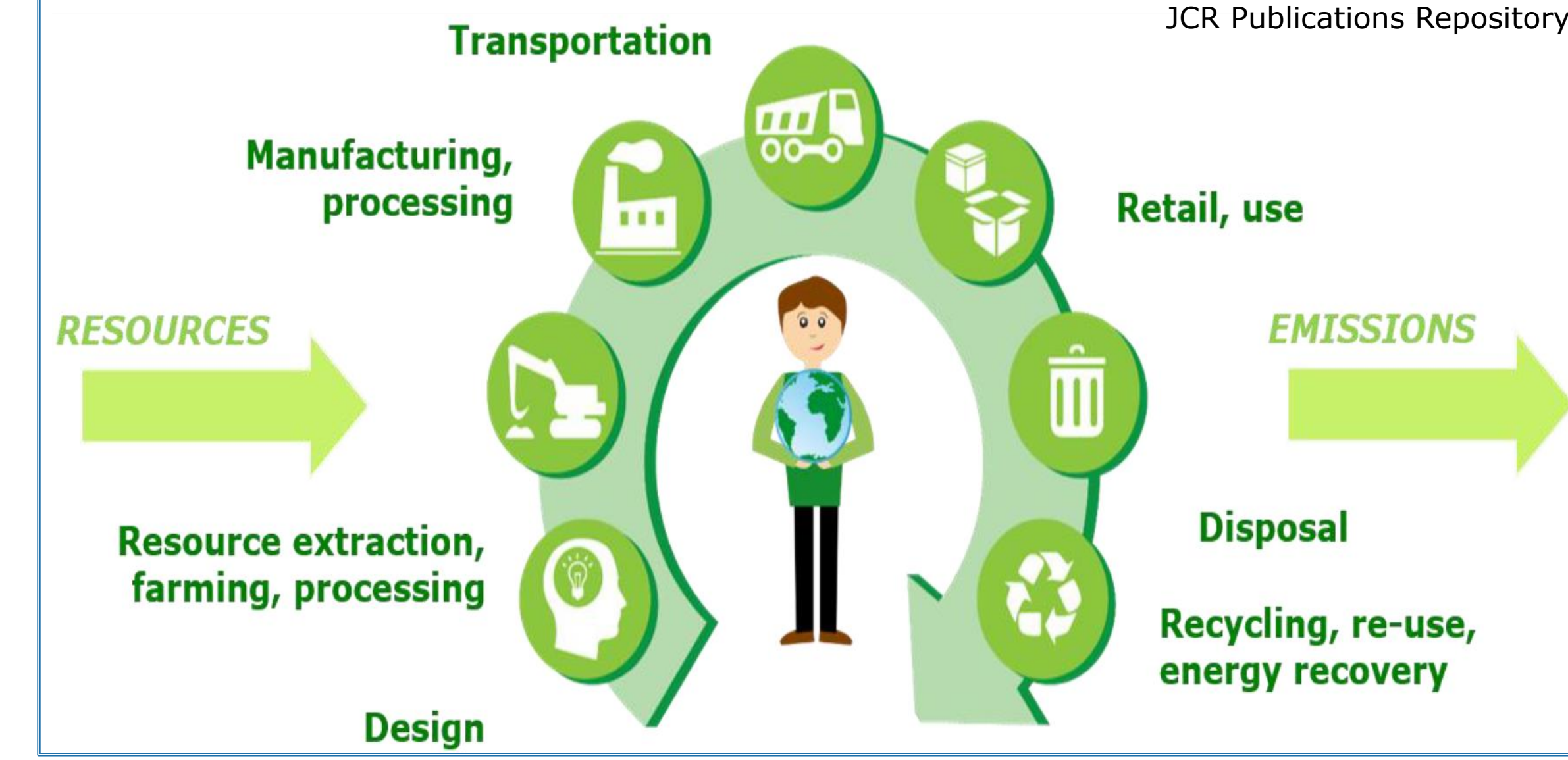


## 1. Introduction to Life Cycle Assessment (LCA)

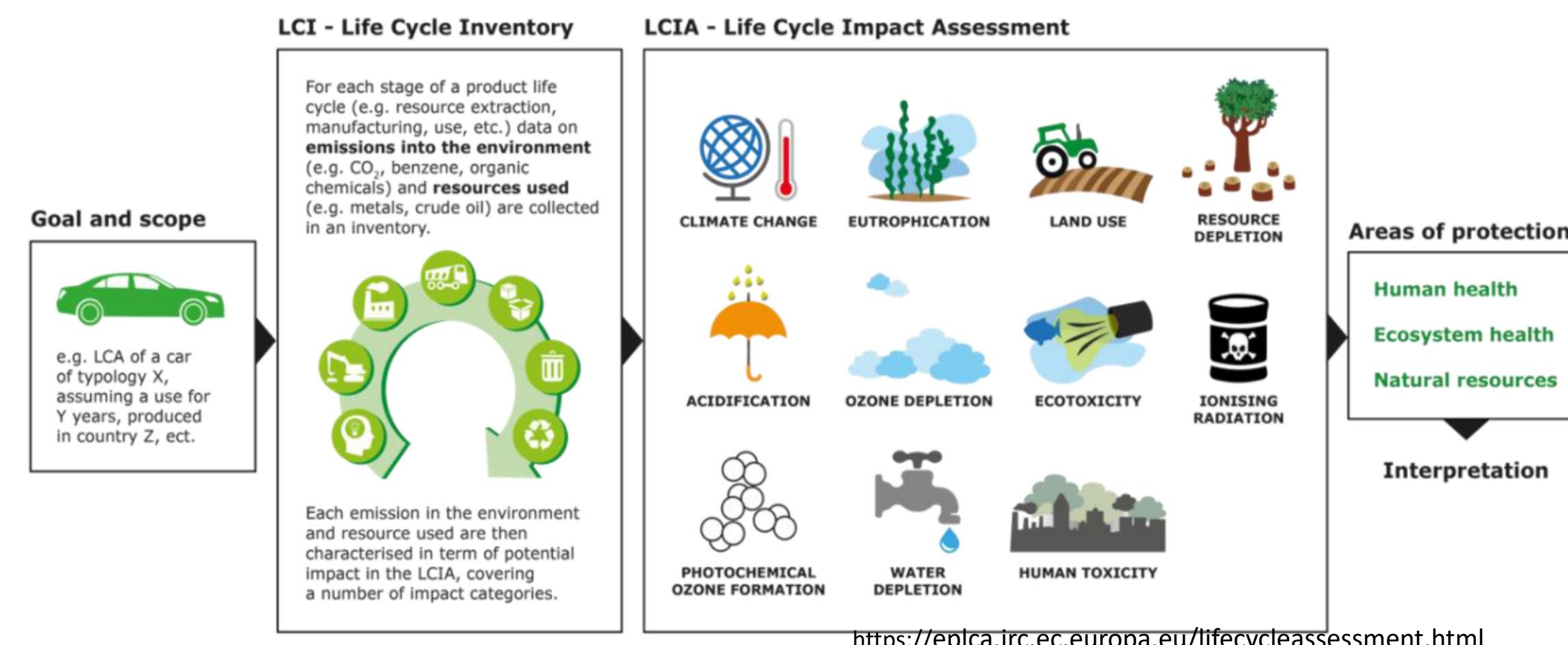
