INDIANA UNIVERSITY

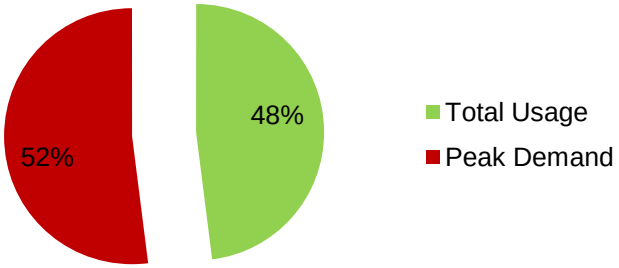
IUB PHYSICAL PLANT CATS

July 20, 2011

Electricity Load Mgt – Understanding IU's Main Electric Bill

- *More than ½ (52%) of IU's electric bill is based on peak usage, 48% is based on total usage*
- *Peak Penalty costs $17.99 per kWh*

% of Total Electric Bill



Duke Energy.

** CORRECTED BILL **

313

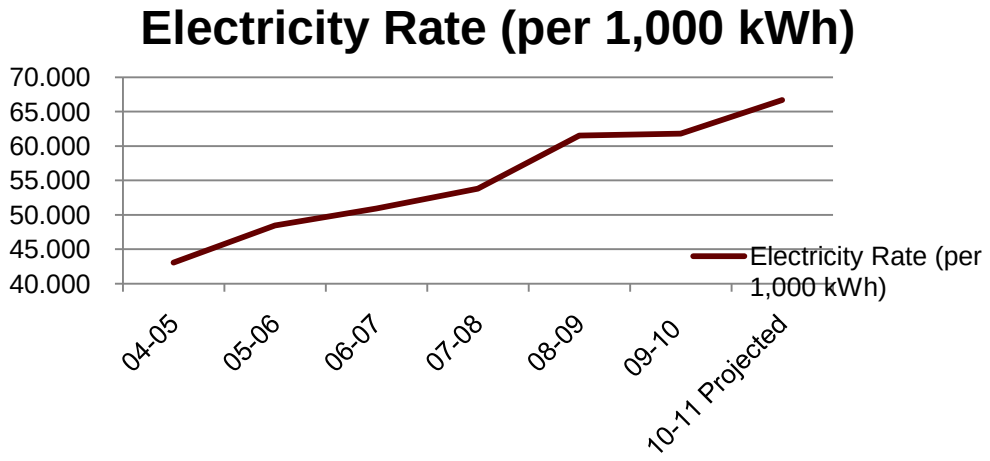
Page 2 of 2

Name	Service Address	Account Number
Indiana University C/O Hank Hewetson	700 Walnut Grove Ave N Bloomington IN 47405	5260-2673-01-4

