Lignocellulose is the most abundant biomass on Earth. This makes it an ideal, i.e. cheap, feedstock for 2nd generation biorefinery possibly replacing oil refinery in the production of fuels and other commodity chemicals. Unfortunately, lignocellulose is very recalcitrant to biodegradation. Currently, lignocellulose bioconversion requires expensive multi-step processes which can hardly compete with traditional technologies. Metabolic engineering can be used to develop microbial strains able to catalyze single-pot fermentation, i.e. consolidated bioprocessing, of plant biomass to industrially relevant products (e.g. lactic acid, ethanol, butanol), thus enabling cost-sustainable 2nd generation biorefinery. The focus will mainly be on strategies enabling efficient fermentation of the main component of plant biomass, i.e. cellulose. Examples will be illustrated highlighting the state-of the-art of the research in this domain and its main challenges.