Before addressing the role of coordinated systems control and its performance objectives in a competitive power market, it is essential to appreciate the nature and limitations of the currently available planning and operating tools and procedures. Power systems are managed according to a variety of time frames. These time frames relate to control objectives that the systems must meet in response to independent input changes [36], [59].

To set the stage for understanding the objectives of systems control, we briefly review the types of input changes likely to be seen in a changing industry. It is important to keep in mind that the present system has been designed for qualitatively different types of inputs than, for instance, the market-driven demand and generation. On the other hand, unless otherwise decided, the technical performance objectives are likely to remain unchanged, and they can be introduced in the context of both present and changing operations. As such, they must be standardized and fully understood by the people responsible for introducing price-charging mechanisms for systems control. In this sense, once agreed on, the performance objectives could serve as a good common denominator for comparing performance quality under particular industry structures. If, on the contrary, these are not well defined, the objectives of systems control support under competition will not be well understood, which could lead to potential conflicts of interest among various parties.
3.1 Dynamics of system inputs to which the control responds

At present, systems control services under normal conditions respond to anticipated demand and its random, small deviations. A typical demand curve for which the scheduling is done is shown in Figure 3.1. This curve represents an aggregate demand as seen at the extra high voltage (EHV) transmission network level. The fluctuations in individual loads are seen in this model as small random fluctuations around this aggregate representation.

In attempting to provide systematic algorithms for system services needed to keep the system together under competition, generally referred to as ancillary services [21], it may be helpful to recognize three qualitatively different causes of system input changes to which ancillaries respond:

1. Firm, long(er) term contracts.
2. Short-term (half hour or less), non-firm contracts.
3. Noncompliance-related changes that reflect deviations from 1 or 2.

In addition we recognize residential load, whose changes are fairly well understood as a function of time. 2

System inputs of types 1 and 2 are shown in Figure 3.2. The noncompliance may display wide ranges of rate and magnitude at which it evolves. The qualitative difference between 1 and 2 does not arise from their different relative durations but is due to the fact that planning can be done with high confidence only for type 1. Short-term contracts are not known over the time horizons relevant for planning system support. Furthermore, the qualitative

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1 Most of the material in this text is related to the EHV transmission level. At a distribution level the relative dynamics of system inputs may be qualitatively different, including the fact that no aggregate load model is used.

2 Retail wheeling is not accounted for here [21].