THE CHOICE OF GREEN AND SUSTAINABLE KITCHEN COMPONENT IN CONDOMINIUM UNITS IN PENANG

by

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LIST OF ABBREVIATIONS

1. (ABS) : Acrylonitrile Butadiene Styrene
2. (IRT) : International Roaming Team
3. (FSC) : Forest Stewardship Council
4. (MDF) : Medium Density Fiber Board
5. (NKBA) : National Kitchen & Bath Association
6. (SPSS) : Statistical Package for the Social Sciences

PEMILIHAN HIJAU DAN MAMPAN KOMPONENT DAPUR DI UNIT-UNIT KONDOMINIUM DI PULAU PINANG

ABSTRAK

Dapur adalah nadi utama aktiviti di setiap rumah. Pada masa kini, gaya hidup Bandar moden, perubahan tabiat, dan lain-lain teknologi komunikasi telah mengubah wajah dapur reka bentuk Malaysia. Tajuk tesis master ini adalah penyiasatan komponen dapur yang berkembang ke arah sifat yang serbaguna, hijau dan mampan. Objektif kajian ini adalah untuk mengenal pasti isu-isu yang menentukan reka bentuk dapur yang sedia ada di unit kondominium Pulau Pinang, dan untuk mengetahui keperluan dan pilihan komponen dapur dalam unit kondominium di Pulau Pinang. Skop kajian adalah memberi tumpuan kepada reka bentuk dalaman dapur dalam unit-unit kondominium. Tujuan kajian adalah untuk mengkaji isu-isu reka bentuk dapur yang sedia ada dan memahami penggunaan komponen dapur supaya dapat diaplikasikan dalam reka bentuk dapur. Daripada hasil penyelidikan yang diperolehi, ia akan membantu industry dapur bergerak ke arah tema hijau dan mampan pada masa hadapan. Kaedah yang diambil dalam kajian ini adalah menggunakan kaedah campuran berurutan penerangan. Data kuantitatif dikumpul menggunakan tinjauan soal selidik dan data kualitatif yang dikumpul menggunakan temubual secara bersemuka dan pemerhatian. Masalah utama yang dihadapi oleh penghuni kondominium di Pulau Pinang pada masa kini adalah tiada ruang penyimpanan yang mencukupi di dapur. Kajiselidik ini juga mendapati bahawa reka bentuk dapur gaya moden adalah pilihan semua penghuni kondominium tanpa mengira kaum dan majority bersetuju bahawa dapur bertemakan kehijauan dan mampan adalah sesuai untuk pengubahsuaian pada masa hadapan. Daripada pemerhatian yang dijalankan, didapati bahawa empat zon dapur adalah penting bagi penyediaan makanan, memasak, mencuci, dan menyimpan dalam setiap reka bentuk dapur dan ia boleh dicapai melalui pemahaman yang betul mengenai susun atur dan reka bentuk dapur. Dapatan kajian ini dapat menambah pengetahuan baru dan menyuntik kajian seterusnya berkaitan reka bentuk dapur.

THE CHOICE OF GREEN AND SUSTAINABLE KITCHEN COMPONENT IN CONDOMINIUM UNITS IN PENANG

ABSTRACT

Kitchens are the heart of activity in any home. Today, a modern urban lifestyle, changing habits, communication technology etc. have been transforming the face of present day kitchens design in Malaysia. The topic of this master thesis is the investigation of kitchen component that evolved towards a multifunctional, green and sustainable nature. The objective of this research are to identify the issues that determine the existing kitchen design in Penang condominium units, to find out the needs and the choice of the kitchen component related to the factors in existing kitchen design in Penang condominium units and to identify the green and sustainable kitchen component choices. The scope of the study was focuses on kitchen interior design in condominium units. The purposes of the study are to study the issues faces of the existing kitchen design and to understand the usage of the kitchen component applying to kitchen design. The findings of the research will assist the kitchen industry to move towards green and sustainable theme in the future. The methodology adopted in this research was using the sequential explanatory mixed methods. The qualitative data was obtained by using questionnaire survey and the qualitative data through observation and face-to-face interview. Not enough storage is the main issue face for the existing kitchen at the moment for Penang condominium units. The survey found that the choice of the kitchen design for all residents irrespective of race prefer modern style kitchen and majority of them agree that green and sustainable kitchen would be preferable for future renovations. The four kitchen zones are important for food preparation, cooking, cleaning, and storing in every kitchen design and it could be achieved through a proper understanding of kitchen layout and its design. The research will add to new knowledge and trigger further research in kitchen related design.

