The production of construction materials is very energy intensive and requires large quantities of fossil fuels. Asphalt is the major road paving material in Europe and is being produced primarily in stationary batch mix asphalt factories. The production process requiring the most energy is the heating and drying of aggregate, where natural gas, fuel oil or LPG is burned in a direct-fired rotary dryer. Replacing this energy source with a more sustainable one presents several technical and economic challenges, as high temperatures, short startup times and seasonal production variations are required. This paper analyses different pathways for the use of biomass feedstock as a primary process fuel. The analysed cases consider the gasification of straw and wood chips and the direct combustion of wood pellets. The additional use of syngas from the gasifier for the production of heat or combined heat and power is further evaluated during hours without asphalt production. The challenges of having varying seasonal production can be solved by this integration of the production unit to the utility system. The results show the economic and technical feasibility of using biomass for process heating in the asphalt factory. The dryer demand of 6.4 MW can be covered with a biomass input between 7.1 and 8.6 MW. District heat can be produced at competitive prices below 40 € per MWh.