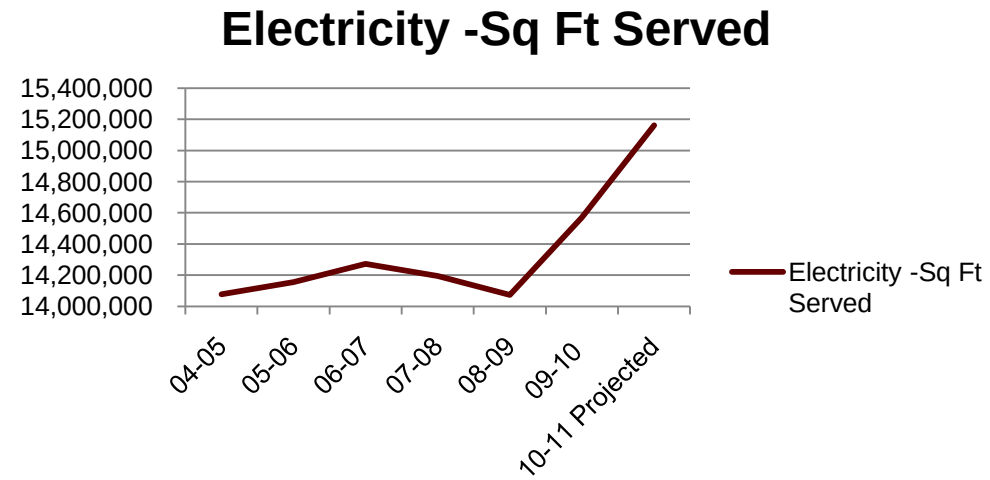
Explanation of Current Charges

Electric		Duke Energy Rate HPN0 - High Load Factor Pri Srv		
Meter -	106012722			
kWh Usage -	4,885,949	~~Connection Charge~~	~~$ 450.00~~	
Meter -	106916897	Demand Charge 40,704.80 kW @ $ 13.08000000	532,418.78	
kWh Usage -	1,829,683	Energy Charge 24,301,398 kWh @ $ 0.01627500	395,505.25	
Meter -	106916949	KVAR Charge 11,548.80 Kvar @ $ 0.24000000	2,771.71	
kWh Usage -	0	Rider 60 - Fuel Adjustment 24,301,398 kWh @ $ 0.01018400	247,485.44	
Meter -	106916950	Rider 61 - Coal Gasification Adj 40,704.80 kW @ $ 1.01927400	41,489.34	
kWh Usage -	4,672,939	Rider 62 - Pollution Cntl Adj 40,704.80 kW @ $ 1.80065900	73,295.46	
Meter -	106940594	Rider 63 - Emission Allowance 24,301,398 kWh @ $ 0.00104100	25,297.76	
kWh Usage -	11,177,654	Rider 67 - Cinergy Merger Credit 24,301,398 kWh @ $ 0.00039300cr	9,550.45cr	
Meter -	106916948	Rider 68 - Midwest Ind Sys Oper Adj 24,301,398 kWh @ $ 0.00072500	17,618.51	
kWh Usage -	1,761,428	Rider 70 - Summer Reliability Adj 24,301,398 kWh @ $ 0.00031400	7,630.64	
Actual kW -	40,761.60	~~Rider 71 - Clean Coal Adjustment~~		
Actual kVa -	42,366.10	40,704.80 kW @ $ 2.09972400	85,468.85	$ 1,419,881.29
Power Factor -	96.2%			
Remote Meter Point	56.80cr			
Billed Kvar -	11,548.80			
Remote Meter Point	26,255cr			
Billed kWh -	24,301,398			
Billed kW -	40,704.80			
Date of Peak	06/23/2010			
Time of peak	13.00.00			

Trends – Electricity



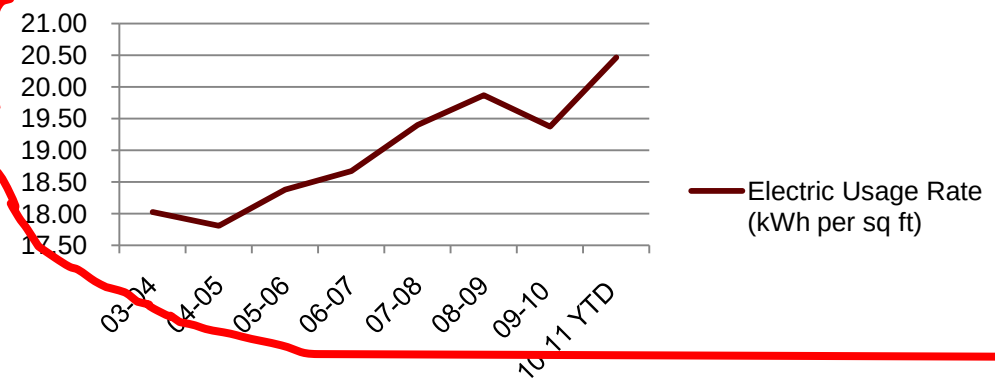
➢***Electric rates have increased more than 74% from period FY03-04 to projected current FY***



➢***In the current FY the campus is serving electricity to over 1 million more square feet more space than in FY 08-09***