CHAPTER 1 - INTRODUCTION

1.0 Background

The ongoing trend in today's world is the conservation of nature in view of rising concerns on global warming. Through the International Roaming Team (IRT) development group 2011, all around the world including Malaysia points of awareness and eco campaigns are being implemented in the hope of getting people to help preserve Mother Nature, the planet that we all live in and are responsible for. Green decorating is the biggest thing in interior decorating today (Abraham, 2009). More and more people are realizing that their impact on the earth is important and by decreasing the footprint each of us leaves behind we leave the earth a healthier, happier place for generations to come (Abraham, 2009). With the emphasis on living a green lifestyle, it can be somewhat overwhelming for an active and busy family to figure out how to convert a home into one that is much more eco-friendly. Kitchen is one of the areas where it is possible to make major change in the green aspect in design (White, 2011).As we know that's, kitchens are the cornerstone of any home, going green in the kitchen is a great place to start on the path to organic living. A green kitchen means using healthier and more environmentally friendly products (Zwiebell, 2010).

The kitchen is more than a place for cooking a meal. It is now being regarded as the heart of a home, a place where family members move in and out throughout the day, a place to discuss the harried day, for planning or for catching up with each other (Rowenta Kitchen, 2010). The kitchen is one of the most utilized rooms in the house; nearly every homeowner will experience the exciting-though-daunting task of planning a kitchen renovation at one time or another. Before space became a luxury, kitchens occupied their

own room, or rooms. When built-in cupboards and appliances replaced the pantry, scullery, laundry, and larder, the modern kitchen was born (Niesewand N., 2006).

Kormann (2011) claims that, the beginning of the twentieth century, kitchen cabinets are being considered to be an integral of modern kitchens. It was since then that the importance of cabinets was realized and they became a necessity in every modern kitchen. With the passage of time the importance of stock cabinetry was being replaced by the custom kitchen cabinetry. Built-in kitchen cabinets are a relatively new element in the kitchen. Cabinets were never part of the kitchen construction in centuries past. They were most often freestanding structures like China cabinets or pie racks that could be moved from place to place. During the twentieth century, cabinets became an integral part of the kitchen. Kitchen cabinets were no longer an afterthought or a secondary need. The introduction of small kitchen appliances made kitchen cabinets a necessity in the home (Delmer, 2011).In 21st century, product innovation has been joined by visual innovation. Behind the many activities that take place in today's evolutionary kitchens, storage is still the main function (Niesewand, 2006). Nowadays, a kitchen requires cabinetry to store utensils, small appliances and dishware. Without cabinetry, working in the kitchen would be extremely difficult (Kormann, 2011).

Niesewand (2006) claims that, in a 2006 Ikea survey of 14,000 people in 28 countries, 60 per cent said the kitchen is one of the two most important rooms in the home. None of them used the kitchen just to cook, and 69 per cent think their kitchen is too small. Laundry, cooking, homework, eating, washing up, watching TV, family discussions, charging mobile phones, surfing the net, socializing, feeding pets, playing board games:

the list of activities they spelled out was endless. Hence, it is important to maintain safety and security at all times to ensure harmonious work in the area. Additionally, kitchen is where most of the appliances are located. Hence, among all other parts in the house, the kitchen contributes almost half of the total energy consumption. With this, it is equally important to create a kitchen design that will match the requirements of integrated or sustainable design (Jo, 2011).

Sustainable design (also called environmental design, environmentally sustainable design, environmentally conscious design, etc.) is the philosophy of designing physical objects, the built environment, and services to comply with the principles of economic, social, and ecological sustainability (McLennan, 2004). According to Jo (2011), with increasing requirements for energy efficient facilities in most countries and with the growing environmental awareness, the idea of incorporating sustainable design into the kitchen will provide the family a better environment home and also offer the community a better place to live. Albright (2005) claims that, kitchen components are the tool used as a way to design a kitchen. The components of the kitchen consist of the kitchen cabinet, kitchen doors finishes, kitchen worktop furnishing, kitchen accessories, and kitchen appliances (Albright, 2005).

Green design is an approach to build that minimizes harmful effects on human health and the environment (Jackie, 2013). Green kitchen design involves reducing the energy and resource dependence in this important household room (Jessica, 2012). Jessica (2012) claims that, with so many appliances and fixtures, the kitchen are often a major culprit in an inflated utility bill. Engaging in green kitchen design can not only save money on

electricity, gas, and water, but can also help fight pollution, deforestation, and non-sustainable materials use.