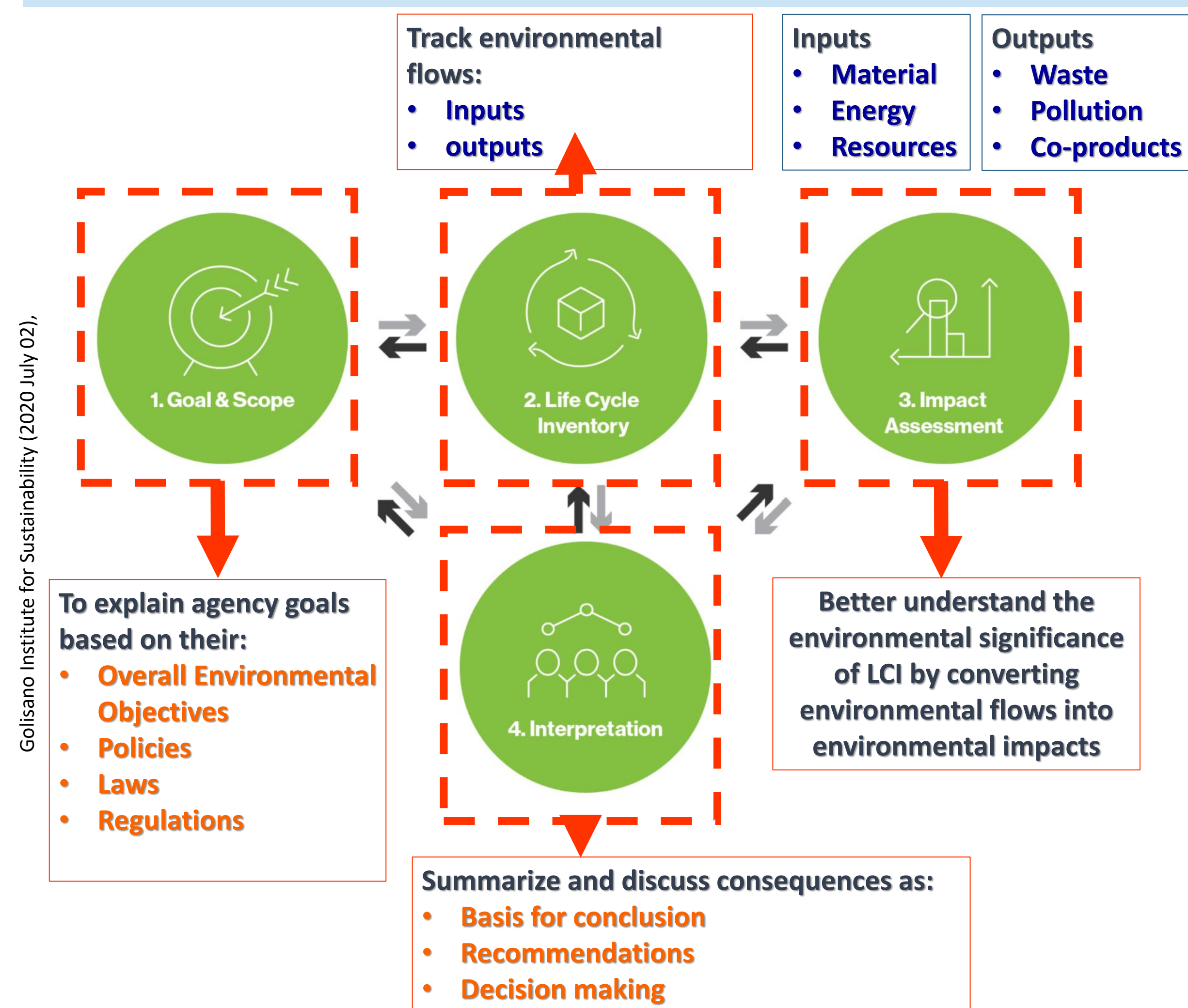
Life Cycle Assessment (LCA) as a technique includes:

