

Using the RB750UP as an Access Point Router

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Presenter

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 - MTCNA, MTCRE, MTCRCE, MTCINE, MTCUME
- ▶ Winters Broadband
 - WISP
 - Founded 2011
 - Coverage area over 500 sq. miles
 - 43 Access Point sites
 - 100% rural customer base
 - Over 300 Mikrotik routers
 - Managed router service – 200+
 - Consulting & Training





Objectives

- ▶ **Product**
 - Provide an overview of the RB750UP router, its features and specifications
- ▶ **Applications**
 - Show how the RB750UP can be applied in WISP Access Point applications
- ▶ **Scripting**
 - Show how the use of scripting can enhance and add value



Typical Access Point Applications

- ▶ Access Point Site
 - Three Sector antennas
 - Two backhaul links
 - Router
 - Power consumption ~ 44W (1.83A @ 24V)

- ▶ Micro POP (AP)
 - Omni-directional antenna
 - One backhaul link
 - Router
 - Power consumption ~ 20W (0.83A @ 24V)





RB750UP Router Specifications & Limitations

- ▶ Specifications
 - $V_{IN} = 8 \text{ to } 30 \text{ VDC}$
 - $I_{OUT} = \text{Max } 1\text{A on a port}^1$
 - $I_{OUTMax} = 2.2\text{A}^1$
 - PoE out on ports 2 to 5
 - Port Prioritization¹
 - Port power monitoring¹
 - Power consumption 2.4 W to 3.6 W
- ▶ Upgrade to version 6.9+

Note: 1. Requires version 2.x PoE-Out controller firmware



RB750 Router

PoE Configuration & Reporting

► WinBox

◦ Configuration

- PoE Out
 - Off, Forced On, Auto On
- PoE Priority

◦ Reporting

- PoE Out Current
- PoE Out Voltage
- PoE Out Power

Interface <ether3>

General PoE Ethernet Status Overall Stats ...

PoE Out: auto on

PoE Priority: 10

PoE Out Current: 138 mA

PoE Out Voltage: 11.5 V

PoE Out Power: 1.5 W

► CLI

```
[admin@MikroTik] /interface ethernet poe> monitor [find]
      name: ether2  ether3  ether4  ether5
poe-out-status: disabled powered-on waiting-for-load powered-on
poe-out-voltage:      11.6V
poe-out-current:      147mA
poe-out-power:        1.7W      0.1W

[admin@MikroTik] /interface ethernet poe settings> print
      version: 2.13
ether1-poe-in-long-cable: no
```