Jo (2011) claims that, to become green and sustainable kitchen, it is important to choose the eco-friendly kitchen component, such as using eco-friendly kitchen cabinet door, using the bamboo cabinetry frame, door and drawer faces and non-formaldehyde plywood apply to the kitchen cabinet, using an energy-efficient appliances such as energy-efficient microwave, refrigerator, water-saving dishwasher, countertop surfacing using manufactured quartz such as recycled paper and wood, recycled aluminum, recycled glass, concrete, and recycled wood. Fruin (2010) claims that, simply choosing a natural wood doesn't necessarily make a good green choice. He adds that some natural wood products used in cabinet-making are from environmentally unsustainable sources such as toxic chemicals glues, adhesives and sealers while other wood products use unhealthy substances such as urea formaldehyde and vinyl.

Compared to a decade ago, Malaysian house owners are today showing more interest in kitchen design. According to Protal (2011), at one time kitchen mainly was located at the back of a house, but nowadays great designs can bring the kitchen out from the background. Furthermore, the challenge for kitchen design today is in making a more multifunction and open-up modern kitchen. He claims that, every house will come with different kitchen layout, and each house owner will come with different idea and style they prefer. The approach to design effectively is close to the nature and to attempt an environmental friendly kitchens design. Environmentally friendly (also eco-friendly, nature friendly, and green) are synonyms used to refer to goods and services, laws,

guidelines and policies considered to inflict minimal or no harm on the environment (Lexico, 2011). There are many types of kitchen styles such as Traditional Kitchen Styles, Country Kitchen Styles, Transitional Kitchen Styles, Contemporary Kitchen Styles, Rustic Kitchen Styles, Arts & Crafts Kitchen Styles, Old World Kitchen Styles, and Pop Art Kitchen Styles (Sarah, 2011).

Mendini (2006) claims that, some parts of home especially the living room and kitchen become very versatile and virtually unique. According to him, aesthetically speaking, the kitchen is the object of great attention – partly because today a kitchen costs more than a living room, and partly because it has become a community space. These days entering a house through the kitchen is an interesting route.

To find out the most choices of the kitchen component in Penang condominiums, it needs market survey in kitchen industry as main criteria. This research will seek to find out the understanding of people in Penang about kitchen design and also will find out their preference of kitchen styles and the choices of green kitchen.

1.1 Problem Statement

The research is to study the elements of kitchen such as the layout of the kitchen, space planning of the kitchen, kitchen design trend, kitchen style, technology of kitchen in kitchen industry which will affect the choice of kitchen component in the residential in Penang, particularly to condominium type of residents. The study shall provide the useful information for the residential kitchen design.

Kitchen design has come of age and it's largely due to the continuing demand for open-plan living areas. Kitchens today need the aesthetics to complement formal living

areas and the functionality to cope with busy family lifestyles (Turley, 2011). Unbeknown to many, food preparation can be tiring. A poorly designed kitchen can dull the pleasure of even the most devoted epicure, as they trudge unnecessary distances between storage and work areas (Hargreaves, 2010).

Newell (2008) states that, designs of existing kitchens do not have space planning due to insufficient understanding of kitchen interior design. A properly planned kitchen can save time and shorten travelling distances (Hargreaves, 2010). Flanagan (2010) believes that kitchen often takes up the most space in the home, responsible for storing everything from the pots and pans to dinnerware and more, the standard of a kitchen should not be judged solely on its appearance. He adds that design and layout functionality of the hardware and storage solutions are just as important. So it is important to have a good space planning of the kitchen. Ergonomics and safety factors are importance for the every user.

Basically, from traditional to modern design there were many kitchen component uses in the kitchen design. However, according to Chew (2008) as regard to knowledge of green and sustainable kitchen component is minimal for the dwellers of condominium. He adds that understanding of green and sustainable kitchen component is important to kitchen industry, without the understanding and usage of green kitchen component the kitchen industry cannot grow up with new upgraded kitchen component info or still maintains of their initials understanding; this may influence the growth of the kitchen market price.

1.2 Research Question: This research will focus on three questions

1. What are the issues of the kitchen design for the existing kitchen at Penang condominium's units?

2. What are needs and desires of Penang condominium's residents for their dream kitchen?

3. What are choices of green and sustainable kitchen component for Penang condominium's residents?

1.3 Research Objectives

1. To identify the issues of the existing kitchen design in Penang condominium units.
2. To find out the needs or the choice of the kitchen component related to the factors in existing kitchen design in Penang condominium units.
3. To identify the green and sustainable kitchen component choices.