- Analysis and quantification of environmental impact of a product
- Inspection of material and energy inputs and outputs over the life cycle of a product
- Generation of environmental indicators

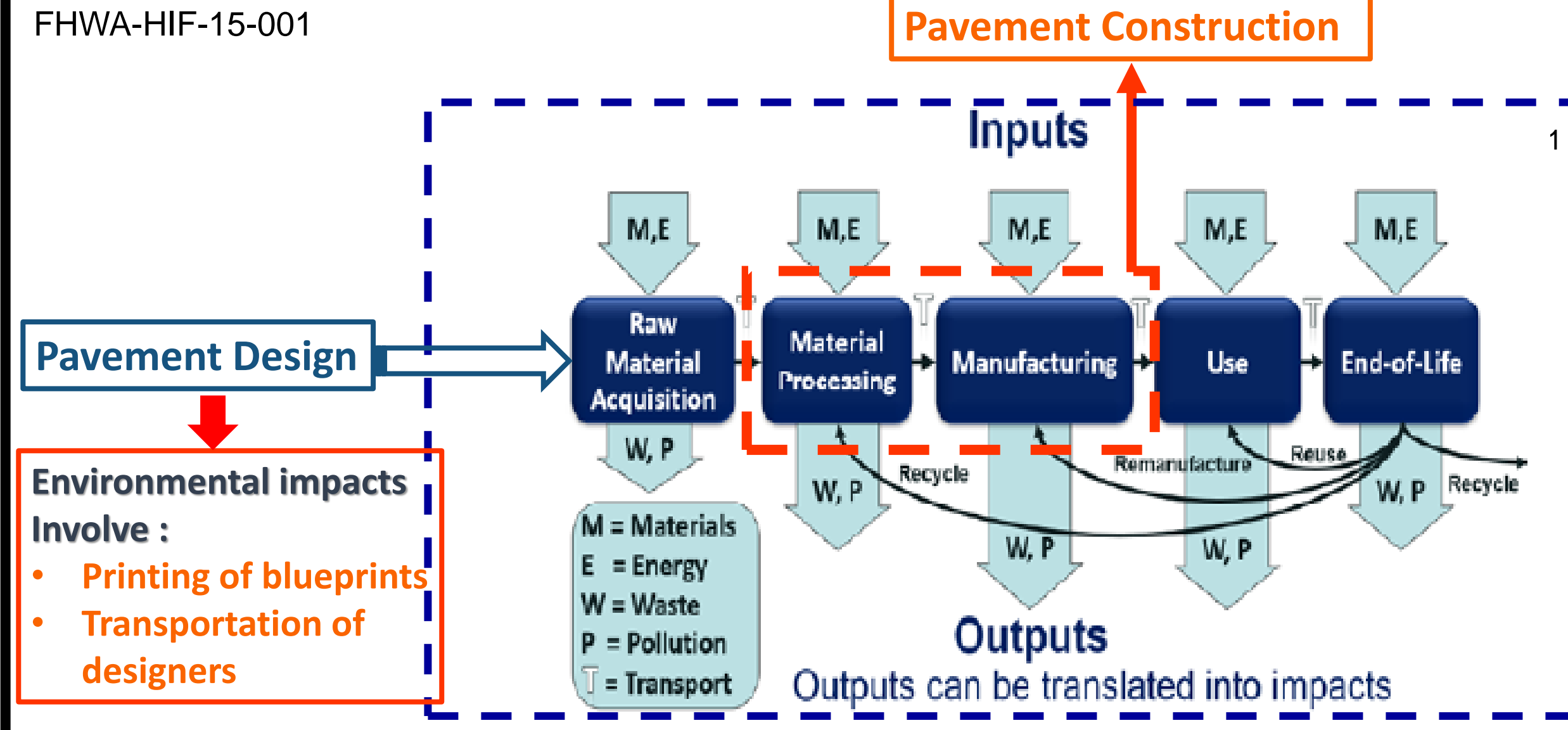


## 2. Key Steps of LCA

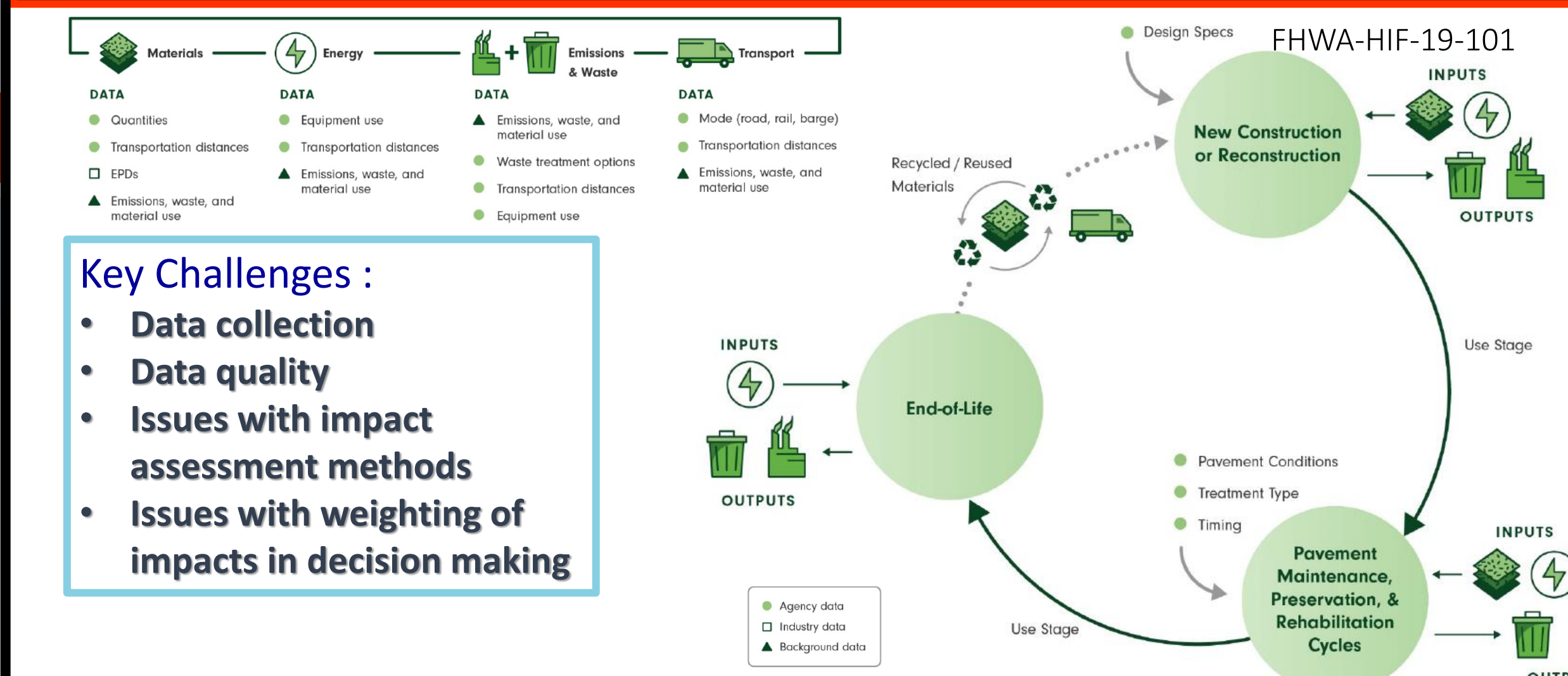
International Organization for Standardization (ISO) 14040 defines the following steps



