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AHP
for
Comprehensive Approach
of
Modern QFD

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Quality Function Deployment (QFD)
First Suggested in Japan in Mid-1960s

Skillfully manipulated the quality management principles

CWQC
Company-Wide
Quality Control

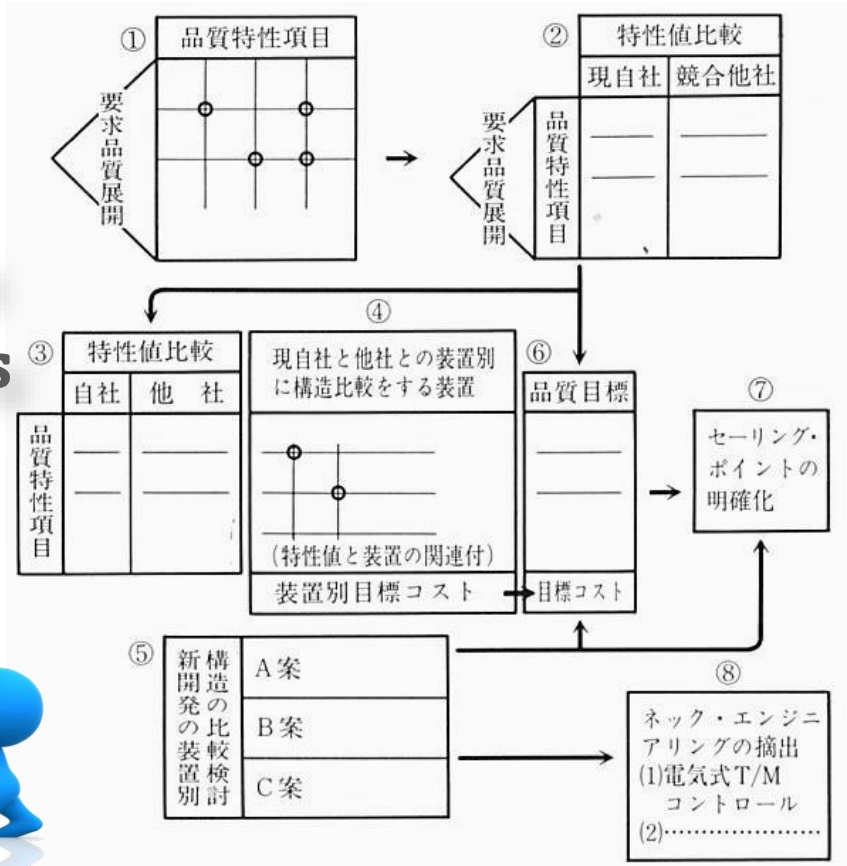
Effectively teams up members
from various departments &
different levels
to unify their efforts
for achieving the goals of the organization

Mid-1960s

Quality Function Deployment (QFD)
First Suggested in Japan in Mid-1960s

Provided a system & a toolbox

Members work together
to specify functional requirements
devise plans & formulate strategies



Mid-1960s

Quality Function Deployment (QFD) Reached the USA in Early 1980s

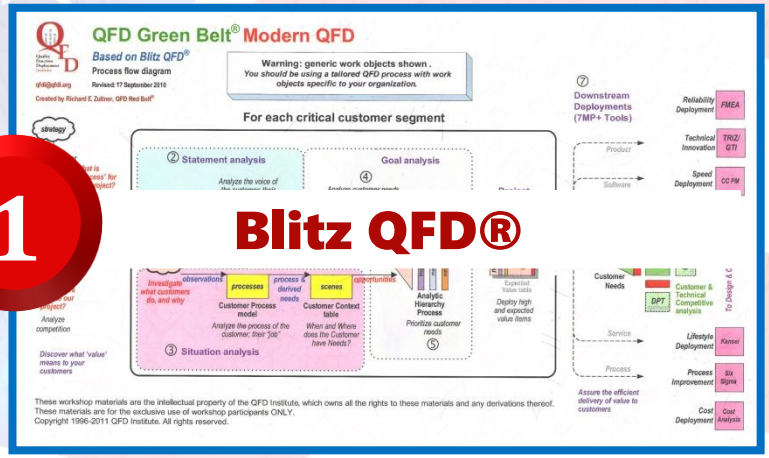
Organizations were aware of the benefits of QFD