1.4 Scope of Study

The research cover and examine the elements of kitchen such as the layout of the kitchen, space planning of the kitchen, kitchen design, kitchen style, green and sustainable material, and technology in kitchen industry of kitchen component (as independent variables) and the choice of kitchen component (as dependent variable) in condominium Penang. Most of the residential developments from mid-1980 onwards were multi-storied developments comprising flats, apartments and condominiums compare with the landed properties. Therefore the scope population of the study is focus on kitchen existing multi-stories high-rise property developments condominium units in Penang with the size from 900s/f to 6000s/f were covered the group range from middle income and above. The parameters of the choice of kitchen component measured from the major criteria of the local perspective, specifically for existing and residential condominium units.

1.5 Signification of Study

Fundamentally, this research study will contribute new alternative on green and sustainable modern kitchen designs derived from application of kitchen component. This study will stress on the important of green kitchen design and the understanding of applying the kitchen component on new developing kitchen. The research will assist in developing the value of resourcefulness and open-mindedness to researchers on the kitchen interior design, and will serve as a propose kitchen design in this modern industry. The significances are:

a. To study the issues of the existing kitchen design.

b. To understand the usage of the kitchen component applying to kitchen design. Those component apply will be related to the kitchen style.

c. To study the green kitchen component in applying new kitchen design.

d. To contribute new knowledge in kitchen interior design studies.

1.6 Research Outline: This research will be dividing into six chapters.

Chapter 1 – Introduction

It consist of the introduction of the research, problem statements, research objectives, research questions, research scopes, research significances and organization of the chapters.

Chapter 2 - Literature Reviews

The literature reviews consist of the introduction and terminology of kitchen. Then will follow by the origin of kitchen, Penang going green, the important of green and sustainable kitchen, the development of kitchen design, technology of kitchen industry, types of kitchen, demand and development of kitchen, kitchen component, and factor for kitchen design.

Chapter 3 - Research Methodology

This chapter will be the main chapter to study and show how the data collected. The data collection will be documented for data analysis. Types of the question provided to achieve the objective of research will provided in this chapter.

Chapter 4 - Analysis, Finding and Discussion

This chapter consists of the analysis, findings of the research. The results of questionnaire survey, observation and interview will be written in this chapter.

Chapter 5 - Conclusion and recommendation

This is the last chapter which describes the overall conclusion and suggestion of this research.

CHAPTER2 – LITERATURE REVIEW

2.0 Introduction

This chapter discusses the literature review, journal extracts and articles discussing in depth about the current and historical research on the subject by other researchers. The literature review and journal extraction enhance the analysis towards the research topic. The theories, facts, point of views, conclusions, details of population and samples and research method used to conduct the study able to provide brief development and overview of the study.

2.1 Terminology

For many years ago, the kitchen was seen as a separate workroom where meals were prepared and cleaned up afterward. It was certainly not considered to be a proper part of the living area of the house, nor even in view of the dining room (Brett, 1977). According to Brett (1977), if there was any thought of kitchen design as such, it was limited to laying out the room to save steps between work areas and allotting adequate space for counters, storage, and appliances.

After World War II, there was four-year lag in housing production and resulting in great demand for modest homes by the returning war veterans presaged a new concept in the interior design of houses: the open plan (Braybrooke, 1982). The idea of the open-plan living-dining-kitchen area was in many ways the concept of the colonial kitchen come full circle. As house design become more formal in the late 18^{th} century, the

kitchen was separated from living spaces and persisted as an isolated utility area well into the 20th century (Roberts, 2008).

The strategy of the open plan used in post – World War II houses was to make small spaces appear large. The elimination of partitions in the living-dining-kitchen area gave an illusion of space in a house that had, perhaps, only 1,000 sqft (95 sq m) of floor area (Bozis, 2000).

As the open interior slowly gained acceptance, the kitchen was reassessed as a space eligible to be included in the living area of the house. From this time on, the kitchen was seen as a place to be designed for family use and not as a solitary workroom.

Architects and interior designers have worked creatively to civilize the kitchen and make it a space where the basic design considerations of mass, volume, line, form, color, texture, light, view, and orientation – all necessary for a habitable environment – are implemented to achieve a satisfying human experience (Roberts, 2008).