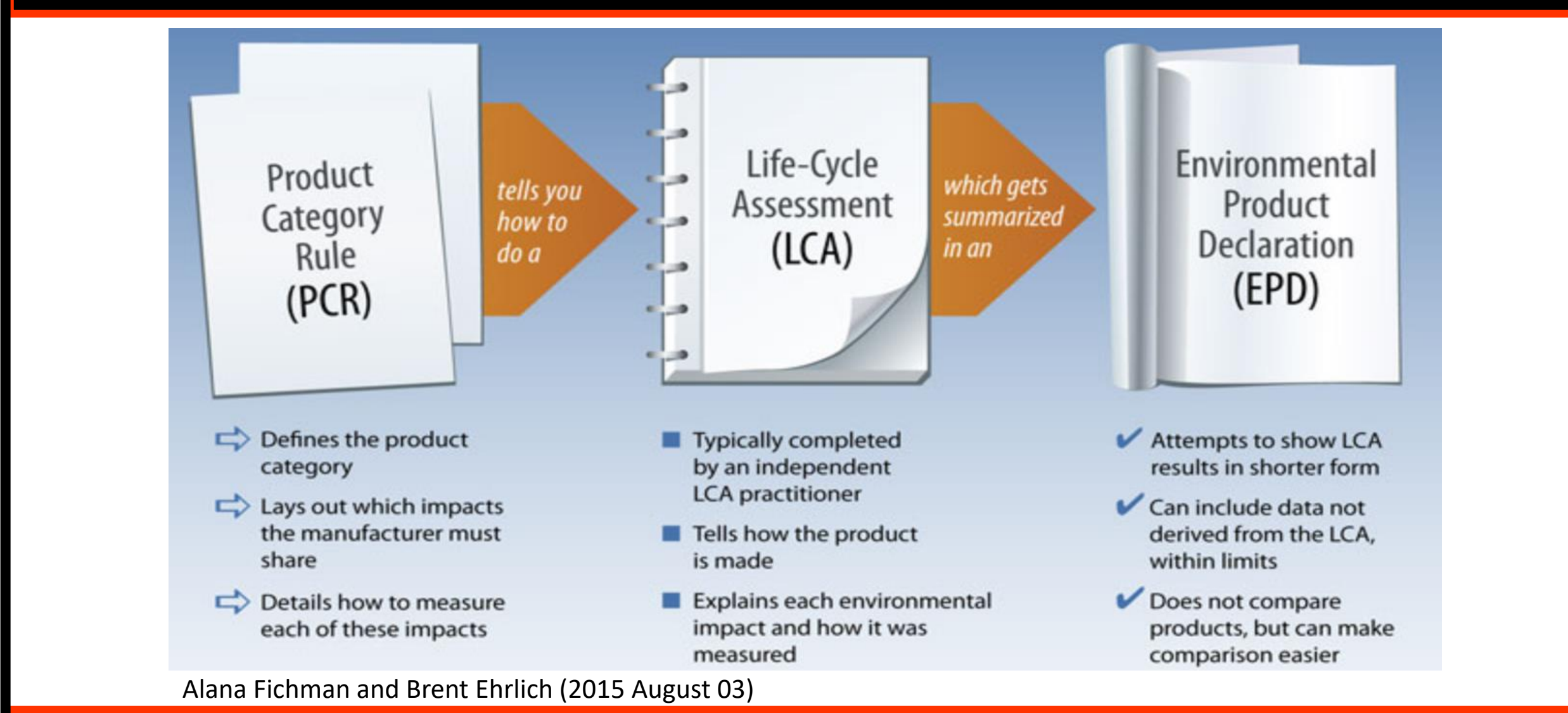
## 3. Stages of Pavement LCA



