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Towards a sustainable society from the
perspective of energy conservation and
Urban Structure

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Objectives

- This paper examines the **relationship between energy and spatial structure** in the context of urban planning.
- It provides platform for **urban planners to facilitate and guide new development** as well as **improve existing settlement structure and built environment** into spatial structure which are **more energy efficient**.



2.0 SETTLEMENT PATTERN AND ENERGY OF MALAYSIAN CITIES

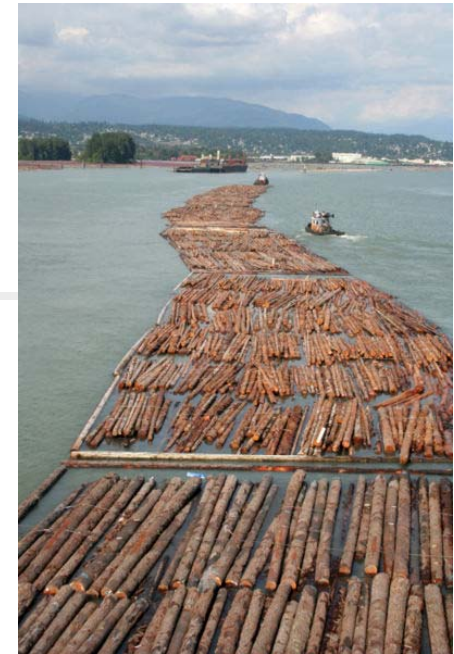
Broadly, spatial structure and energy use can be divided into three (3) main stages: -

- a) Agriculture - Industrial stage (1960-1980)
- b) Industrial–Digital stage (1980-2000)
- c) K- economy (beyond 2000)



Agriculture - Industrial stage (1960-1980)

- After gaining Independence in 1957, the **rapid urbanization process Malaysia permitted urban concentration** in order to optimize the agglomeration of economy and transportation network.
- Many major cities such as **Kuala Lumpur, Penang, Malacca, Ipoh, Johor Bahru and other state capitals were primary commodity-based economy**. They are usually located at confluence of river or located at coastline or road and rail terminal/stations.
- The **availability of energy in the form of oil made many cities as a focal point of concentration** since many of the industries depend on coal and oil as resources for the rapid urban growth.





b) Industrial–Digital stage (1980-2000)-cont.

Malaysia initiated the Industrial Master Plan 1 (IMP1, 1986-95) that laid the **foundation of manufacturing** and **promoted the processing of natural resources** instead of exporting them in raw form.

Industrial Master Plan 2 (IMP2, 1996-2005) tried to **broaden manufacturing capability** through the strategies of cluster-based development and *manufacturing plus*.

Earlier advantages of spatial concentration based on **natural transportation became increasing irrelevant**. The **increased mobility, network of communications and services such as electricity grid with network of generating plants provides possibilities of decentralization**

The **“relatively” cheap fossil fuel** in Malaysia has contributed to **rapid suburbanization** phenomenon in many cities as new township in the form of mixed housing estates development.

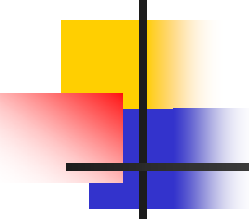
b) Industrial–Digital stage (1980-2000)

They were built along **major development corridor** usually along the main road. The rapid suburbanization process has produced a pattern of **spatial de-concentration and low-density development**. In addition, multi nucleated pattern also emerged which is characterized by a series of centres located at or near transportation nodes both at the metropolitan or regional level. Among these centres are **Bangi, Kajang and Damansara and Subang** located within the Klang Valley.