BUT

- Long time required for completing the whole matrix of matrices
- Generation of inaccurate priority data

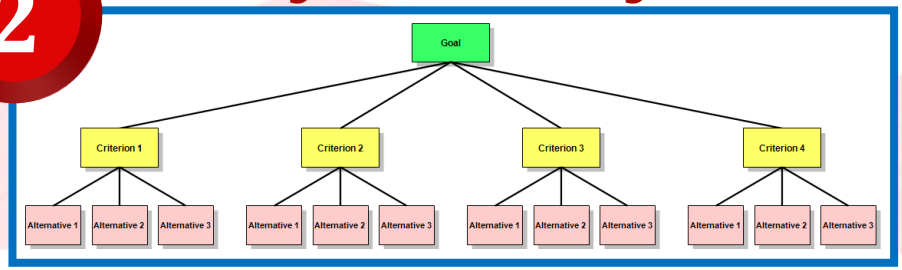
Early 1980s

Quality Function Deployment (QFD) Reached the USA in Early 1980s



1 **Blitz QFD®**

2 **Analytic Hierarchy Process**



Mid-Late 1980s

Blitz QFD® for QFD

Making deployment across multiple columns of a spreadsheet

The full range of compact tables suggested by Blitz QFD® considerably shortens the time required by the process

Mid-Late 1980s

AHP for QFD

AHP powers the operation

by supplementing with the essential mechanism for quantification

With the added power

could be readily applied to projects of much larger scale &

used to address a wider range of aspects

with each aspect of greater depth


AHP is formulated in such way that the derived priorities
could give a proportionate ordering
of the different possible outcomes
to which one can allocate in an optimal way

AHP & QFD in Common

AHP is Quantitative • **QFD** is Qualitative

AHP & QFD

both use hierarchical structure
to display their models &
as the backbone for operation

- Relationship of Dependency
- Stratification by Levels
- Focusing on the Vital Few

Aim of the Paper

To explain why the practice of

Comprehensive QFD

is enhanced with incorporating **AHP**

A Reported Case for Illustration

An Energy Transition Program in UK

Conducted by Stansfield, Colechin & Mazur in 2016

1. Align Projects with Business Goals

Organizations could hardly succeed if they could not map out how their projects would contribute to achieving the business goals

To **Modern** QFD

The first & also the most important step is to align the project with the business needs

Project Goals with Relative Importance

Deploy VOB into Project Goals

The priority data of the project goals plays a central role in the whole operation of QFD