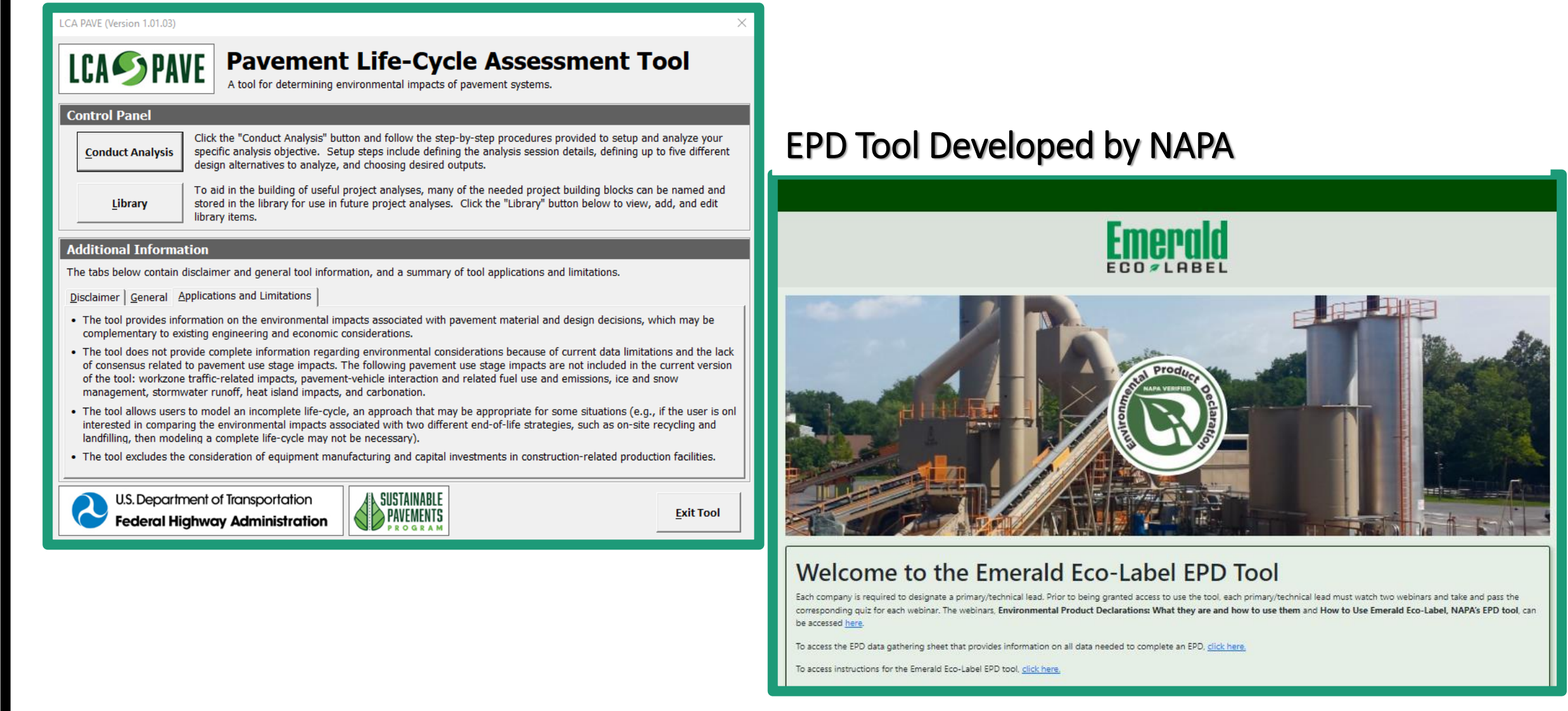
## 4. Data Consideration for Pavement LCA and key Challenges