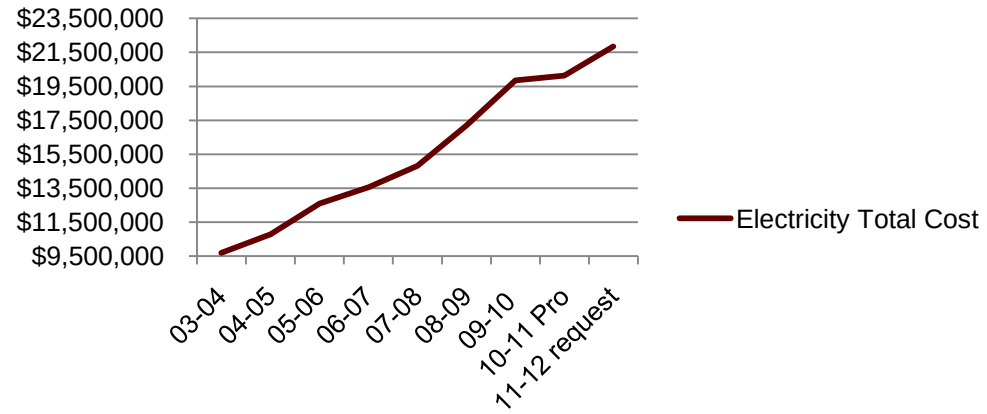
Trends – Electricity

Electric Usage Rate (kWh per sq ft)



➢ ***When normalized for Sq Ft increases, IUB's consumption of electricity increases by an average 1.6% EVERY year***

Electricity Total Cost



➢ ***The combination of all of these factors yields an increase in the total cost of electricity to IUB of 125% in less than 10 years***

➢ ***A continuation of current trends will result in electricity costs of $49,635,763 by 2020***

Jeff Honaker – Duke Energy

Doug Trueblood – IU Control Center

Control Center Activities

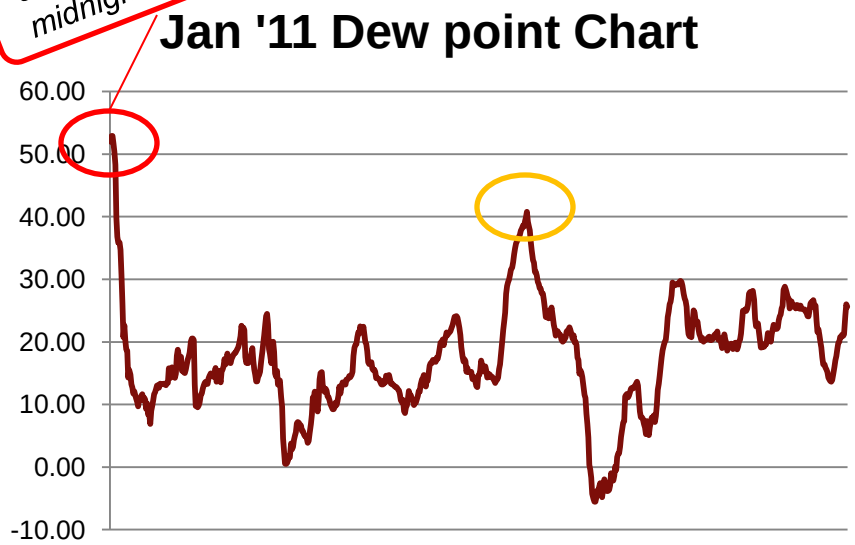
1. Peak Load Shed – attempts to minimize the peak demand of a billing period
2. Chilled Water Reallocation – attempts to reallocate chilled water to meet basic needs with available capacity