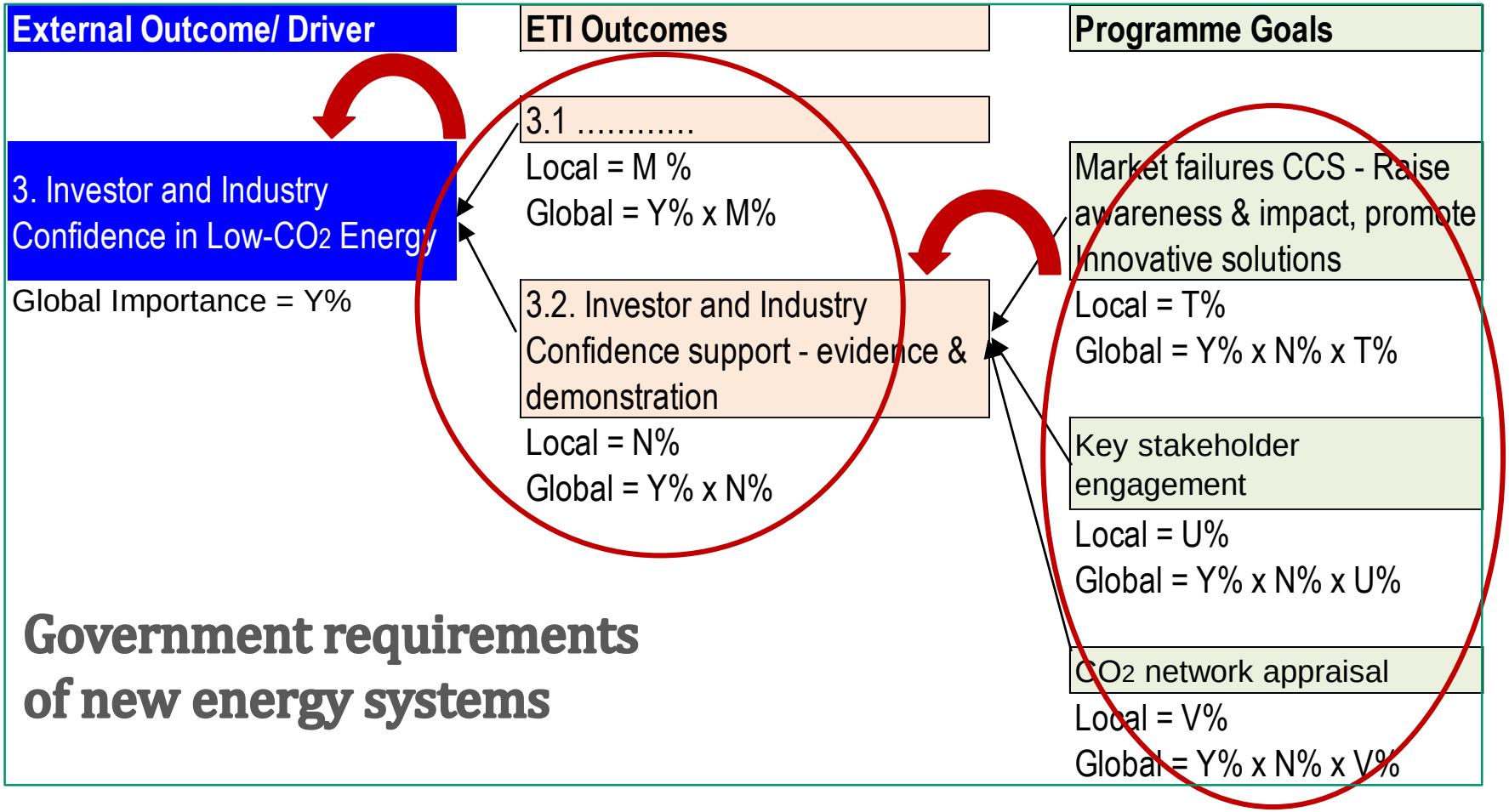
1

Link up all the deployments of the project

2

Put into subsequent matrices for making further prioritization & selection

Prioritize Project Goals with AHP



Prioritize Project Goals with AHP

1. Project goals were further visible to the team
2. Priority data were mathematically valid

AHP produces outputs in ratio numbers

The priority data produced by **AHP** enable the project goals to be deployed from high-level system design to detailed components & processes

2. Review Stakeholder Impacts

Energy transition not simply between supplier & users

Need to carefully review the gain & the loss of the players

&

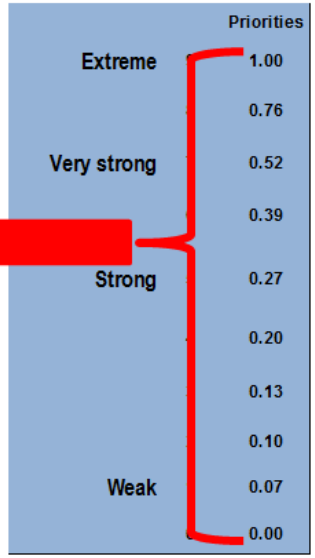
properly address the needs of the key stakeholders