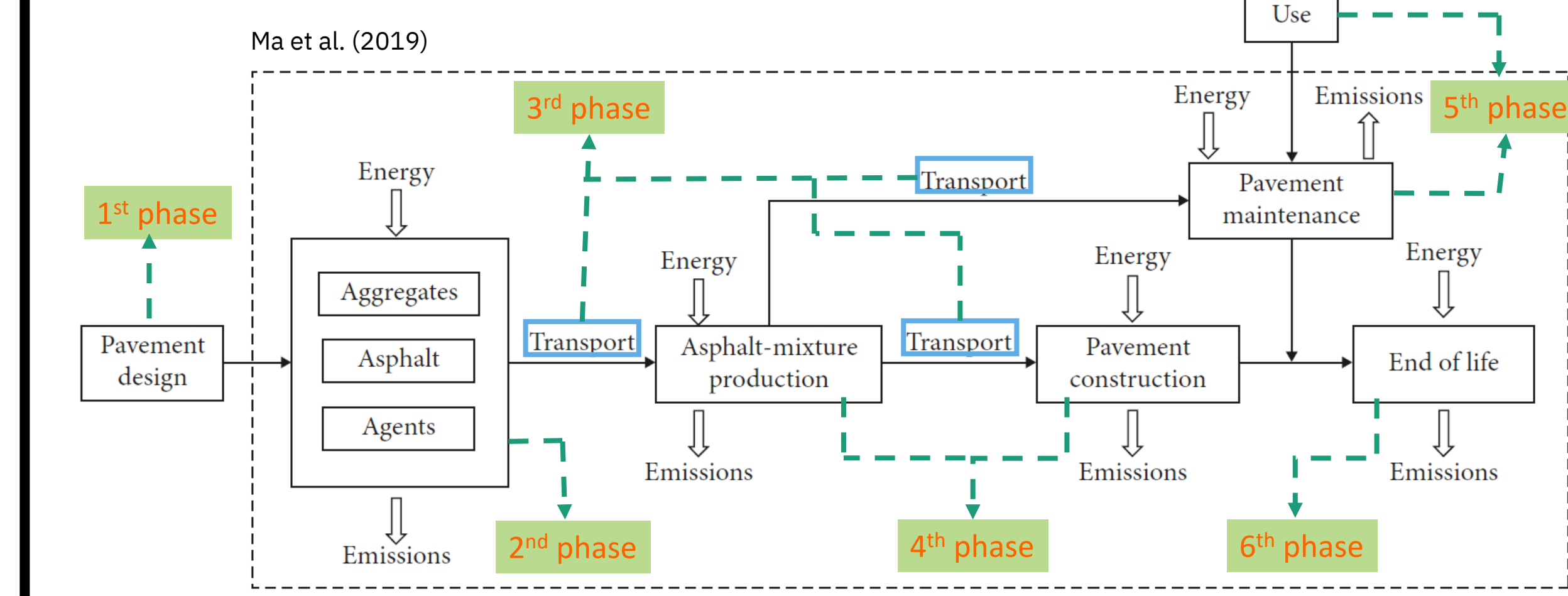
## 5. Why PCR & EPD ?