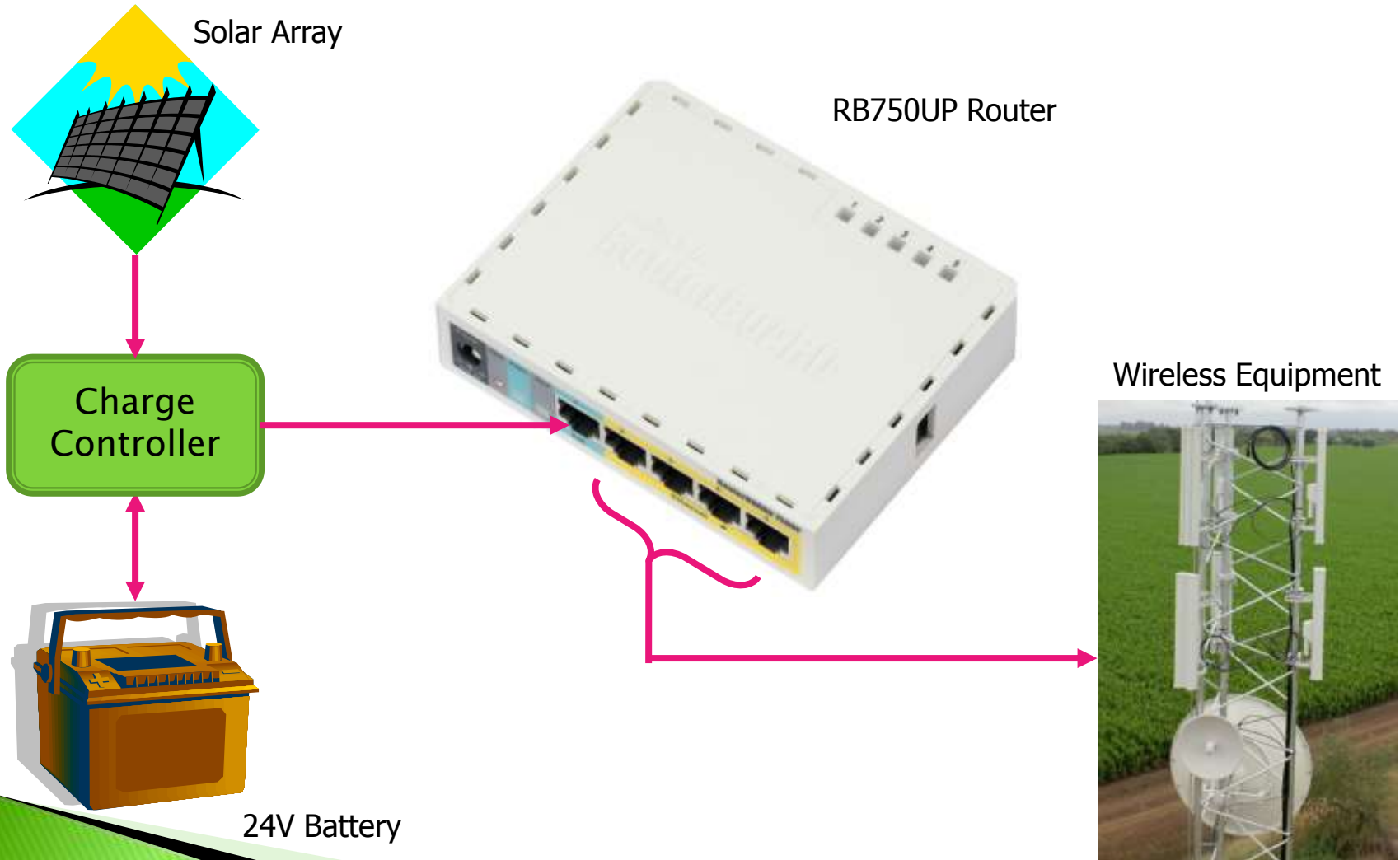


RB750UP Router Benefits

- ▶ Router
 - OSPF for backbone links
 - Increased network availability
- ▶ Power Control
 - Control of attached wireless devices
 - Power monitoring
 - Reduced maintenance costs – no truck roll required
- ▶ Bandwidth Control
 - Allows global upload speed to set optimizing backbone utilization
- ▶ Scripting
 - Allows features to be added
 - Enhanced router capability
 - Reduced operating and maintenance costs



Typical Solar Powered Solution





Access Point Power – Solar Solution

► Charge Controller – SunSaver SS-20L-24V

- 24V 20A charge controller with LDV
 - Load Disconnect 23.0 V
 - 11.5 V per battery
 - Load Reconnect 25.2 V
 - 12.6 V per battery

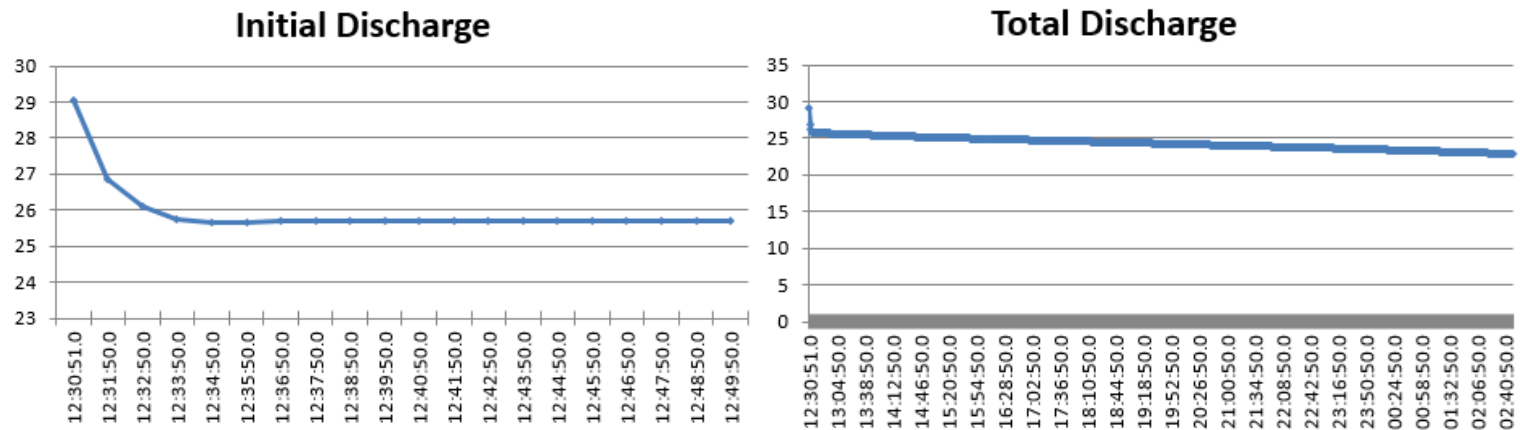
? How long between disconnect and reconnect with battery being charged





