The Dynamics of Security
stability, durability, resilience, robustness
Energy Security

conventional approaches focus on outcomes

IEA, 2006
“availability of a regular supply of energy at a reasonable price”

Umbach, 2004
“availability of energy at all times in various forms in sufficient quantities and at affordable prices”

Rubbelke, 2008
availability of at least current volumes of energy in the short- and medium-term at prices, which do not significantly exceed past medium-term-prices

DECC, 2008
includes
physical security: involuntary interruptions
price security: unnecessary price spikes
geopolitical security: undue reliance on specific nations
Dynamics of Energy Security

need complementary focus on dynamics
Dynamics of Energy Security

1: temporality of threat – are threats envisaged as:

- *energy availability (reasonable access and cost)*
- threat parameter

- shocks

eg:

- **internal to energy system**
  - price spikes, infrastructure failures, industrial conflict

- **external to energy system**
  - market disruption, geo-politics, natural disaster
Dynamics of Energy Security

1: temporality of threat – are threats envisaged as:

- **energy availability**
  - threat parameter

- **shocks**
  - eg: internal to energy system
  - price spikes, infrastructure failures, industrial conflict
  - external to energy system
  - market disruption, geo-politics, natural disaster

- **stresses**
  - eg: internal to energy system
  - market evolution, resource depletion, consumer shifts
  - external to energy system
  - technology /geo-political change, demographic shifts
Dynamics of Energy Security

2: potency of action – do interventions aim at:

- energy availability
- threat parameter

![Diagram showing shocks and control over energy availability.]

control

- eg: regulate prices
- protect infrastructure
- prevent oligopoly
- industrial relations
Dynamics of Energy Security

2: potency of action – do interventions aim at:

- energy availability
- threat parameter

shocks

- eg: regulate prices
- protect infrastructure
- prevent oligopoly
- industrial relations

stresses

- eg: market intervention
- resource substitution
- mitigation / adaptation
- military action

control
Dynamics of Energy Security

2: potency of action – do interventions aim at:

- energy availability
- threat parameter

**shocks**
- eg: flexible options
- supple infrastructures
- redundant capacity
- network connectivity

**stresses**
- eg: foresighted institutions
- reversible commitments
- adaptable infrastructures
- technological diversity
Dynamics of Energy Security

shocks
control
response

stresses
Dynamics of Energy Security

- Shock (against transient disruption)
- Stress (against enduring shift)
- Temporality of threat
- Control (change is internal to control system)
- Respond (change is external to control system)

Potency of action

Stability

Durability

Resilience

Robustness
Dynamics of Energy Security

Four necessary and sufficient dynamic properties
From Dynamics to Strategies

Contrasting strategies promote different aspects of energy security

(after JESS / BERR 2006-8)
From Dynamics to Strategies

Contrasting strategies promote different aspects of energy security

Policy attention prioritises…
From Dynamics to Strategies

Contrasting strategies promote different aspects of energy security.

Infrastructure qualities emphasise…
From Dynamics to Strategies

Contrasting strategies promote different aspects of energy security

Research and technology policies focus on…
From Dynamics to Strategies

Contrasting strategies promote different aspects of energy security

(stability)

 strengthened commitments
“maintain asset reliability”
“enforce operational margins”
“promote efficient markets”
“allow effective price signals”
“support social / political stability”
“take preventive action”
“sustain pressure on other states”
“foster domestic self-reliance”
“undertake planning (eg: SYS)”

 flexible commitments

(after JESS / BERR 2006-8)
From Dynamics to Strategies

Contrasting strategies promote different aspects of energy security

(after JESS / BERR 2006-8)

strengthened commitments

“adaptive infrastructures”
“systemic innovation”
flexible commitments

robustness
From Dynamics to Strategies

Contrasting strategies promote different aspects of energy security

(after JESS / BERR 2006-8)

multi-functional capacities

“create market incentives”
“establish futures markets”
“develop new sources / carriers”
“extend asset lifetimes”
“deepen engagement with producers”
“substitute obsolete options”
“transition management”

mission-focused interventions

durability
From Dynamics to Strategies

Contrasting strategies promote different aspects of energy security

(after JESS / BERR 2006-8)

