Mathematic Property: *atis*Efficiency

(Mathematic properties are those properties that are part of the meta-theory and have been abducted from mathematics to be used as a tool to provide solutions concerning the theory. Those solutions may be assigned as values to components or relations of the theory and thereby become part of the theory.)

Efficiency, $_{EF}\mathfrak{S}$, $=_{df}$ the ratio of *input-utilized derived production output* to corresponding *feedin input-components*.

$$_{EF}\mathfrak{S}, =_{df} \mathcal{M}[(_{DP}\ell_{T})\mathbf{I}_{\mathcal{P}} \div \mathbf{I}_{\mathcal{P}}]; \text{ where, } (_{DP}\ell_{T})\mathbf{I}_{\mathcal{P}} = \mathbf{I}_{\mathcal{P}} \setminus {}_{SP}\mathfrak{S} \cup \mathbf{S}_{\mathcal{P}}$$

Efficiency is defined as a measure of *input-utilized derived-production feedthrough* divided by *input*; where *input-utilized derived-production feedthrough* equals *input* less *spillage* and *storeput*.

That is, to obtain a value for the *efficiency* of a system, we must know what *input* is being utilized, and we must consider only that *input* that is processed for *output*. That *toput* that is initiated for transmission to *input* but results in *spillage* is not considered, and neither is the *input* that remains in storage and is not made available to *fromput*.

Before considering *efficiency*, as it will be used in ATIS, we need to consider the fact that *efficiency* has been defined in several different ways as the development of this theory model has been pursued. Initially, SIGGS defined efficiency as follows:

Efficiency, $_{EF}\mathfrak{S}, =_{df}$ a system that has commonality between *feedthrough* and *toput*.

The problem with this definition is that *feedthrough* and *toput* are two different types of terms. *Feedthrough* is a morphism and *toput* is a set of components. Then, the first revision of the SIGGS definition made both terms the same type as follows:

Efficiency, $_{EF}\mathfrak{S}, =_{df}$ a system that has commonality between *feedthrough* and *feedin*.

$$_{EF}\mathfrak{S}, =_{df} \mathcal{A}(\wp_T) \equiv \mathcal{A}(\wp_I)$$

Efficiency is a measure of the commonality of feedthrough and feedin.