Battery Discharge Characteristics

- ▶ 24V 26AH Battery Configuration
 - Two 12V 26AH batteries in connected in series
 - Fully charged
 - 2A load

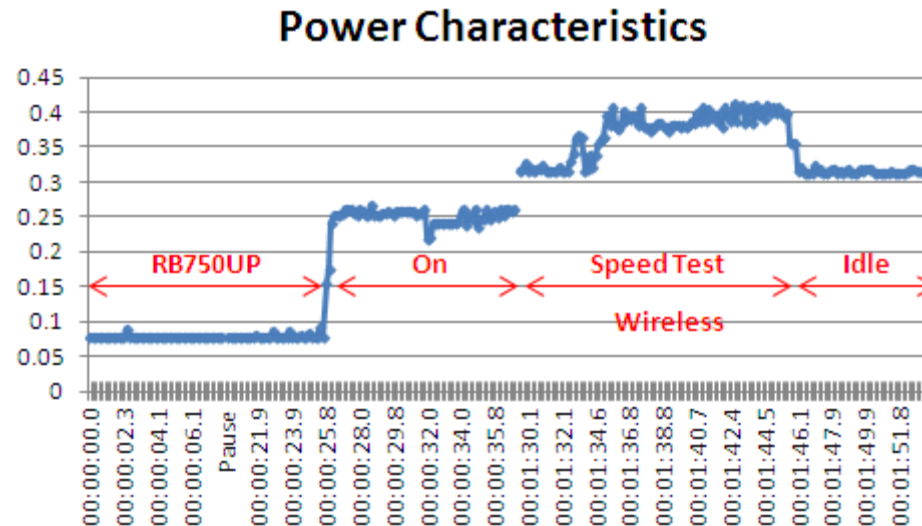


- ▶ Run time at 2A to 23V disconnect voltage = 13:43 hours
 - 23V is recommended disconnect voltage to avoid battery damage
 - Need longer run time – use larger capacity batteries