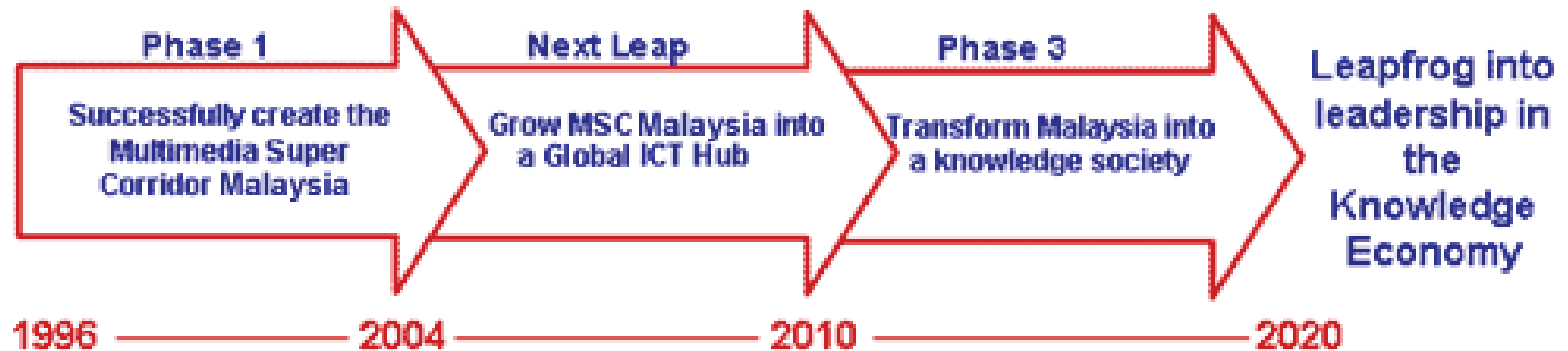
During this period **many Structure plans and Local plans** were prepared to guide development of local planning authorities. However, **none of these plans have incorporated any energy conservation policy**.



c) K- economy (beyond 2000)

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- During the **Eight Malaysia Plan (2000-2005)**, concerted effort were undertaken to provide stronger platform for the country's transition towards **a knowledge base economy**.
 - In order for Malaysia to transform her economy by **quantum leap from manufacturing to k economy**, spatial structure should also be planned to accommodate the new economy. **Trip reduction is possible with digital revolution based on e-commerce, e-banking and e-travel etc.**
 - On the contrary, **k economy age may permit continued interaction between widely spaced activities** even if energy costs rise to constrain physical mobility.
 - During this period, urban development will be promoted based on **conurbation to support development of urban economic activities** that is value added and knowledge based economy. (NUP, 2006)
 - The change of **energy supply and cost as well as the Information Communication Technology (ICT)** will have impact on the spatial structure. The presence of **telecommuting and continuing emphasis of k-economy**, will have impact on the urban structure.

The MSC Malaysia Vision: From 1996 To 2020

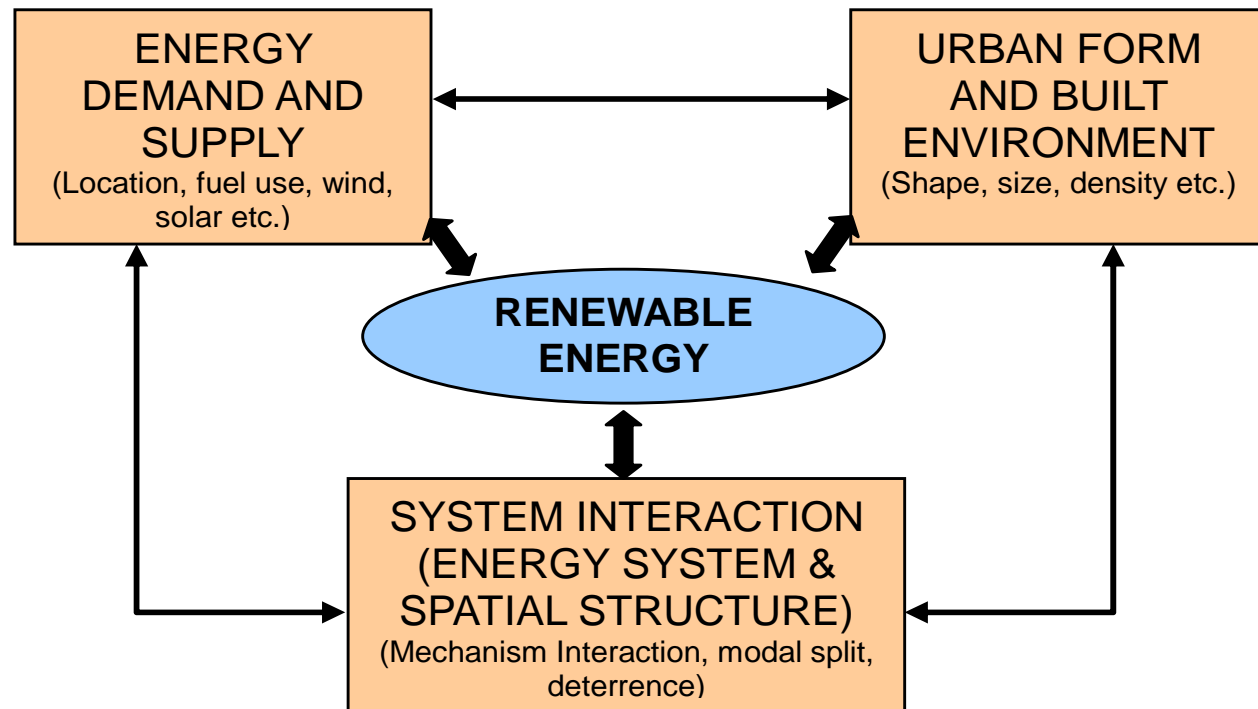


In **Phase 1 (1996 -2003)**, the MSC Malaysia was successfully created. Every Phase 1 milestone was surpassed.

