Beam Energy Replacement in a Compact FEL, P.A. McINTOSH, M.W. POOLE, X. QUERALT and G. SAXON, CLRC Daresbury Laboratory, Warrington, WA4 4AD, UK - To achieve high energy extraction from a compact FEL requires a method to negate the energy loss from the electron beam. A number of proposals have been made to incorporate an accelerating system within the FEL to overcome this restriction. The present study has examined various RF structures that can be conveniently integrated with an undulator magnet and has assessed the resultant performance limitations of possible infrared FELs. The muffin-tin geometry has been shown to be feasible for longer output wavelengths, whereas a side-coupled structure looks more promising below 50 μm. Permanent magnet design options have also been explored. Solutions for practical FELs are proposed and should allow high power output despite relatively low electron energies.