In addition to the changes in design taking place during the early 20th century, Jan Jennings's 1992 work, *"Drawing on the Vernacular Interior",* looks at the evolution of visual understanding of architectural materials by the general public.Specifically, Jennings discusses the difference in floor plans, elevations and perspective drawings that populated magazines and journals, from simple sketches to complex renderings, and how such drawings influenced society's understanding of the built environment. The availability of plan books to the general public is also noted, and the growing influence of women on design. Though the man was responsible for the final selection and purchasing of a house design, it was with the woman in mind that many plans were

executed. Though much of the article describes the drawings and techniques utilized at the time to create an architecturally aware society, there is some comment on kitchen design in regarding efficiency, creating an environment which required as few steps as possible for the housewife's movement throughout, and popular material usage. Jennings also mentions the development of the progressive movement which demanded the simplification of middle-class housing, and the kitchen as the center of a modern house. Also noted is the need for creating sanitary cooking environments, almost laboratory-like in appearances.

Just the simple fact that the vast majority of families eat all their meal in the kitchen seems reason enough to consider the kitchen an important part of the living scheme of things. Most of us are drawn to the kitchen as a place of warmth, intimacy, informality, and sustenance (Pilaroscia and Ragan, 1995).

2.2 Origin of the Kitchen

Kitchen is the place where food is prepared, cooked and stored; moreover it is placed in the center of the dwelling in which eating activity is done if there is enough space. Activities like storing the rest of the food and cleaning the dishes are also done in the kitchen.

"*Frank Llyod Wright's solution implies that cooking need no longer be done behind closed doors, hidden from the eyes of the family or from the guests*" (Giedion 1948: 624). As women started working, the time they spend at home reduced. So, they preferred to spend more time with their family when they were home. At that point, the open floor plan become popular and the kitchen become a main part of the house instead a separate

room standardization and rationalization found their most complete expression in 1920s and they considered as concepts relating to industrial and commercial efficiency. They were applied to domestic work, especially to domestic kitchen with the book of Catherine Beecher in 1896 "*suggesting changes in the organization and layout of kitchens*" (Heskett: 1995: 81). Her proposal was that *"housework should be divided up so far as possible among the members of the family*" (Giedion 1948: 516).

The kitchen called *Frankfurt Kitchen* developed in 1926 with a standard layout depending on previous research. It was built for two purposes: to optimize kitchen work to reduce cooking time and to lower the cost of building well-equipped kitchens. At first, people were not accustomed to the changed processes because it was so small that only one person could work in it. But the Frankfurt kitchen embodied a standard for the rest of the twentieth century in rental apartments: the work kitchen. It was criticized to prison the women in the kitchen, but there were economic reasons lying behind. The kitchen once more was seen as a work place that needed to be separated from the living areas because of practical reasons. Standard dimensions and layout were developed for the Frankfurt kitchen. And also the equipment used was standardized: hot and cold water on tap, a kitchen sink, an electrical or gas stove and an oven. The refrigerator was added as a standard item afterwards. Lastly, dishwashers and the microwave oven took their place in the kitchen.

As the civilization develops, the understanding did not change. Myerson and Katz (1990: 91) puts forth the relation between the kitchen and the lifestyle of that era with saying *"just as home wasa machine for living in* (*Le Corbusier), so was kitchen a machine for preparing meals in*"(Niesewand, 2006). After long years, there has been a

change in the function of kitchen from being just a place for cooking. It turned into a place in which not just food is prepared; but a part of home, with Roenisch and Conway's (1987) words "*kitchen is a sanctuary from the pressures of the workplace, and the outside world*".

By the disappearance of servants at homes, changes occurred in the organizations of kitchens. Giedion (1948) mentions the servant less household formed the framework. The actual solutions depend on the mode of life. The process is not only limited to the kitchen but it is bound up with a changed conception of the house. According to him, disappearance of the isolated kitchen is connected with the disappearance of the isolated dining room. In the twenties, this trend was popular. In 1934, the space of the kitchen now called by Wright the work space is joined to that of the living room for the first time.

While Giedion (1948) mentions the living kitchen, Raymond Fordyce wishes to make the kitchen an active center of household life, where the family can work, play, eat and spend their time. The living kitchen realizes this by combining four rooms which are separate from each other: the laundry, the kitchen, the dining room and the living room. Koontz and Dogwell (1994) agree that kitchen often serves as the location for the interaction between adults and children within the household. It can be stated that kitchens were the focus of family activity and interaction.

