis) of EbDH substrates with ortho-, meta- and para-substituents in comparison to ethylbenzene.
Supplemental Fig. S6: Bar chart of relative apparent $k_{\text{cat}}$ values (left axis) and catalytic efficiencies (right axis) of EbDH bicyclic substrates in comparison to ethylbenzene and $n$-propylbenzene.

Supplemental Fig. S7: Kinetic plots of the EbDH substrates 4-ethylbiphenyl (A), 4-ethylanisol (B), 5-methoxyindane (C) and 2-ethyl-1H-indene (D). The kinetic data were fitted using a modified Michaelis-Menten equation including a substrate inhibition term (see supplemental Fig. S8 below).
\[ v = \frac{v_{max}}{1 + \left(\frac{K_m}{[S]}\right)} \] (Michaelis Menten equation)

\[ v = \frac{v_{max}}{1 + \left(\frac{K_m}{[S]}\right) + \left(\frac{[I]}{K_{ic}}\right)} \] (Michaelis Menten equation including substrate inhibition)

\[ v = \frac{v_{max} [S]}{K_m \left(1 + \left(\frac{[I]}{K_{ic}}\right) + [S]\right)} \] (Competitive inhibition)

\[ v = \frac{v_{max} [S]}{K_m \left(1 + \left(\frac{[I]}{K_{ic}}\right) + [S]\left(1 + \frac{[I]}{K_{iu}}\right)\right)} \] (mixed inhibition)

**Supplemental Fig. S8.** Equations used for fitting of kinetic data.