Peak Load Shed

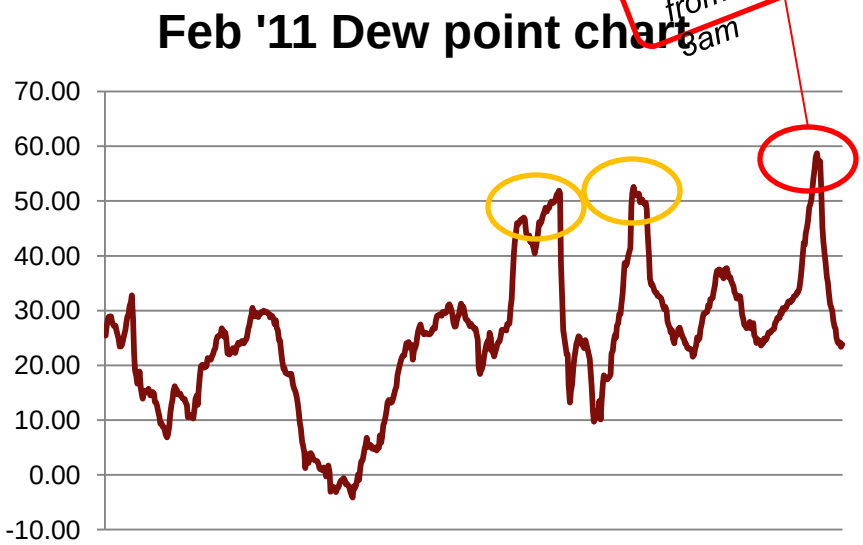
INDIANA UNIVERSITY

- *Peak load shed*
  - *Greatest opportunity during months where there is a period of unseasonably warm weather (non-cooling months especially)*
  - *4,000 kW peak can cost upwards of $75,000 on a single month's bill*
  - *When peaks in temperature/humidity combinations clearly exceed the average for the month (as was the case in January and February 2011) IU's ability to manage electric loads during those peaks will have a substantial impact on peak demand, and consequently the bill*
  - *In the summer there is not as much difference between peak and non peak days*

January 1st from midnight to 3am



February 28th from 11pm - 3am



Managing Peak Load

INDIANA UNIVERSITY

Peak Load Shed

- Establish a target for the peak for the month
  - Look at same billing period over past two years and average the peak from those two years
  - Set a target of 2,000 kW below that average then start working to manage peak at 4,000 to 5,000 below the average
- Manage the Peak
  - Watch the weather forecast to anticipate demand
  - If demand is 4,000 to 4,500 below the previous average, do nothing
  - Nearing the target peak –
    1. Shut off re-heat systems on various facilities
    2. Begin to lower differential pressure set point on Central Chilled Water Plant (CCHP) until the building pumps begin to come on
    3. Back off chillers where possible (e.g. facilities with multiple chillers)
    4. Execute some Chilled Water reallocation steps

Building Systems weather page

http://electron.electronics.indiana.edu/weather/

Vista - rtrueblo - [Campus Main Meters[User Diagram:network]]

File Edit Options View Window Help

CCWP_1227 — 5,049.8 — CCWP 1227 KW

CCWP_1221 — 342.2 — CCWP 1221 KW

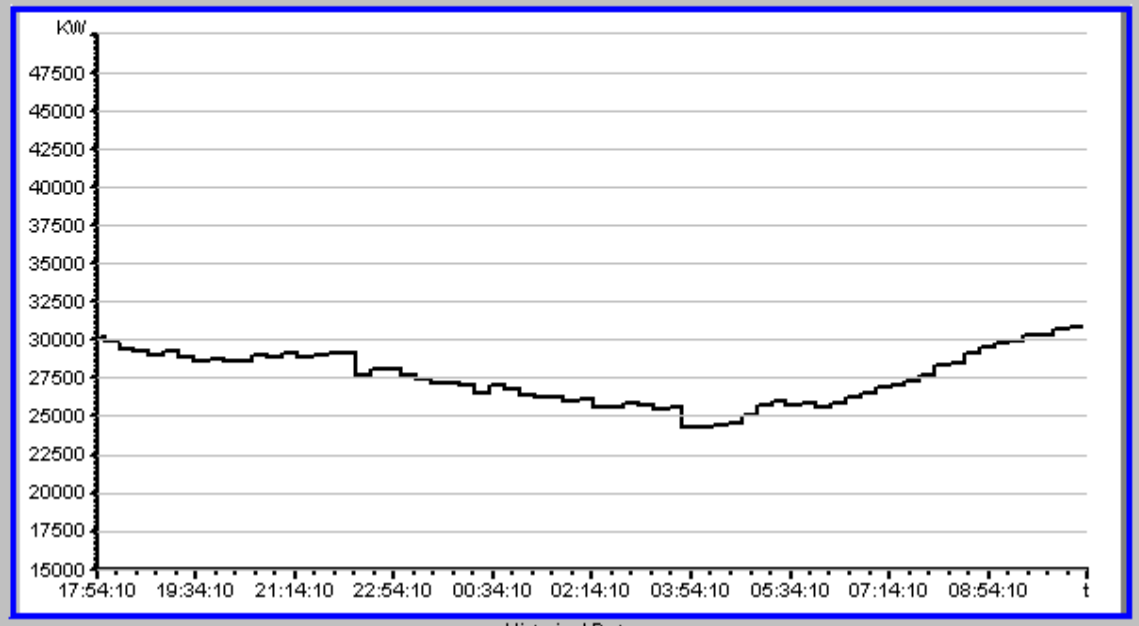
Distribution_Center — 13,769.9 — Distribution KW