While kitchens were counted as the center of socializing place of the house, different kinds of tools are produced in the meantime, parallel to the development of the kitchens.

Wikipedia Dictionary (2006) states that starting in the 1980s open kitchens appeared again and integrated more or less with the living room. The reintegration of the kitchen

and the living area changed the perception of cooking: increasingly, cooking was seen as a creative and sometimes social act instead of work, especially in upper social classes. Another reason for the trend back to open kitchens is changes in how food is prepared. In the 50s most cooking started out with raw ingredients. The advent of frozen meals changed the cooking habits of many people, who consequently used the kitchen less and less.

The kitchen underwent a radical transformation through the years as it has been the central living space or socializing place within home. During the last century, our kitchens changed more than ever. The important changes were the use of gas and electricity, cooling and freezing techniques, thermostatic control for cooling and cooking.

According to Bozis (2000) in order to know the characteristic properties of a certain kitchen's style, it should not only be looked at its geographical and climatic conditions but also to the social and economic construction and the cultural roots of that kitchen.

There have been many developments and changes in kitchens according to the needs and circumstances of social life. In addition to that, it is possible to see many differences in local kitchens in different parts of the world. Regional differences in the approach of kitchen design also results from climatic, social and cultural influences. All these factors might be studied separately, but in this thesis, a general overview of the emergence of the kitchens is tried to be given.

Changes, in whatever way it happens, as Mokyr (1990) states that in two centuries daily life changed more than it had in the 7000 years before. As the years pass, the role of the kitchen and the people within it, change according to the necessities and life styles of

that particular time and culture. Consequently, the tools used in kitchen progress. This progression brought about evolutionary process in kitchen product lifespan.

2.3 Penang Going Green

Since the last general election in year 2008, Penang has taken steps to turn it 'green'. To active this action, it begins with a campaign of 'No Plastic Mondays' that launch by state government to turn Penang as the first state of going green starting from July. It is a mark for Penang turned green. After a year of launching the campaign, which in year 2009, the second campaign 'No Plastic Bag' launch where the hypermarkets and supermarkets in Penang would not giving the plastic bags for shoppers. In the other hand, the shoppers or buyers have to take their own recycle bags or shopping bags otherwise they have to pay 20cents of each plastic bag request in the shopping centre (iProperty, 2009).

According to Penang Chief Minister Lim Guan Eng, in order to improve and transform Penang into the environmentally friendly state, the new campaign 'Cleaner, Greener Penang' launch in 2010. It will help transform the current living environment into more sustainable and cleaner city and improve the quality of life. Penang is also a habitat choice of sustainable living. It proves by the ranking to be the 8^{th} most livable city in Asia for 2010 which moved up from the 10^{th} ranking in 2007.

2.4 The Important of Green and Sustainable Kitchen

In order to identify issues of sustainability with respect to kitchen renovation, the simple framework of the 1993 RIBA Environmental Policy provides a basis. The four key sustainable principles are to: maintain / restore biodiversity; minimize pollution of soil, air and water; minimize the consumption of resources (particularly non-renewable sources); and maximize the health, safety and comfort of building users. These principles can be applied to kitchen remodelling with the following strategies.

Supporting biodiversity may appear distant from a kitchen interior perspective, but the selection of materials from sources and process which respect the natural environment is a fundamental prescription (ASID, 2009).

Minimizing resource consumption promotes using the minimum amount of material and energy in the preparation and eating of food. This can be achieved by several different strategies: by sharing facilities in communal living, eating out or dining on take away food (Loftness, et. al, 2007). Kitchen facilities can be small and simple. Existing kitchen components can be re-used. Alternatively, designing kitchens to last a long period of time and making components recyclable or reusable minimizes the use of resources.

Minimizing pollution be achieved by specifying materials that do not cause pollution in their mining, manufacture or disposal. Careful selecting of energy sources and technologies can reduce emissions from fossil fuels (Marvin, 2009).

The ideal kitchen of the earlytwentiethcenturyembraced efficiency and cleanliness. Efficiency and cleanliness are still important butthe biggestpart of today's design concept is: sustainability. Early 20th-century kitchen designers and their users were

unaware that sustainability was part of the elements they prescribed. From the use of local woods to build cabinetry to the development of natural linoleum (currently experiencing a revival in use for its environmentally friendly materials), the early twentieth century kitchen embraced local goods and services in both its creation and day-to-day functions. It also encouraged the reduction of kitchen space thereby reducing material usage and energy required to run it (both human and fossil fuels) (United States Green Building Council, 2009). The concerns may have been for saving the housewife time and insuring her family remained healthy, but the design and construction of the early twentiethcenturykitchen has influenced present-day ideas about sustainability.