In **Phase 2 (2004 -2010)**, a web of similar corridors will be established in Malaysia , and a global framework of cyberlaws will be passed; furthermore at least four or five intelligent cities will be linked to other global cities worldwide.

In **Phase 3 (2011 - 2020)**, Malaysia will evolve into one Multimedia Super Corridor. An International Cybercourt of Justice will be established in MSC Malaysia and 12 intelligent cities will be linked to the global information highway.

3.0 RELATIONSHIP BETWEEN ENERGY USE AND SPATIAL STRUCTURE





Energy demand and spatial structure

- The three (3) main components define relationship between **energy demand** and **spatial structure** is:
 - **Energy demand and supply** (spatial distribution of energy demand for different end purposes, fuel used, source of fuel, incidence of solar radiation, wind speeds, potential for renewal energy)
 - **Urban form and other aspect of built environment-scale** of analysis.
 - **Mechanism of interaction** between the energy system and spatial structure. (Deterrence effect of trip making, modal split, efficiencies of heating/cooling equipment, price of various fuel and elasticity)

4.0 LITERATURE REVIEW – FINDINGS ON ENERGY VARIABLES ON SPATIAL STRUCTURE

Table.5: Possible Energy Saving Percentage by Land Use Variables

Land Use Variable	Mechanism	Effect on Energy Demand
Combination of factors (shape, size interspersion)	Travel requirement (esp. trip length and frequency)	Variation 150%
Interspersion of activities	Travel requirement (trip length)	Variation up to 130%
Shape of urban area	Travel requirement	Variation up to 20%
Density /clustering trip ends	Facilitate economic public transport	Energy saving 100%
Density/mixing of land use and built form	Facilitate CHP	Efficiency 100%
Layout, orientation design	Passive solar gain	Variation 20%

Source: Owens (1986)

5.0 SPATIAL STRUCTURES VARIABLES – THE CASE OF MALAYSIA.

Table 1: Spatial Variables Affecting Energy Use

	Spatial variables	Descriptions
A	Population size	Total population based on census data and developed land
A2	Population density	Population per square km
B	Developed area	Total built up area
D	Land use pattern /Shape of community	Relative location of residential and employment patterns /Cluster or non cluster metropolitan area
E	Type and density of housing	High residential density / medium /high rise flats
F	Spatial form	Concentric shape versus multi centres
G	Network level of services	Automobile energy consumption efficiency falls when congestion happens less than 32km per hour
H	Public transport	Modal split =Ratio of private vehicle use as to public transport usage.

Spatial variables

Table 2 Spatial Variables Affecting Energy Use

	Spatial variables	Descriptions
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Urban area by size class

Table 3: Urban Areas by Size Class

Urban population, number of cities and percentage of urban population

Size class	1950	1955	1960	1965	1970	1975	1980
1 to 5 million							
Number of agglomerations	0	0	0	0	0	0	0
Population	0	0	0	0	0	0	0
Percentage of urban population	0	0	0	0	0	0	0
500 000 to 1 million							
Number of agglomerations	0	0	0	0	0	1	1
Population	0	0	0	0	0	645	921
Percentage of urban population	0	0	0	0	0	14	16
Fewer than 500 000							
Population	1 244	1 639	2 165	2 842	3 631	3 971	4 866
Percentage of urban population	100	100	100	100	100	86	84

Size class	1985	1990	1995	2000	2005	2010	2015
1 to 5 million							
Number of agglomerations	1	1	1	1	1	1	1
Population	1 016	1 120	1 213	1 306	1 405	1 534	1 696
Percentage of urban population	14	13	11	9	8	8	8
500 000 to 1 million							
Number of agglomerations	0	0	1	3	3	4	4
Population	0	0	516	1 798	2 018	2 826	3 168
Percentage of urban population	0	0	5	13	12	14	14
Fewer than 500 000							
Population	6 181	7 770	9 596	11 105	13 644	15 419	17 421
Percentage of urban population	86	87	85	78	80	78	78

-Helps to understand pattern of urbanisation
Malaysian cities are relatively small.