Switching Center Circuit 1221 — 2,306.1 — Switch Center 1221 KW

Switching Center Circuit 1225 — 9,399.4 — Switch Center 1225 KW

Main Usage Graph

Campus Usage Trend



Historical Data

Data Center is not part of Total Campus Calculation

Data Center MDC Circuit 501 — 1,826.0 — Total KW

30,957.9 KW — Total Campus Usage

38,500.00 — Duke Peak

2,000.00 — Warning Bias Subtract from Duke

Below Peak Warning — Peak KW Warning

36,947.3 KW — Maximum KW to Date

1,000.00 — Peak Bias Subtract from Duke

Below Peak — Peak KW Alarm

Max KW Reset

E-mail Used When Shedding Peak Load

To All:

Due to high electrical usage, we are asking for help from the Building Representatives and Building Services in turning off unused lights, computer monitors, printers, etc. today, Monday XX/XX/XX, and tomorrow ,Tuesday XX/XX/XX; (especially between the hours of 11am and 5pm) and again before leaving for the day.

We will be coming close to establishing a new electrical peak demand . . . . . and ask for your cooperation in our peak electrical demand shaving efforts towards energy efficiency, conservation, and savings.

Your assistance during this situation is greatly appreciated.

Thank you,
Doug Trueblood
Physical Plant

Chilled Water Reallocation

- Design day – Building system is designed to handle up to the load of a design day (up to dew point of 78 and temp 95 degrees)
- If we do nothing on a design day, because of the hydraulics of our chilled water system, some buildings will get chilled water and some get nothing at all
- Goal of chilled water reallocation is to keep all as comfortable as possible
- Buildings are grouped and prioritized
  - Some would experience research and equipment damage if temperature and humidity are not maintained
  - Of the building groups that can scale back, they alternate in the level of chilled water they receive
  - Leading supply water temperature indicates when we are exceeding capacity at CCWP

COMMON CHILLED WATER PLANT

FOR: 411 CENTRAL CHILLED WATER PLANT

CLS411	COMMON CHW SUPPLY	40.06 DEG F	OAT411	OUTDOOR AIR	61.36 DEG F
CLR411	COMMON CHW RETURN	53.41 DEG F	OAH411	OUTDOOR HUMIDITY	91.39 PCT RH
CCR411	COMMON CHLR RETURN	51.09 DEG F	ODP411	OUTDOOR DEW POINT	57.49 DEG F
NCR411	NORTH CHW RETURN	51.55 DEG F	LSP411	COMMON SUP PRESS	39.95 PSIG
SCR411	SOUTH CHW RETURN	51.66 DEG F	LRP411	COMMON RET PRESS	28.17 PSIG
			LDP411	COMMON DIFF PRESS	12.16 PSID
RDP411	REMOTE DIFF PRESS	3.65 PSID	RDS411	REM DIFF PRESS SP	4.00 PSID
BPF411	BYP RET TO SUP FLOW	-918 GPM	CMF411	COMMON FLOW	14492 GPM
SP1411	SYSTEM PUMP 1	ON	TON411	TOTAL TONS	8050 TONS
SS1411	SYSTEM PUMP 1 SPEED	68.61 PERCNT	SP2411	SYSTEM PUMP 2	OFF
SA1411	SYSTEM PUMP 1 FAULT	NORMAL	SS2411	SYSTEM PUMP 2 SPEED	20.00 PERCNT
SP5411	SYSTEM PUMP 5	ON	SA2411	SYSTEM PUMP 2 FAULT	NORMAL
SS5411	SYSTEM PUMP 5 SPEED	68.61 PERCNT	SP3411	SYSTEM PUMP 3	OFF
SA5411	SYSTEM PUMP 5 FAULT	NORMAL	SP4411	SYSTEM PUMP 4	OFF