Normalized Scale to Identify Key Customers

Programme Goals

Programme Goals \ Stakeholders		1. UK Gov Energy & CC Agency	2. UK Treasury	CCS System Integrators	CCS Association	Committee on Climate Change	Stakeholder n
Relative Importance of Programme Goals estimated using AHP in previous step.	Relative Importance						
1. Market failures CCS - Raise awareness & impact, promote Innovative solutions	T%	A1	A2	A3	A4	A5	An
2. Key stakeholder engagement	U%	B1	B2	B3	B4	B5	
3. CO2 network appraisal, selection & Operation sustainable sites	V%	C1	C2	C3	C4	C5	Cn
Total	100%						
Absolute Weighting, AbW e.g AbW1 = T*A1 + U*B1 + V*C1		AbW1	AbW2	AbW3	AbW4	AbW5	AbWn
Stakeholder Weight, StW e.g. StW1 = AbW1/Sum(AbW1:AbWn)		StW1	StW2	StW3	StW4	StW5	StWn
Rank Number, R. Highest Value StW, Rank = 1		R1	R2	R3	R4	R5	Rn

Stakeholder Groups



Assess pair by pair with normalized scale

Customer Voice Table (CVT) with Maximum Value Table (MVT)

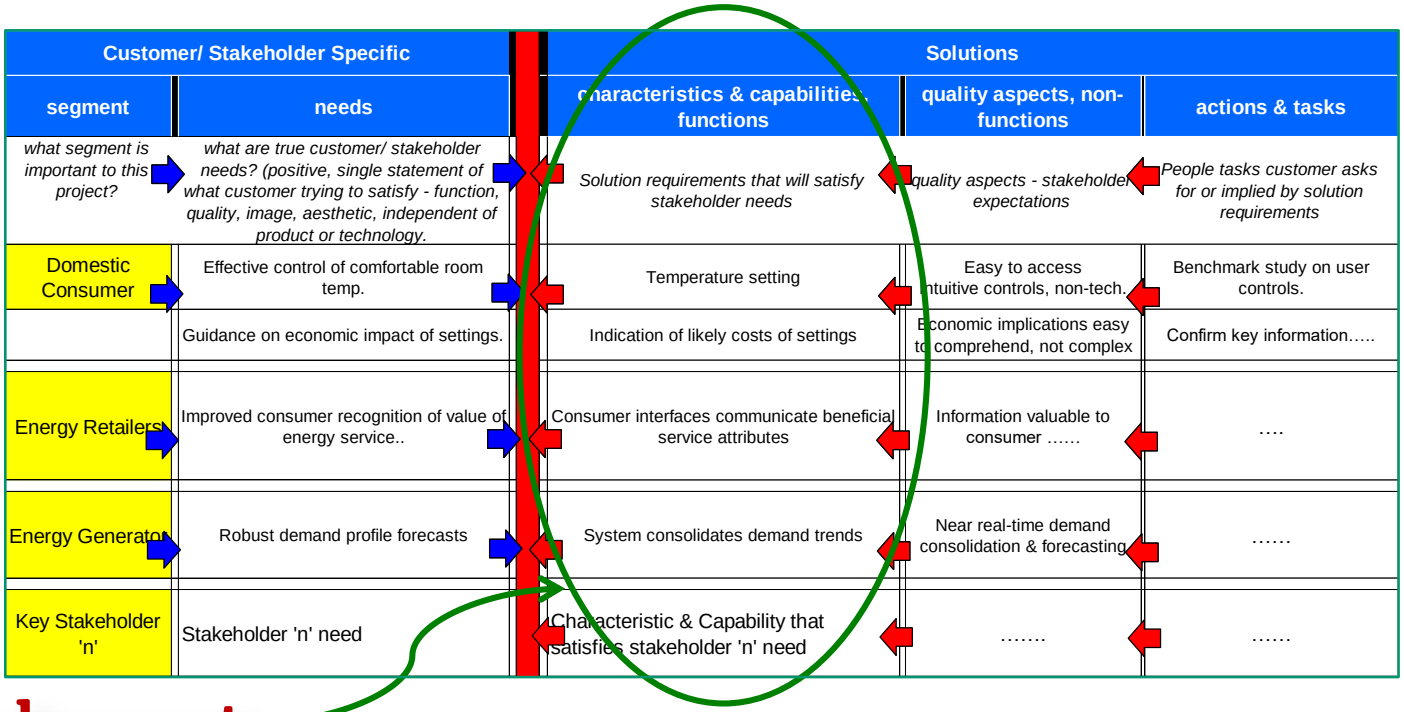
Customer/ Stakeholder Specific				
segment	**characteristics**	**situations**	**problems**	**needs**
what segment is important to this project?	*what is unique about this segment*	*what is customer/ stakeholder doing?*	*what did customer say? clarified items, problems?*	*what are true customer/ stakeholder needs? (positive, single statement of what customer trying to satisfy - function, quality, image, aesthetic, independent of product or technology.*
Domestic Consumer	Family of 4, three bedroom semi-detached (X% of market)	Adjusting temperature to get comfortable	Difficult to control comfortable tempearture for family	Control comfortable room temperature easily
		Trying to keep energy bills to budget	Cannot see cost implications of temperature selections	Economic impact of settings available while setting comfort level
Energy Retailers	Customer/ Consumer Facing; Local; Low Profit Margin; Mix of Large Companies and niche new-players	Selling Energy (Gas, Electric) to Consumers & Business	Market sensitivity about cost increases	Enhanced consumer recognition of value of energy service.
Energy Generator	Heavily regulated, Large Co's., Commercially constrained	Predicting generation needs	Difficult to predict consumer demand	Robust demand profile forecasts
Stakeholder n	USPs for stakeholder n	Key relevant activities for Stakeholder n	Relevant problems for Stakeholder n	Specific needs of Stakeholder n