Power Usage Characteristics

- ▶ Test with wireless unit

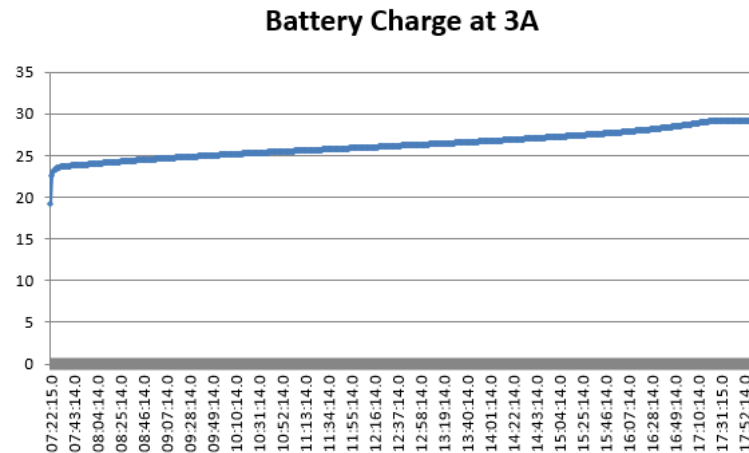


- ▶ Power consumption
 - RM750UP = 80mA
 - Wireless unit = 170 to 330mA



Battery Charge Characteristics

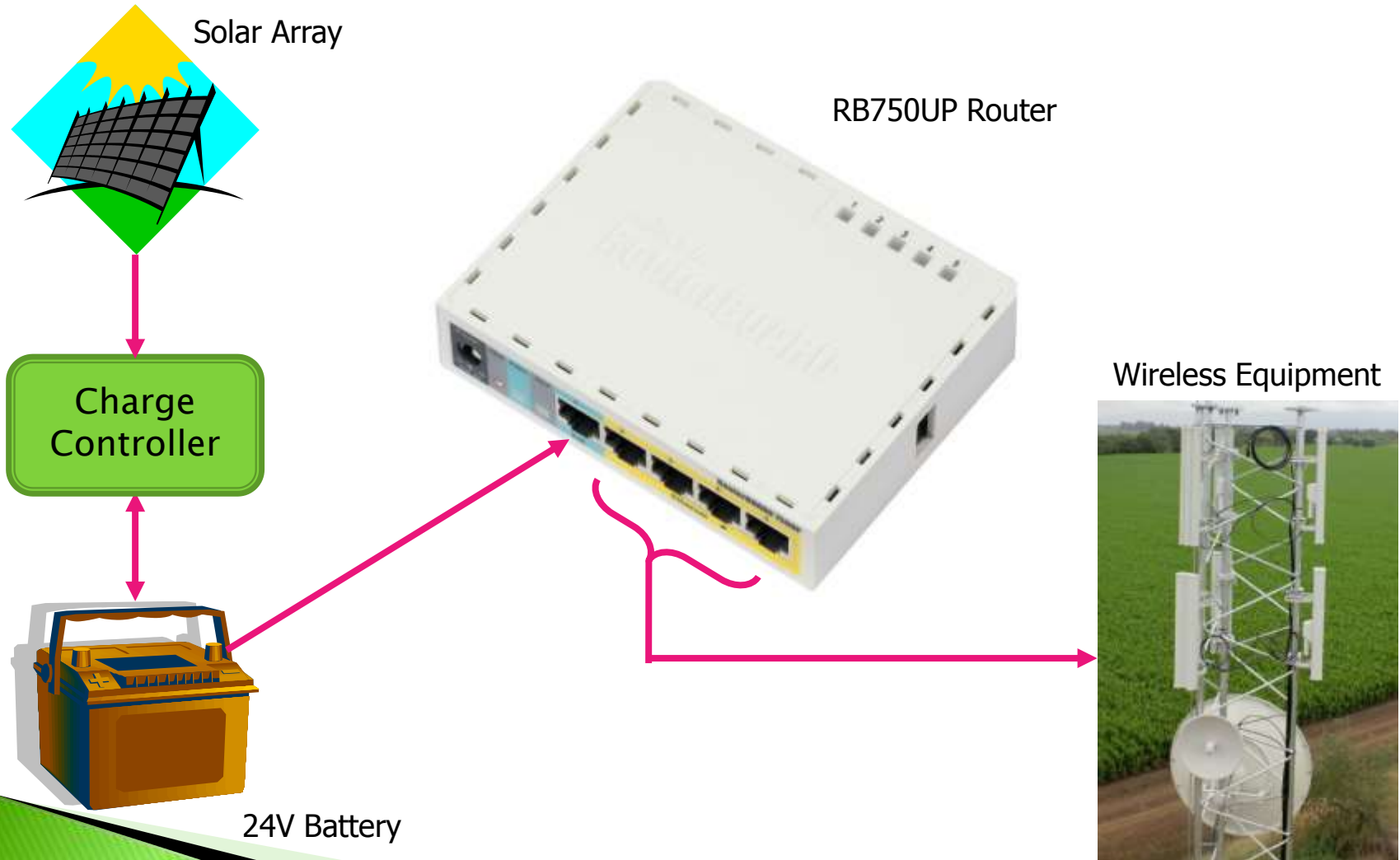
- ▶ 24V 26AH Battery configuration
 - Two 12V 26AH batteries connected in series
 - Discharged to 23V disconnect level
 - 3A battery charge rate



- Charge time = 10:30 hours
- Time to reconnect voltage of 25.2V = 2:48 hours
 - No power = No service = Support Calls



RB750UP Solution Solar Powered





RB750UP Configuration

Low Voltage Disconnect (LDV)

