Table of Rebound effects for use in the Rebound Framework Paper

Component of economy-wide energy rebound	Origin/Mechanism	
	Existing typologies (Sorrell (2009), Jenkins et al. (2011), Thomas & Azevedo (2013), and Walnum et al. (2014))	This paper (with comparison *in italics* to Sorrell, Jenkins, Thomas & Azevedo, and Walnum)
Microeconomic rebound: these rebound mechanisms occur at the single device level, within a static economy, based on responses to the reduction in implicit price of an energy service.	Direct rebound: describes the direct response to the single energy efficiency improvement. Jenkins et al. (2011) and Walnum (2014) split into two sub-classes: • Substitution effects: captures the substitution of that energy service for other goods or services (consumers) or inputs to production (producers). • Income/output effects: the increasing demand for that energy service by consumers who expand their spending (an "income effect') or by producers who expand their output (an "output effect"). Commonly, direct substitution and income effects are assessed via combined elasticities.	**Emplacement effect** The direct emplacement effect accounts for performance of the Energy Efficiency Upgrade (EEU) only. No behavior changes occur. The direct energy effect of emplacement of the EEU is expected device-level energy savings. By definition, there is no rebound from direct emplacement effects. The direct emplacement effect is also known as expected energy savings. **Substitution effect** Spending of freed cash on more of the energy service. *(Same as other authors.)* **Income effect** Spending of freed cash on more of the energy service. *(Same as other authors.)*
	Indirect rebound: describes the indirect response to the single energy efficiency improvement. Sorrell (2009) and Jenkins et al. (2011) split into two sub-classes: • Embodied energy effects: The energy "embodied" in the efficiency improvements themselves will offset some portion of the energy savings achieved. • Re-spending and re-investment effects: If consumers and firms see net cost savings from energy efficiency improvements, they increase expenditures or investments in production, increasing demand for goods, services, and factors of production, which in turn require energy to produce and use. Commonly, respending or reinvestment effects are assessed via combined cross-price or cross-sector elasticities.	**Emplacement effect** Differential lifecycle energy effects (versus counterfactual) of the EEU, i.e., embodied energy (emb), and implied energy demand from maintenance and disposal (md). (*Other authors include embodied effects (emb) but not effects associated with md.*) **Substitution effect** Decreased spending on other goods and services. (*Other authors typically include indirect substitution effects within re-spending and re-investment effects.)* **Income effect** Increased spending on other goods and services. (*Other authors typically include indirect income effects within re-spending and re-investment effects.*)
Macroeconomic rebound: These mechanisms originate from the dynamic response of the economy to reach a stable equilibrium (between supply and demand for goods and energy services). These mechanisms combine various short and long run effects.	Thomas and Azevedo (2013) split into 5 components: • a lower market price for energy, • changes in economic structure, • economic-competitiveness • investment and disinvestment, and • labor market changes. Sorrell (2009), Jenkins et al. (2011), and Walnum et al. (2014) split into three effects: • market price effect, • composition effect, and • economic growth effect.	**Macroeconomic rebound effect** Comprised of numerous components including: • energy market effect, • composition effect, • growth effect, • scale effect, • labor supply effect, and • disinvestment effect (*We have close alignment withThomas and Azevedo (2013). Sorrell (2009), Jenkins et al. (2011), and Walnum et al. (2014) (i) fold the scale and dis/investment effects into economic growth effect and (ii) include labor market effects within the indirect factors of production response.*)