To fulfill the vision of Penang, it is important for the kitchen designer to provide a green and sustainable kitchen in the resident. It is one of the great ways to start 'green' from their resident. The role of the kitchen designer is important to help Penangites to be more concern about the environment and the vision of the state government with provide recyclable or reusable component kitchen component. Besides, according to Fuad – Luke (2005), the green and sustainable kitchen is probably the most popular kitchen design today, as everyone has jumped on the "Go Green" bandwagon. He added being green is such a trend today, there has been a move for builders and remodelers to offer green solutions in term of the choices of flooring material, such as wood, cork floor which is much less toxic than other flooring materials.

Paints with low volatile organic compound levels are also encouraged. Charter (2001) claims that nearly all environmental friendly kitchen designs boast energy efficient appliances and recycled or refinished items (anything from refinished cabinets to recycled stain glass).

The green and sustainable kitchen design is not so much about looks, but about utility and saving the planet (Richardson, 2005). Fans of the green and sustainable kitchen design are far more concerned with what goes into landfills than getting their kitchen featured in Better Homes & Garden, though some green and sustainable kitchens are very high end and green and sustainable does not necessarily mean ugly (Boyko, 2005).

Green kitchen design involves reducing the energy and resource dependence in this important household room (Fuad – Luke, 2005). The kitchen is often a major culprit in an inflated utility bill with so many appliances and fixtures. Engaging in green kitchen design can not only save money on electricity, gas, and water, but can also help fight pollution, deforestation, and non-sustainable materials use (Manizini and Jegou, 2003).

Sustaining the health and well-being of human beings is a more complex issue. Maslow's hierarchy of needs (Maslow 1987) provides a framework for considering this. At a basic physiological level, the kitchen stores and cooks food. Safety needs require clean lines and hygiene in the preparation of food, as well as firm control of cooking processes. As a setting for family meals prepared by home-maker and caregiver, kitchens are strongly linked to belongingness and love needs. Flooring, cabinetry, and counters all play a part in green kitchen design. Choosing materials that are recycled, sustainably sourced, and environmentally safe can go a long way toward creating an ecologically sound kitchen. Consider using recycled material finishes, such as terrazzo or paper stone, for counters. Bamboo is an excellent material for cabinetry, flooring and counter tops, and is a sustainable product. Marmoleum flooring is similar to linoleum but made from natural, eco-friendly substances (Brentwood, 2011).

Open-plan and great-room style of kitchen design is a recent trend in Malaysia residential architecture; the one-room concept actually began two centuries ago in one form or another. Designers who coordinate kitchen components are needed to ensure that good, healthy nourishment is easy to prepare and consume; cleanup should also be less laborious. Beyond basic kitchen design, there are a number of challenges to good nutrition and health maintenance that design professionals should be aware of. Open plan kitchen can considered as sustainable kitchen with applying the environmental friendly and sustainable materials finish.

2.5 The Development of Kitchen Design

Papanek (1971) claims that all things we do almost all the time can be named as design, so it is convenient to say that design is basic to all human activity. It has been in our lives since the man started to produce tools for himself. Dormer (1993) says that design and even the professionalization of it is not a new activity. All ascendant civilizations have used it before.

Design that is rising in the last quarter of 19th century became a part of everyday life. It is a social and material activity. It is *"questioning our daily environment, creating new ideas and goods for some problems, or sometimes just for fun"* (Roenish and Conway 1987: 133). Freidman (2003) summarizes design as solving problems, creating something new, or transforming less desirable situations to preferred situations. To do this, designers must know how things work and why. Understanding how things work and why requires us to analyze and explain. According to Frascara (2001) during the action of our world, design should bring new tasks and innovation to the world.

"The transition from predominantly agricultural/craft cultures to ones based on industrialization, with all the consequences for technique, form, organization and social significance, will therefore continue to be the main focus of attention in any history of industrial design" (Heskett 1995: 115). In order to realize a design problem, it is a must to understand the design structure.