- ▶ Connect the RB750UP directly to the battery array and configure it to provide the LDV
 - Monitor battery voltage
 - Provide alert when battery voltage is $< 24V$ & $> 23V$
 - Disconnect load when battery voltage $< 23V$
 - Provide alert, keep router alive
 - PoE voltage readings report the port output voltage
 - For input voltages from 8V to 16V it is $-0.5V < \text{input voltage}$
 - For input voltages from 17V to 30V it is $-0.6V < \text{input voltage}$
 - E.g. 24V input provides a PoE output of 23.4V

```
[admin@MikroTik] > interface ethernet poe monitor [find]
      name: ether2 ether3 ether4 ether5
poe-out-voltage: 23.4V  23.4V  23.4V  23.4V
poe-out-current: 172mA  164mA  124mA  492mA
poe-out-power:  4W      3.8W   2.9W   11.5W
```



RB750UP Scripting

Low Voltage Disconnect (LDV)

▶ LDV Script

- Get system voltage Vpoe
- If (Vpoe>23.4V) log result
 - Battery fully charged
- If (Vpoe<23.4V & Vpoe>22.4V) send warning message
 - Battery being discharged
- If (Vpoe<22.4V) send alert message & take action
 - Battery at LDV point
 - Turn PoE power off
- If (Vpoe>22.4V) send alert message & take action
 - Turn PoE power on
 - Battery charging. Above LDV point



RB750UP Scripting

PoeControl Script

- ▶ Script that can be executed by other scripts
 - Switches PoE on selected interface/s

```
:global PoePort
:global PoeMode
:global PoeDelay
:local ptr
:if ($PoeMode = "ON") do={
# Turn selected PoE port on
  if ($PoePort=0) do={
    :for ptr from=2 to=5 step=1 do={
      /interface ethernet poe set "ether$ptr" poe-out=auto-on
      :delay ($PoeDelay.s)
      :log info "PoE on port $ptr switched $PoeMode"}
    } else={
      /interface ethernet poe set "ether$PoePort" poe-out=auto-on
      :log info "PoE on port $PoePort switched $PoeMode"}
  } else={
# Turn selected PoE port off
    if ($PoePort=0) do={
      :for ptr from=2 to=5 step=1 do={
        /interface ethernet poe set "ether$ptr" poe-out=off
        :log info "PoE on port $ptr switched $PoeMode"}
      } else={
        /interface ethernet poe set "ether$PoePort" poe-out=off
        :log info "PoE on port $PoePort switched $PoeMode"}
      }
  }
```



RB750UP Router Scripting

PoE Control Scripts

- ▶ PoEControl script
 - Single script, multi-function, controlled by variables
 - PoePort – Port # or 0 for all ports
 - PoeMode – “OFF” or “ON”
 - PoeDelay – Delay in seconds between startup for all ports
- ▶ PoEControlTest script
 - Enables testing of PoEControl script

```
:global PoePort 0  
:global PoeMode "OFF"  
:global PoeDelay 0  
:execute PoEControl
```



RB750UP Scripting

Low Voltage Disconnect Script

► Variables

```
:global PoePort
:global PoeMode
:global PoeDelay
:global Vbatlow 234
:global Vbatoff 224
:global Vtest
:global TestMode
:global Vsystem [/system health get voltage]
:local SystemName [/system identity get name]
```

► Test mode? Use voltage from test program

```
:if ($TestMode=1) do={:set Vsystem $Vtest}
```

► Battery voltage between 23V and 24V – alert message

```
:if (($Vsystem < $Vbatlow) && ($Vsystem > $Vbatoff)) do={
  :local emessage ("Warning ".$SystemName. " voltage is ". [:pick $Vsystem 0 2] . "." . [:pick $Vsystem 2 3]. "V")
  # /tool e-mail send to="youremail@yourdomain.com" subject="Warning $SystemName - Low Voltage"
  body=$emessage
  :log info $emessage}
```



RB750UP Scripting

Low Voltage Disconnect (contd)

- ▶ Battery voltage below cutoff voltage of 23V – activate LDV

```
:if ($Vsystem < $Vbatoff) do={  
  :local emessage ("Alert ".$SystemName. " voltage is ". [:pick $Vsystem 0 2] . "." . [:pick $Vsystem 2 3]. "V")  
  # /tool e-mail send to="youremail@yourdomain.com" subject="Alert $SystemName - Powered Down"  
  body=$emessage  
  :log info $emessage  
  :set PoePort 0  
  :set PoeMode "OFF"  
  :execute PoeControl}
```