## 6. Tools for Asphalt Pavement LCA



## 7. Asphalt Pavement LCA



## 8. Comparative LCA of WMA vs HMA

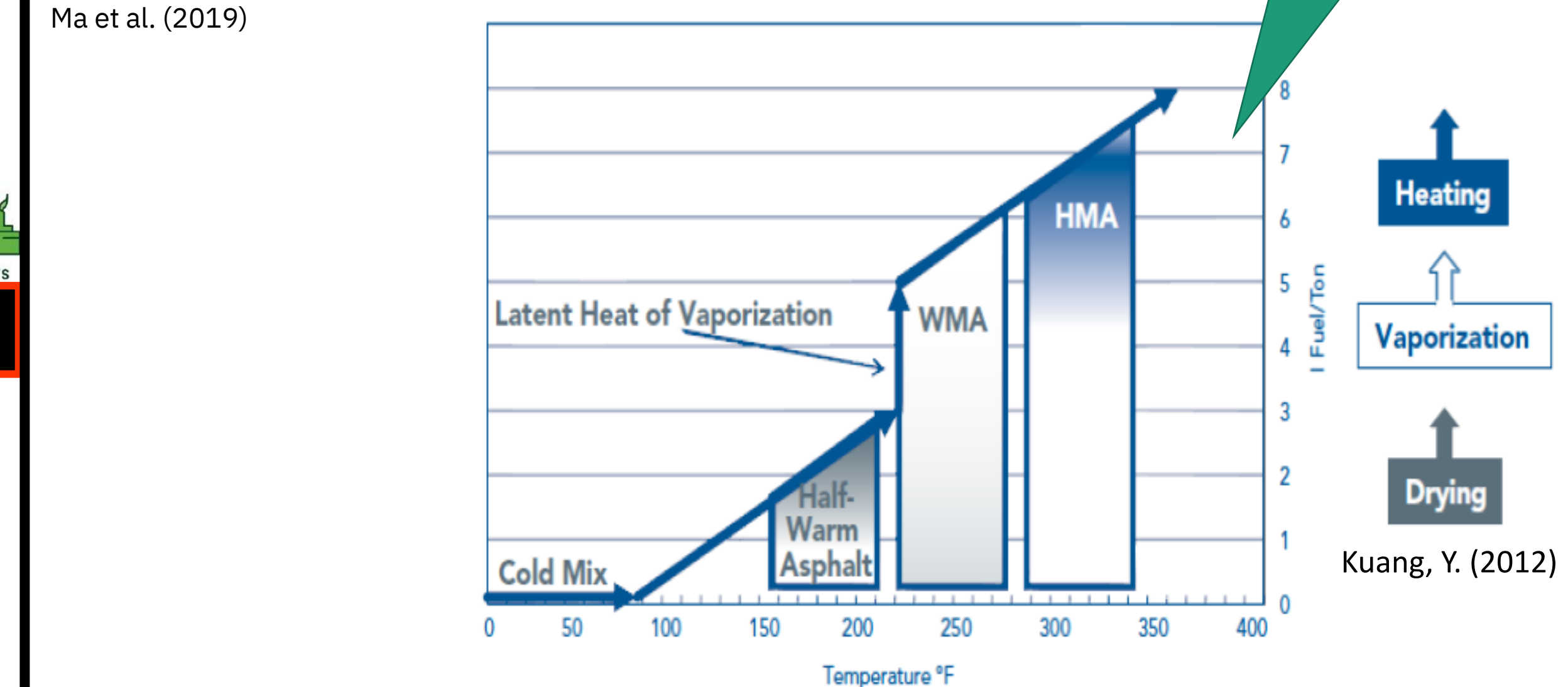
Case study in China: The LCIs of mixing energy every 1000 m<sup>3</sup> HMA and WMA mixtures

Generic Classification by Newcomb (2006)

- Cold Mix: 68 – 120 F
- Hot Mix: 280 – 340 F
- Warm Mix: 220 – 275 F

Type of consumption/emission	HMA	WMA
Heavy fuel oil (kg)	12955.44	9900.55
Electricity (kWh)	7988.77	6105.02
Diesel (kg)	291.33	222.63
CO <sub>2</sub> (kg)	45510	18204
NO <sub>x</sub> (kg)	147.6	40.44
SO <sub>2</sub> (kg)	108.24	26.84
PM <sub>2.5</sub> (kg)	10.33	5.38

Classification of Mix Type



## 9. The Path Forward

**Executive Order on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability**

DECEMBER 08, 2021 • PRESIDENTIAL ACTIONS

**The Road Forward**  
A Vision for Net Zero Carbon Emissions for the Asphalt Pavement Industry

- (v) net-zero emissions from Federal procurement, including a Buy Clean policy to promote use of construction materials with lower embodied emissions;
- (vi) climate resilient infrastructure and operations; and
- (vii) a climate- and sustainability-focused Federal workforce.

**Work with Oklahoma asphalt producers to develop mix EPDs**

**Generate EPDs for Oklahoma mixtures incorporating WMA**

**Develop a framework to incorporate LCA into the project selection process in Oklahoma**

Sec. 208. Sustainable Acquisition and Procurement. (a) Agencies shall reduce emissions, promote environmental stewardship, support resilient supply chains, drive innovation, and incentivize markets for sustainable products and services by prioritizing products that can be reused, refurbished, or recycled; maximizing environmental benefits and cost savings through use of full lifecycle cost methodologies; purchasing products that contain recycled content, are biobased, or are energy and water efficient, in accordance with relevant statutory requirements; and to the maximum extent practicable, purchasing sustainable products and services identified or recommended by the Environmental Protection Agency (EPA).