The 1st Deployment

Interpret the characteristics, situations & problems of each customer segment to compile the extracted items into a list of need items

Customer Voice Table (CVT) with Maximum Value Table (MVT)

Blitz QFD®

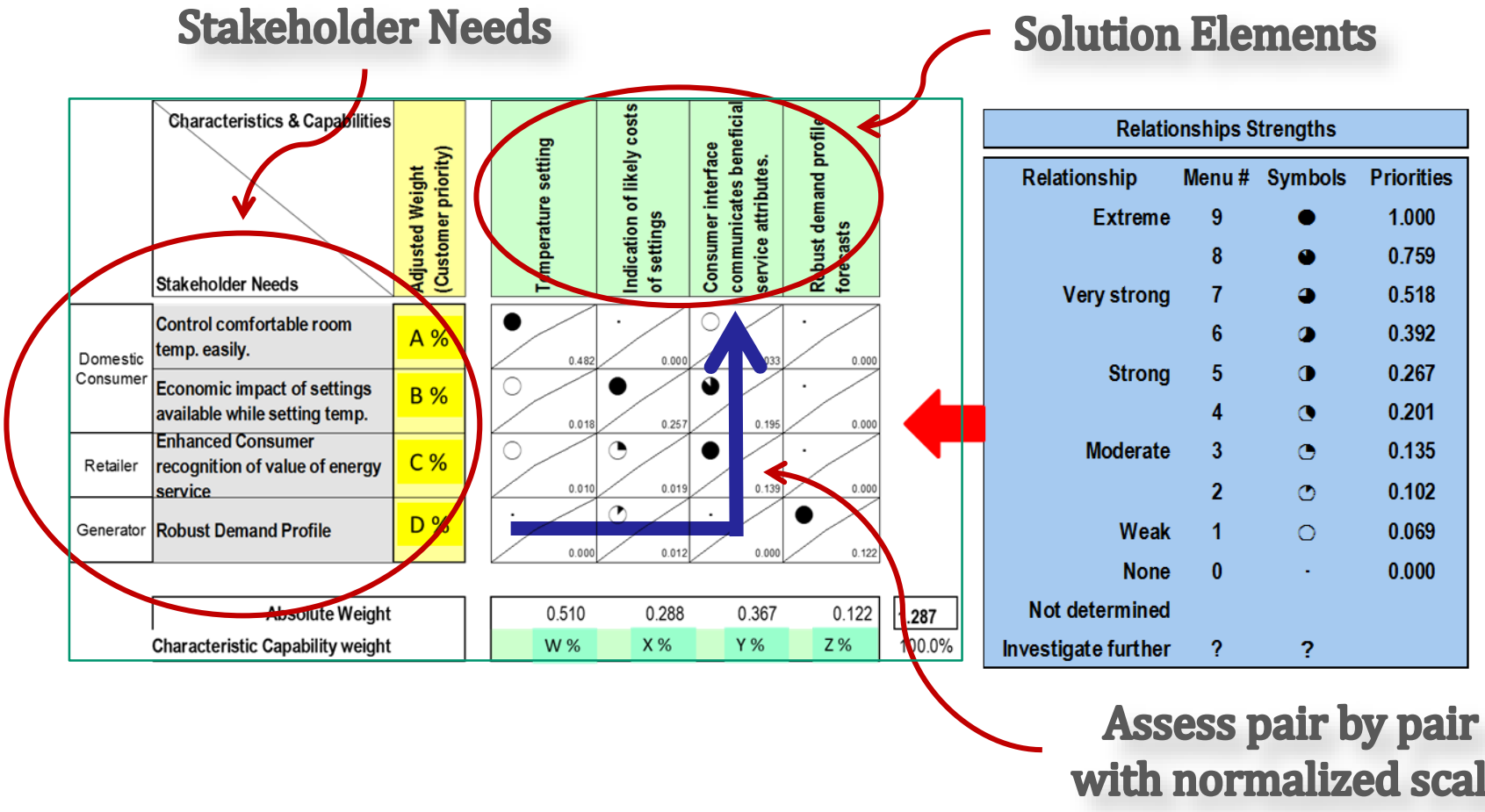


Customer/ Stakeholder Specific		Solutions		
segment	needs	characteristics & capabilities, functions	quality aspects, non-functions	actions & tasks
what segment is important to this project?	*what are true customer/ stakeholder needs? (positive, single statement of what customer trying to satisfy - function, quality, image, aesthetic, independent of product or technology.*	*Solution requirements that will satisfy stakeholder needs*	*quality aspects - stakeholder expectations*	*People tasks customer asks for or implied by solution requirements*
Domestic Consumer	Effective control of comfortable room temp.	Temperature setting	Easy to access intuitive controls, non-tech.	Benchmark study on user controls.
	Guidance on economic impact of settings.	Indication of likely costs of settings	Economic implications easy to comprehend, not complex	Confirm key information.....
Energy Retailers	Improved consumer recognition of value of energy service..	Consumer interfaces communicate beneficial service attributes	Information valuable to consumer	....