- ▶ Battery voltage above cutoff voltage – activate load

```
:if ($Vsystem > $Vbatoff) do={  
  :local emessage ("Alert ".$SystemName. " voltage is ". [:pick $Vsystem 0 2] . "." . [:pick $Vsystem 2 3]. "V")  
  # /tool e-mail send to="youremail@yourdomain.com" subject="Alert $SystemName - Powered Up"  
  body=$emessage  
  :log info $emessage  
  :set PoePort 0  
  :set PoeMode "ON"  
  :set PoeDelay 10s  
  :execute PoeControl}
```



RB750UP Router

LDV Script Summary

- ▶ LDV script
 - Control rules and actions to be taken as battery is discharged and charged
- ▶ Testing LDVTest script
 - :global Vtest 226 # Change voltage to test different modes
 - :global TestMode 1
 - :execute LDV
- **Note: Information on this emailing of messages can be found on the Mikrotik wiki and has therefore not been included in this presentation.**

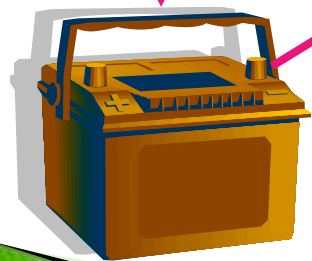


RB750UP Solution Utility Powered

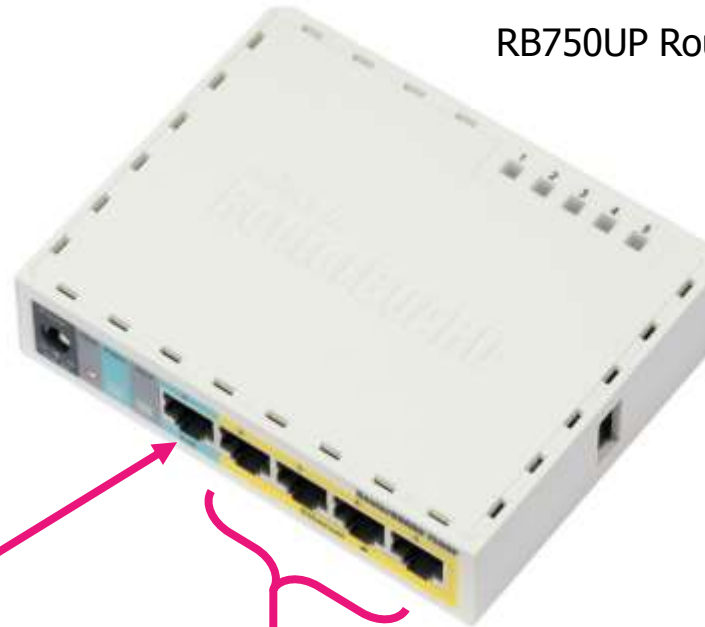
RB750UP Router

Utility Power
110/220V

Battery
Charger



24V Battery



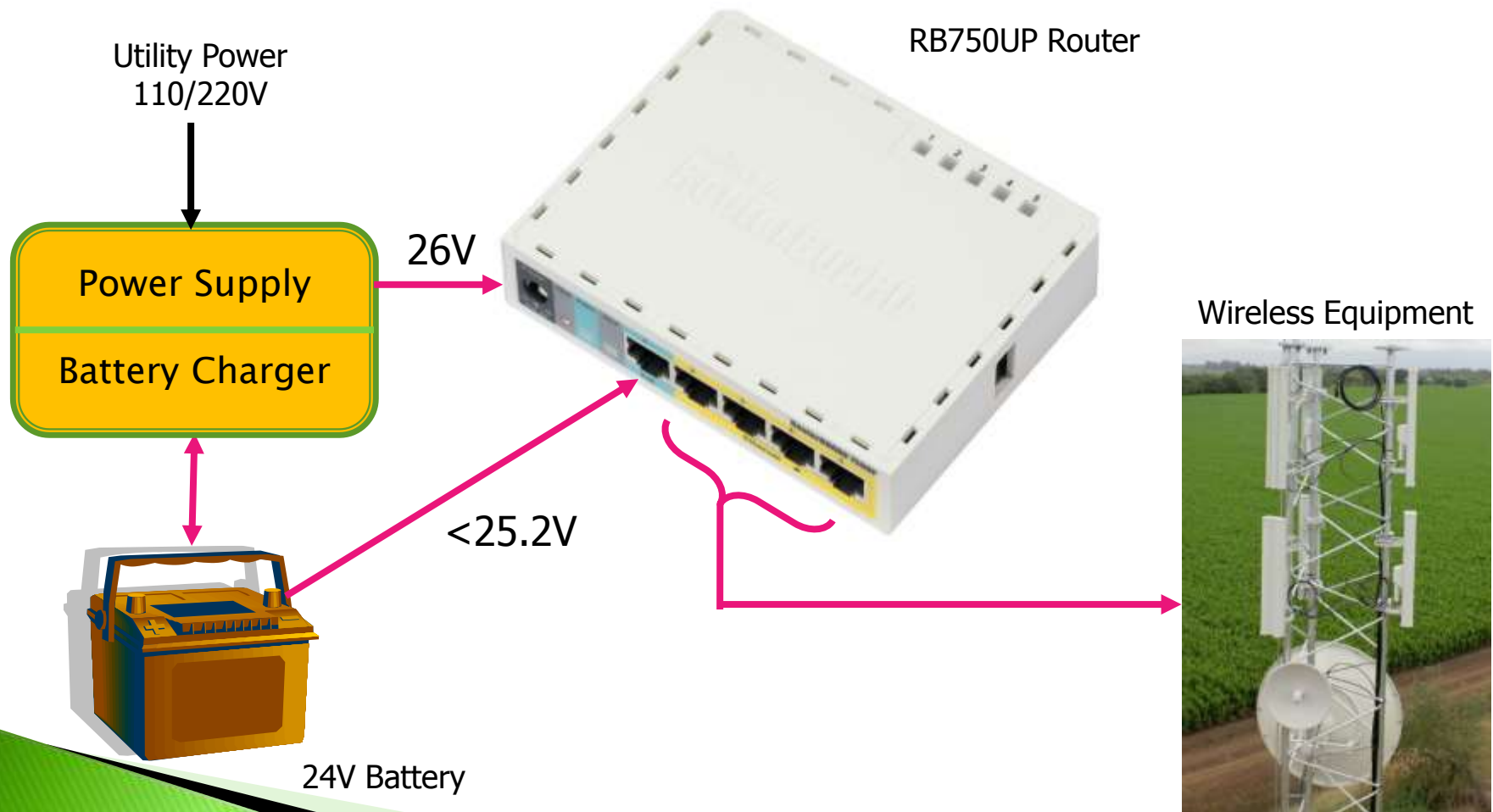