**resilience**

- multi-functional capacities
- operational stocks / storage / reserves
- “demand-side response capacity”
- “flexible, multi- input/fuel refining/generation”
- “enhance network connectivity”

mission-focused interventions
From Dynamics to Strategies

Vested interests condition an emphasis on stability-based strategies.

( après JESS / BERR 2006-8)
From Dynamics to Strategies

But … a few strategies can help promote several dynamic properties

(after JESS / BERR 2006-8)
Dynamics of Energy Security

**STABILITY**
- Context
- System
- Endogenous disruption

**RESILIENCE**
- Context
- System
- Transient exogenous shocks

**DURABILITY**
- Context
- System
- Internal stresses

**ROBUSTNESS**
- Context
- System
- Secular external stress
Dynamics of Energy Security

- **Control** (change is internal to control system)
  - Temporality of threat
  - Stress (against enduring shift)

- **Shock** (against transient disruption)
  - Potency of action
  - Response (change is external to control system)

- **Stability**
  - Price spikes
  - Infrastructure failures
  - Oligopolistic action
  - Industrial conflict

- **Durability**

- **Resilience**

- **Robustness**
Dynamics of Energy Security

STABILITY

context

system

endogenous disruption

control internal shock
causes held to be broadly subject to control system
(eg: regulate prices
protect infrastructure
prevent oligopoly
industrial relations)
Dynamics of Energy Security

- **Control**: (change is internal to control system)
- **Shock**: (against transient disruption)
- **Stress**: (against enduring shift)
- **Temporality of threat**
- **Response**: (change is external to control system)
- **Potency of action**

**STABILITY**
- market evolution
- local resource depletion
- consumption shifts
- regulatory change

**DURABILITY**

**RESILIENCE**

**ROBUSTNESS**
Dynamics of Energy Security

context

system

internal stresses

DURABILITY
Dynamics of Energy Security

control internal stress
causes are held to be broadly subject to control system
(eg: market intervention
resource substitution
mitigation / adaptation
military action)
Dynamics of Energy Security

- **Shock** (against transient disruption)
- **Stress** (against enduring shift)
- **Control** (change is internal to control system)
- **Response** (change is external to control system)

**Stability**
- Global price spikes
- Geopolitical events
- Sabotage or attack
- Political ‘scares’
- Natural disaster

**Durability**

**Resilience**

- Temporality of threat
- Potency of action

**Robustness**
Dynamics of Energy Security

respond to external shock
causes are held to be beyond control
system, so subject only to response

(eg: flexible options
supple infrastructures
redundant capacity
network connectivity)
Dynamics of Energy Security

- **Shock** (against transient disruption)
- **Temporality of threat**
- **Stress** (against enduring shift)

**Control** (change is internal to control system)

**Response** (change is external to control system)

- **Stability**
- **Durability**
- **Resilience**
- **Robustness**

- Climate change
- Technological revolution
- Geo-political movements
- Cultural / demographic shifts
Dynamics of Energy Security

secular external stress

context

system

ROBUSTNESS
Dynamics of Energy Security

ROBUSTNESS

context

system

secular
external
stress
Dynamics of Energy Security

respond to external stress
causes are held to be beyond control system, so subject only to response
(eg:
  institutional foresight
  adaptable infrastructures
  technological diversity)

ROBUSTNESS
Dynamics of Energy Security

- Shock: (against transient disruption)
- Stress: (against enduring shift)
- Temporality of threat

Control:
- (change is internal to control system)

Respond:
- (change is external to control system)

Potency of action

Stability

Resilience

Durability

Robustness