Energy Generator	Robust demand profile forecasts	System consolidates demand trends	Near real-time demand consolidation & forecasting	.....
Key Stakeholder 'n'	Stakeholder 'n' need	Characteristic & Capability that satisfies stakeholder 'n' need	.....	.....

The 2nd Deployment

Translate the need items into the requirements of the energy system with MVT (the extension of the CVT)

3. Assess Solution Elements against Stakeholder Needs



4. Evaluate Design Options

After completed the development of design options for addressing the high value requirements

AHP was incorporated into **Pugh concept selection** to evaluate the design options

AHP for QFD

1. AHP

Ratio Scale to Collect Responses

AHP uses ratio scale to collect responses

Judgements from a group of respondents could be combined & team decision could be facilitated in **QFD**

2. AHP

Pairwise Comparison to Capture Judgments

People could not give precise judgments

resulted with receiving responses not actual & exact

Accurate judgments could be received with **AHP**

Rankings & magnitudes of the judgments are informed

Pairwise comparison helps **QFD** on receiving quality responses

3. AHP
Ratio Numbers to Present Priorities

AHP yields outputs in ratio numbers
that are mathematically operative

Helps **QFD** deploy from high-level system design
to detailed components & processes

Priority data could be transferred
from one matrix to another matrix with high accuracy