Wireless Equipment





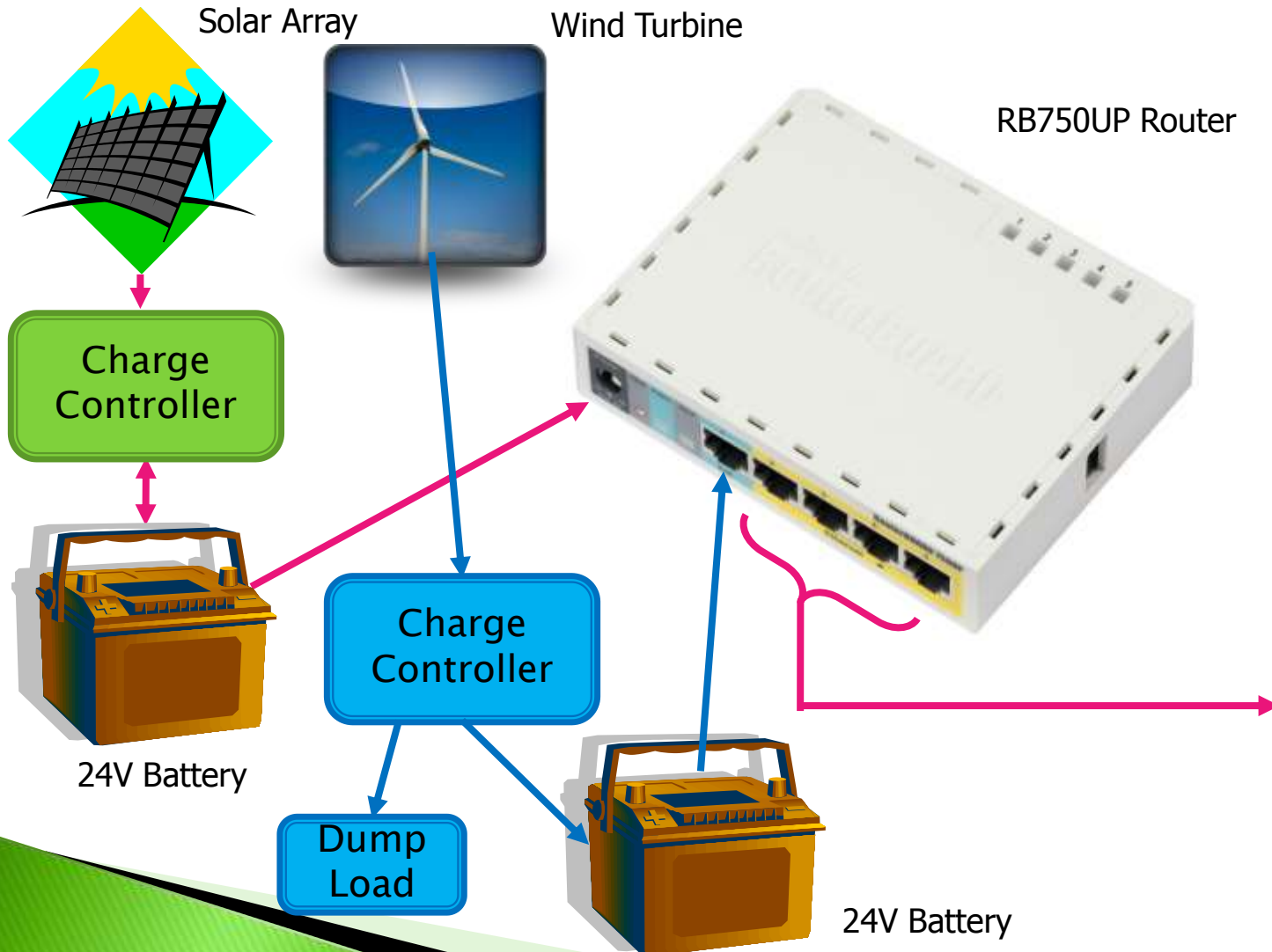
RB750UP Solution

Utility Powered Split System





RB750UP Solution Solar/Wind Powered



Wireless Equipment





RB750UP Configuration

Wireless Equipment Power Control

► Netwatch

- Monitor device IP address and reboot if connectivity is lost
- Log actions taken

Netwatch Host <10.0.36.21>

Host Up Down

Host: 10.0.36.21

Interval: 00:01:00

Timeout: 10000 ms

Status: up

Since: Sep/09/2013 15:46:00

OK

Cancel

Apply

Disable

Comment

enabled

Netwatch Host <10.0.36.21>

Host Up Down

On Down:

```
/interface ethernet poe set ether5 poe-out=off
:log info "PoE 5 turned off"
:delay 30s
/interface ethernet poe set ether5 poe-out=auto-on
:log info "PoE 5 turned on"
```

enabled



RB750UP Configuration

Power Monitoring and Reporting

- ▶ Scheduler
 - Set schedule for script to run
- ▶ Script
 - Monitor PoE/System Health Voltage to determine status of DC power feed
- ▶ Reporting
 - Send an alert and report messages
- **Note: Information on this subject can be found on the Mikrotik wiki and has therefore not been included in this presentation.**



RB750UP Configuration

Sequenced Power Up

- ▶ Turning on all loads simultaneously can result in a power spike which can place router in overload condition
- ▶ Sequencing power turn up minimizes power spike
- ▶ Included in LDV script
- ▶ Scheduler
 - Run script after startup
- ▶ Script
 - Put 15s delay between starting each interface



RB750UP Configuration

Load Shedding

- ▶ Reduce power consumption by powering down devices
 - If battery voltage is reaching critical level, run time can be extended
 - Power down backup link
 - Power down non critical sectors
 - **Maximize uptime**
 - **Keep the router up it provides the control and reports**



RB750UP Router Summary

- ▶ Ideally suited as an Access Point router
 - Routing
 - Bandwidth control
 - Control over powered devices
- ▶ Scripting enhances functionality
 - Cost effective redundant power solutions
 - Highly efficient Low Voltage Disconnect (LDV)
 - Powered equipment monitoring and reboot
 - Power monitoring and reporting
 - Load shedding