Primate city is KL of size more than 1 million.

Medium size city and small medium cities are on increasing trend (4.9 m (1980) to 11m (2000)

Small and intermediate towns are growing at 5.2% p.a as compared with average of annual growth of 2.5% -p.a

Esp located within the conurbation fast growing mother city.

Distribution of housing units and types by 2000

Table 4: Distribution of housing units by housing types in Malaysia 1990-2000

Types	Number (thousands'000)		% distribution		Annual change
	1991	2000	1991	2000	
Detached	1998.8	2222.2	49	40	1.2
Semi-D	424.3	503.4	10	9	2.1
Row houses	1074.0	1806.9	27	32	7.6
Longhouse	76.0	86.1	2	2	1.5
Apartments	283.7	697.7	7	13	16.1
Shop houses	135.1	165.9	3	3	2.5
Others	68.9	64.8	2	1	-1.0
Total	4060.9	5547.0	100	100	4.1

Source : Population and Housing census of Malaysia -2000

- 81% are low rise houses (40% detached)

Row houses – esp terrace houses in new housing estates are increasing rapidly (7.6% p.a)

Apartment building such as flats, condominium esp in larger cities experiencing a significant growth of about 16.1%p.a

Relationship between the Spatial Structures at Different Scale

SCALE	CRITERIA	VARIABLES
<p>BUILDING</p> <p>Nu-UNIT</p> <p>URBAN</p> <p>REGIONAL</p>	<p>Settlement Pattern</p> <p>Transport- inter Settlement</p> <p>Size of Settlement</p> <p>Shape of Settlement</p> <p>Transport- intra Settlement</p> <p>Density</p> <p>Degree of Mix Land Uses</p> <p>Degree of Centralization of Facilities</p> <p>Detailed Layout - green Sun Orientation</p> <p>Sitting Design concept</p>	<p>Spatial Structural Variables</p>



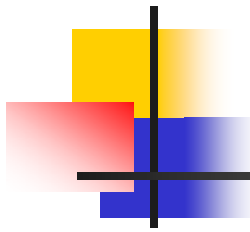
CURRENT SPATIAL PLANNING IN MALAYSIA AND ENERGY CONSIDERATION

- National Physical Planning(NPP2005)
- National Urbanization Policy
- Development plans
 - State Structure Plans
 - Local Plans
- Development Control/ Planning approval



Goal of NPP

- Goal of Malaysia's National Physical Plan i.e. the establishment of an **efficient, equitable and sustainable national spatial** .
- Sustainable development is adopted as national spatial framework for the **general direction of physical development for the nation** (NPP, 2005).
- It will be the **guiding plan providing directions and trends on the development, use and conservation of land in the country.**



National Physical Planning(NPP2005)

Four mutually supportive objectives are identified as follows;

- To rationalize **national spatial planning** for **economic efficiency** and **global competitiveness**
- To optimize **utilization of land and natural resources** for sustainable development
- To promote **balanced regional development** for national unity
- To secure **spatial and environmental quality** and diversity for a high quality of life.



National Urbanization Policy

- NUP policy is further supported by policy measures.
- **Thrust 1: Towards an Efficient and Sustainable Urbanization**
- Thrust 2: Development of a Resilient, Dynamic and Competitive Urban Economy
- **Thrust 3: Towards an Integrated and Efficient Urban Transportation System**
- Thrust 4: Provide Quality Urban Services, Infrastructure and Utility
- Thrust 5: Create a Conducive Urban Living Environment with a Distinct Identity
- Thrust 6: Effective Urban Governance

Growth Conurbation Policy



Figure 1.0 : URBAN HIERARCHY OF PENINSULAR MALAYSIA, 2006-2020



Source : National Urbanisation Policy Study, 2006.

- The NUP 2 outlines the **urban hierarchy of Peninsular Malaysia** to promote national growth conurbation policy.
- The growth conurbation policies designated four (4) main urban areas as major national growth conurbation areas i.e. **Johor Bahru, Kuala Lumpur, Kuantan and Ipoh** conurbation zones complemented with regional, state and district growth conurbations



Conclusion

- Towards a sustainable society require the **current change of unsustainable lifestyles of our modern society** with present consumption and living.
- The **overuse of our natural resources and dependence on fossil fuel** has brought about **serious pollution, ecosystem destruction and human induced climate change**.
- Urban and regional planning is recognized to **play important roles** in the development of sustainable cities.
- Based on the discussion there is no doubt **urban land use planning policies i.e. at building scale to city scale** will have important implication for energy demand and supply which will in turn affect environmental sustainability.