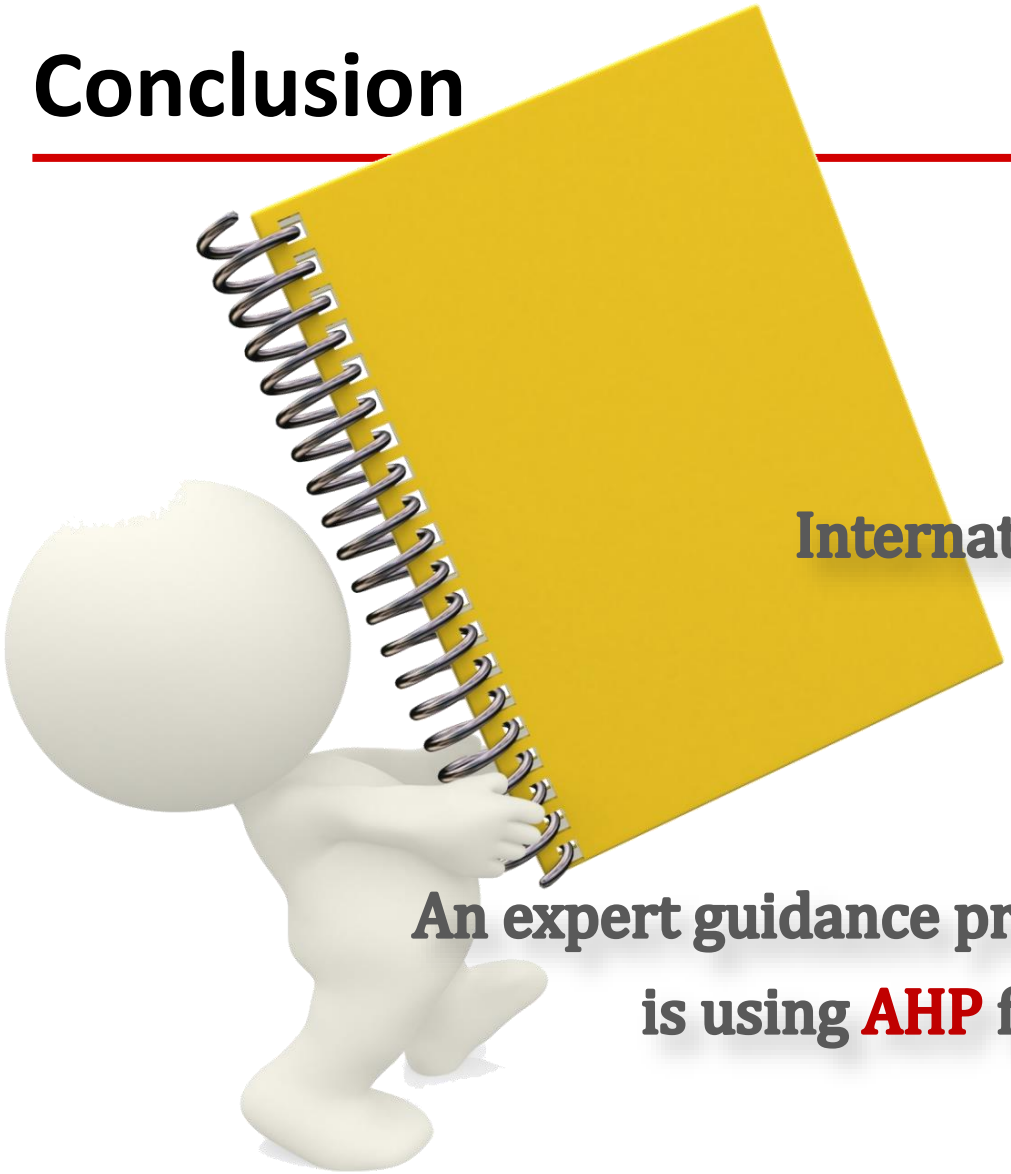
4. AHP
Help QFD Focus on Important Branches

AHP turbocharges Blitz QFD®

Putting the items in a hierarchical structure
Applying the top-down approach &
focusing on the high-value branches

The most important items could be determined
without the need of evaluating all the items

Conclusion



The new **ISO 16355** International Standard for **QFD** was published in 2017

An expert guidance provided by the standard is using **AHP** for doing quantification

Conclusion

QFD provides a practical method
for processing with qualitative data

The excellent mathematical formulation of AHP
supplements QFD with a quantitative mechanism
for making valid deployments &
performing in a comprehensive way

Thank You