CL1411	CH1 LOAD	85 PERCNT	CE1411	CH1 ENABLE	ENABLE	CS1411 CH1 SUPPLY	39.41 DEG F
CL2411	CH2 LOAD	0 PERCNT	CE2411	CH2 ENABLE	DISABLE	CS2411 CH2 SUPPLY	52.94 DEG F
CL3411	CH3 LOAD	0 PERCNT	CE3411	CH3 ENABLE	DISABLE	CS3411 CH3 SUPPLY	63.39 DEG F
CL4411	CH4 LOAD	0 PERCNT	CE4411	CH4 ENABLE	DISABLE	CS4411 CH4 SUPPLY	60.55 DEG F
CL5411	CH5 LOAD	0 PERCNT	CE5411	CH5 ENABLE	DISABLE	CS5411 CH5 SUPPLY	42.52 DEG F
CL6411	CH6 LOAD	68 PERCNT	CE6411	CH6 ENABLE	ENABLE	CS6411 CH6 SUPPLY	39.94 DEG F
CL7411	CH7 LOAD	72 PERCNT	CE7411	CH7 ENABLE	ENABLE	CS7411 CH7 SUPPLY	39.86 DEG F
CL8411	CH8 LOAD	77 PERCNT	CH8411	CH8 STATUS	ON	CS8411 CH8 SUPPLY	39.84 DEG F

E-mail Used When Reallocating Chilled Water

To All:

Today, Monday XX/XX/XX, and tomorrow, Tuesday XX/XX/XX; due to anticipated excessive heat, humidity, and dew-point, our cooling capacity at the Central Chilled Water Plant will likely be exceeded. To try and obtain comfort for facilities and staff served by the Campus Chilled Water Loop, we need to curtail chilled water to facilities on the Campus Chilled Water Loop for hopefully no longer than 1 hour, followed by 2 hours of normal availability; and repeated as necessary.

Your assistance during this situation is greatly appreciated.

Thank you,
Doug Trueblood
Physical Plant

Dennis Cromwell

Go Green Gadget & Reporting Service Goals

- Change behaviors
- Make progress visible
- Leverage the technology and talent we have to develop creative solutions
- Save big money with incremental change

Making It Personal

- Bring the information to the desktop by way of GoGreen Gadget

- Communicate what we're doing

How do we do it?

- IT Staff

  Do maintenance during the day

    It’s OK to turn off the computers

    - It doesn’t reduce the life of the computer
    - It’s not all the inconvenient for us