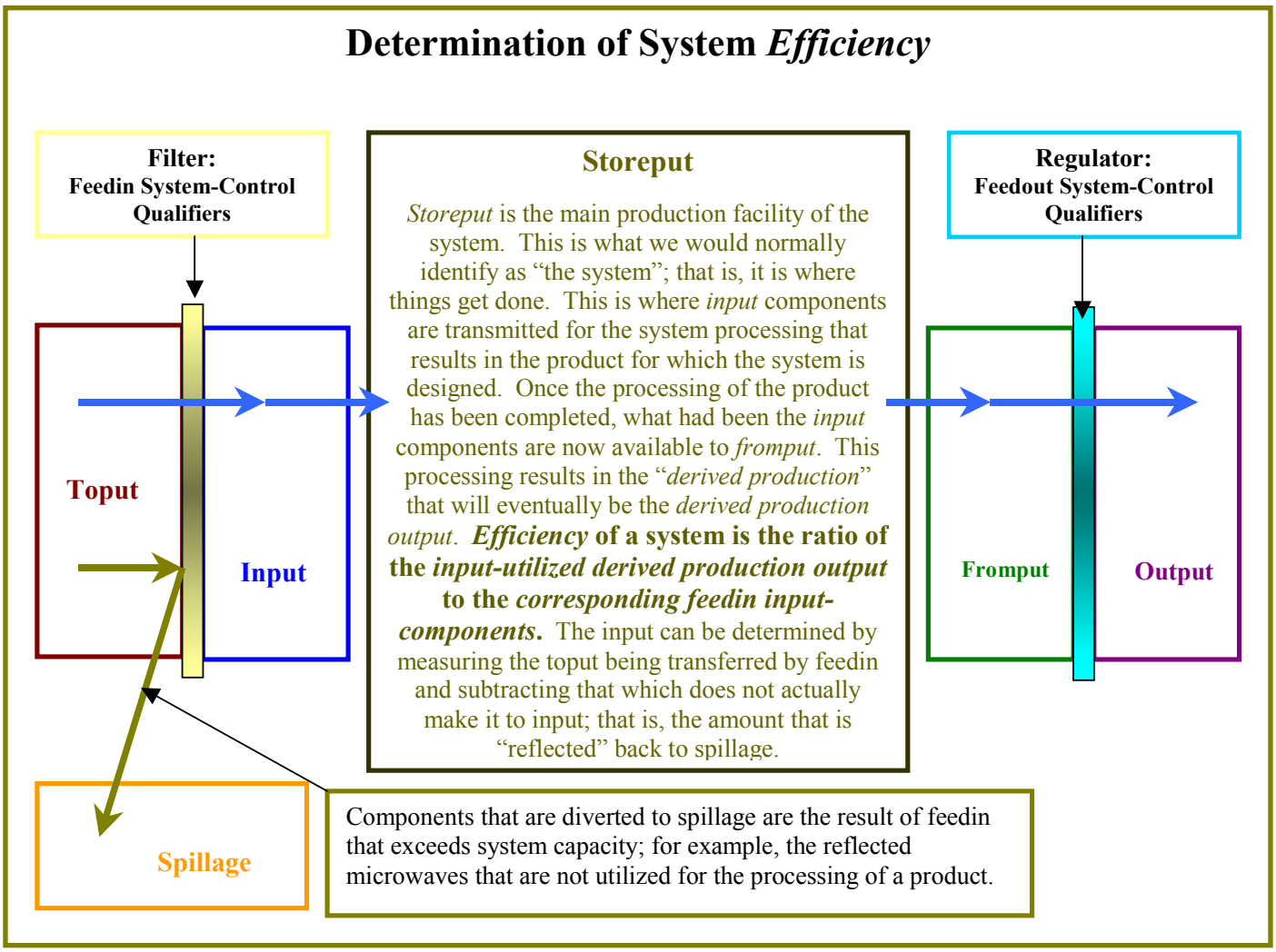
However, while this definition suggests what is wanted, we still do not have a good grasp of just what is happening and the measure that can be easily identified with the definition. As a result of these considerations, the definition provided above seems to provide the best indicator of just what is meant by *efficiency*. However, feedthrough can give us valuable perspectives on efficiency by identifying the **efficiency maximization principle** and the **efficiency minimization principle**. The **Efficiency maximization principle** results when feedin produces the largest possible feedthrough and **efficiency minimization principle** results when feedthrough is obtained with the least possible feedin. This efficiency relationship is between *feedthrough* and *feedin*, and not *feedthrough* and toput. The reason is that, as noted above, *feedthrough* and *toput* are different types of properties.

Efficiency is normally measured as a ratio of *output*:*input*. However, for *ATIS*, this ratio must be more carefully considered. For example, the efficiency of microwave energy used to dry beech wood was determined as follows:

> To investigate the energy efficiency, input and reflected microwave power were detected. Energy efficiencies with respect to MW-power of up to 80% were reached depending on the moisture content of the samples.
>
> (*Vacuum Microwave Drying of Beech: Property Profiles and Energy Efficiency*, Matthias Leiker, et al., Matthias.Leiker@mailbox.tu-dresden.de, Technische Universität Dresden, Thermal Process Engineering and Environmental Technology, 01062 Dresden, Germany; http://www.vtt.fi/rte/bss/coste15/cost%20e15%20esitelmat/CD/17Leikeretal.pdf).

In this example, **efficiency** was determined by evaluating the amount of microwave *spillage* with respect to the energy *input*; that is, the "reflected microwave power" (*spillage*) to the microwave power *input*. In this example, **efficiency** is determined by evaluating the input that is used for *derived production output* as determined by measuring the amount of *spillage*. Therefore, **efficiency** is the ratio:

Input-utilized derived production output : *corresponding feedin input-components*.



Examples: School systems may be viewed from either a maximization or minimization efficiency principle. That is, efficiency maximization could be obtained when each student obtains the greatest achievements, and efficiency minimization could be obtained when the learning of each student is optimized with respect to resources.