Every time we eat, a designer has something to do with how the food is served, presented, packaged, or cooked. Table top is a broad area inhabited by product designers. From the plate on which the food is served to the utensils, designers are involved. That is why they need information. While designing a kitchen, designers firstly establish its relation with its environment, which can realize through a classification on the flow of activities in kitchen. There have been many technological breakthroughs that happened both in production techniques and in materials technology. Industrial revolution brought many changes in the production of goods. Professional industrial designers have paid more attention to kitchen products as the century has progressed and kitchenware became green and sustainable mechanized and energy saving electrical.

2.5.1 Technology of Kitchen Industry

Design cannot remain isolated from technology, markets and the culture. Technological improvements occurred gradually over the centuries, and they have affected the quality and way of life. Technology allows us to dominate many inputs in our lives. Güngör (1996) explains the history of technology as the historical process of the dominancy of nature over human, changing into a state of dominancy of human over human and nature.

This century has produced a series of dramatic technological breakthroughs, which have radically transformed the kitchen, and the equipment used in it. New materials such as heat resistant glass, stainless steel and high-performance plastics have reshaped existing functions and created new ones; the advent of mass production techniques and domestic electricity has revolutionized life in the home, making domestic appliances more convenient, varied and available (Myerson and Katz 1990: 6).

Materials technology has been very dominant in shaping the direction of modern kitchenware design. New developments in each kind of material has significant role in changing design products. New materials have reshaped the existing functions and created new ones. Myerson and Katz (1990) believe the biggest change has been caused by the development of plastics in materials technology. The first synthetic, plastic, bake lite appeared in the kitchen in 1907. In the 1920s it was used for colanders and egg cups but because of its unpleasant smell it was swiftly replaced by material called urea formaldehyde. High density polyethylene was introduced in 1956 in Germany. It was tougher and more heat resistant. In the late 1950s ABS improved; this was expensive but very tough. In 1958 polyacetal was invented, a material which revolutionized the kettle.

The invention of heat resistant glass, pyrex changed the use of glassware in the kitchen. Cast iron and tin sheet pots emerged in kitchens in the mid-19th century. In the meantime, aluminum had been developed in the late 19th century. But the most significant advance in metal kitchenware was the development of stainless steel in the 1930s.

Apart from the development of materials technology, changes might easily be seen in the cooking source developments. Ubach (2003) summarizes the evolution of kitchen materials throughout the 19th century by explaining the progress in cooking. In the beginning of the century kitchen stoves were made of bricks, and wood was used for burning. Later on, iron stoves with the burner incorporated appeared. The first gas stoves made their appearance around 1850 and they gradually started replacing the ones using coal. "The arrival of gas meant the beginning of the mechanization of the house" (Ubach 2003: 34).

Sparke (1986) agrees that electrical power was one of the major technological advances to influence new consumer machines in the second half of the nineteenth century. Roenisch and Conway (1987) say, similar to Sparke, that the sources of power like gas and electricity gave rise to a new range of domestic appliances from gas cookers, to electric kettles. Design of the kitchen was influenced by the science applied in mid nineteenth century. Electricity was a big revolution for domestic appliances. The effects of electricity can be seen in the transformation of some manual objects to electrical ones. Electricity caused an evolution and development in the process of product lives.

It is mentioned that the most important reason in the increase of product variety is the use of electricity. Today's users benefit from electricity in saving their valuable time. Electrical household appliances, having many functions, became indispensable in our

kitchens since they bring convenience. Multi-functional food processors, kettles, automatic coffee or tea machines or toast machines not only provide time saving but also affect the quality of taste and increase in alternatives.

2.6 Types of Kitchen

Kitchen is a place where the cooking process is held. In this decade, there are two types of kitchen which is wet kitchen and dry kitchen. Wet kitchen means the kitchen is really used for cooking, from raw material to ready-to-eat food. Dry kitchen means the kitchen is only used to prepare simple food, such as for breakfast (Gardener, 2011).

Wet and dry kitchen has a different function. Due to its function, it is normal that many families choice dry kitchen as a place to gather with other family members, not only in the living room. Meanwhile, the wet kitchen is used for cooking. Wet kitchen is more widely used to heat food before serving. The kitchen is usually combined with a family room or dining room is often referred as a pantry or kitchen to dry. This kitchen is usually equipped with modern cooking(Gardener, 2011).

2.7 Demand and Development of Kitchen

The kitchen which is equipped with modern kitchen fixtures becomes an important issue in the management of the house. The management of the kitchen is important as the arrangement of the living room and family room. Modern lifestyle requires fundamental changes because of the development of technology, the change of environment and the need of fashion (Teng, 2010).

There are important elements to be considered for safety in the kitchen.