- End Users

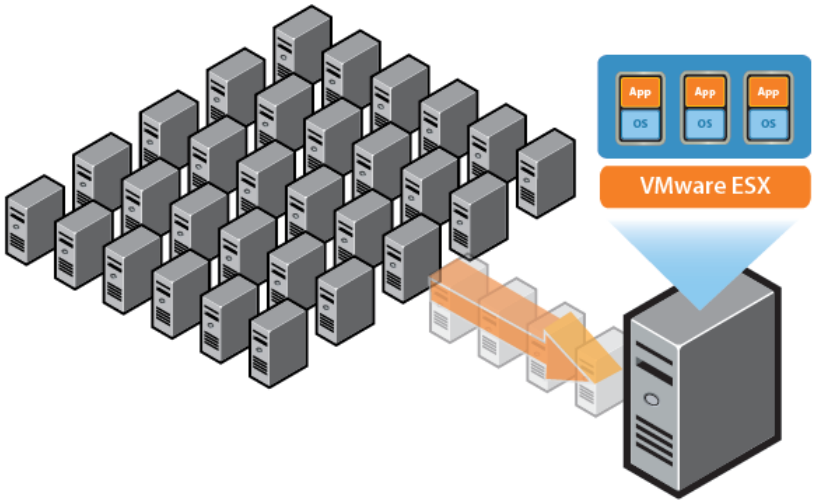
    It’s OK to turn off computers

    - You can get to your computer if needed

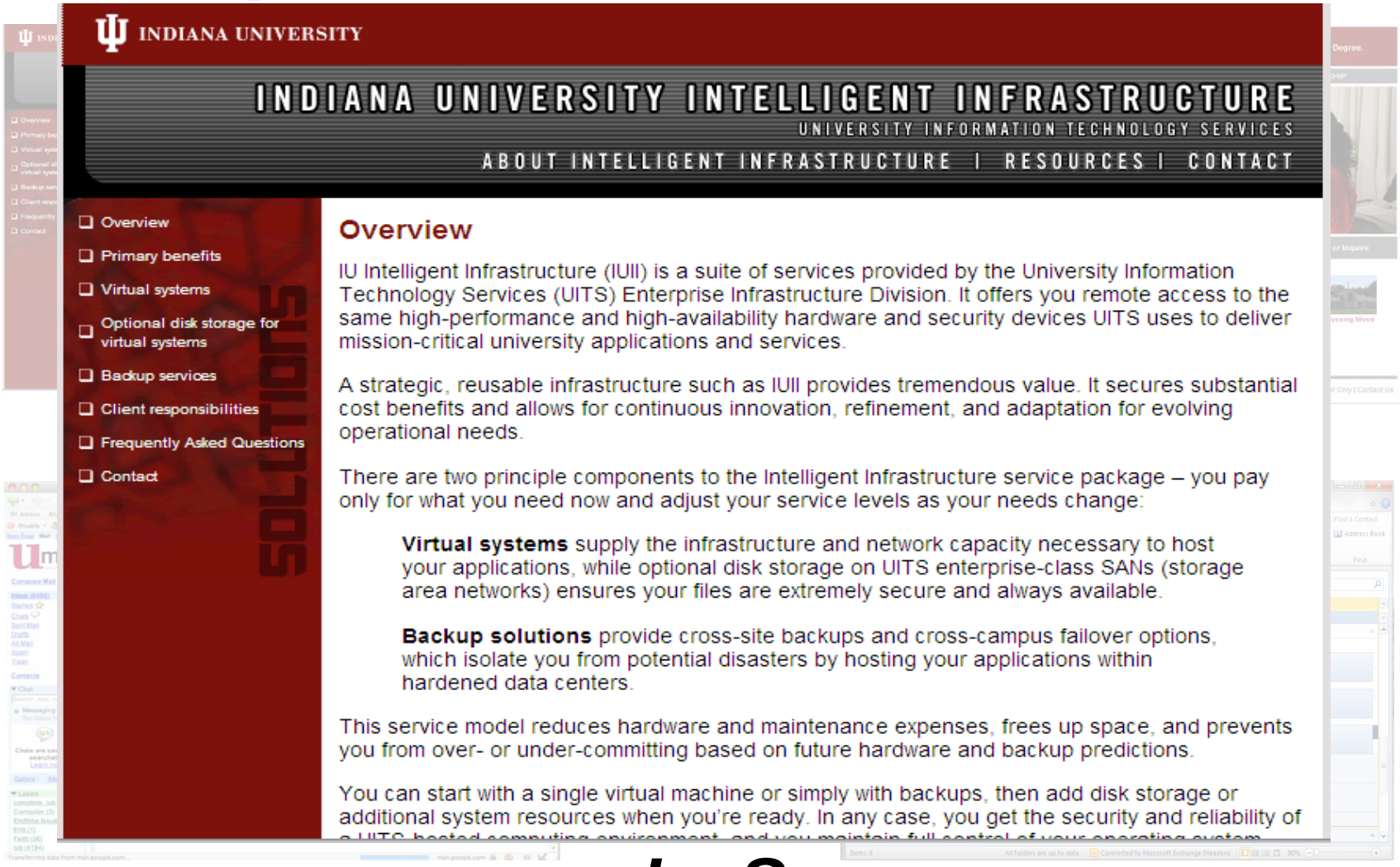
Current Status

- GoGreen Gadget
  - XP, Vista, Windows 7 *desktop*
- New Wake On LAN service
  - Centrally hosted
  - Allow “magic packet” to flow throughout the IU network

Server Virtualization



Examples of Services



SaaS **IaaS** SaaS